



GREBE

Generating Renewable Energy
Business Enterprise



Advice Notes on Solar Thermal 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/>

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

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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, solar thermal is not deployed on a large scale in Iceland; however, it is deployed to a certain extent in Scotland, Finland, 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 CHP
- Wind
- ***Solar Thermal***
- Small – scale hydro
- AD
- Geothermal
- Air source heat pump
- Ground source heat pump
- Energy storage
 - Electric (batteries)
 - Thermal (heat storage)
 - Chemical (hydrogen – fuel cell and electrolysis).

The selection of the right RE technology will also be determined by the balance of energy demand of the business, the prospect to exploit local natural resources and the existing supply network. Assessing the energy mix assists in determining which RE technology is apt for your business. Those matters will be discussed in depth in the Renewable Energy Resource Assessment Toolkit.

Solar Thermal Economics Across the NPA



Solar thermal systems use solar collectors to absorb energy from the sun and transfer it, using heat exchangers, to heat water. Solar thermal delivers hot water at temperatures of between 55°C and 65°C. This is a comparatively mature technology and many installations date back to the 1970s.

There are two main types of solar heating collectors:

- Flat-plate collectors – a sheet of black metal, that absorbs the sun's energy, encases the collector system. Water is fed through the system in pipes, which conduct the heat to the water.
- Evacuated tubes – a series of parallel glass heat tubes grouped together. Each tube contains an absorber tube enclosed within a vacuum. Sunlight passing through the outer glass tube heats the absorber tube contained within it, and in doing so, the heat is transferred to a liquid flowing through the tubes.

Evacuated tubes are the most efficient type of solar water collector at around 80% efficiency (compared to around 70% for flat plate collectors). Correspondingly, they also cost more to manufacture; thus, they are more expensive.

Solar thermal collectors can be classified as

- Low-temperature collectors – usually flat plates, the temperature range is between 5 to 30 degree and are normally used to heat swimming pools or ventilation air preheating.

- Medium- temperature collectors - generally flat plates where the temperature range is between 30 to 100 degrees. They are used for heating water or air for residential or commercial purposes. Some examples are domestic water and space heating; commercial cafeterias, laundries, hotels and industrial process heating
- High-temperature collectors - The temperature range of high thermal collectors is above 100 degrees. They attract sunlight through mirrors or lenses and are typically used to fulfil high heat requirements in industries and for electric power production.

Modern solar thermal technologies are dependable, efficient and completely safe. Solar thermal technology can have up to 80% efficiency rate in delivering heat to your business.

The total costs vary greatly, depending on factors such as:

- Quality of products and installation
- Ease of installation
- Available solar radiation (latitude, number of sunny hours, orientation and tilting of the collectors)
- Ambient temperature
- Patterns of use determining the heat load.

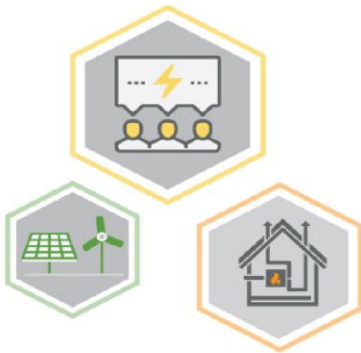
The main parameters governing solar thermal power economics include¹:

- Capital costs (CAPEX) – the technology itself (solar thermal collectors) and installation. Collectors account for the largest share of the total investment around 45%, the storage accounts for approximately 20 %, and installation and commissioning are approximately 25 % of the overall costs. Other system components make the smallest contribution with around 10 %.

¹ Renewable Energy, Technology, and Environment Economics, 2007.

- Operational cost (OPEX) - operation and maintenance costs. Maintenance costs only occur for the exchange of the heat transfer medium and for small repairs. The operation of the solar thermal system necessitates auxiliary energy; thus those costs largely depend on the price for electricity. The annual OPEX costs are at approximately 0.9 to 1.8 % of the capex costs.
- Heat generation cost = CAPEX+OPEX over the lifetime of the thermal collectors
- Thermal collectors lifetime – between 20 - 30 years

Due to site-specific matters, there can be a large difference in the CAPEX of an installation, pipework and components for commercial systems. One of the most important issues is the comparative location of the solar collectors and the hot water storage tank. This will determine how complex (expensive) it is to run pipework between the two. However, the low OPEX cost of solar thermal panels needs to be taken into consideration as well. Most reliable manufacturers will offer 20 to 25 years warranty. Solar panels need only to be kept clean, there are no moving parts (no wear and tear) and the only part that may need to be change in 5 to 10 years is the inverter. Thus, after covering the CAPEX of the solar system, the hot water you receive from the sun will be free. A solar hot water heater is hardly ever sufficient to substitute an electric or gas system, but adding solar heating panels to the hot water system may cut costs for heating water in half.



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Scotland



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Costs and economics

Solar thermal is an established technology, capital costs are still relatively high but the introduction of the Renewable Heat Incentive (RHI) should bring down payback periods. The most economically viable solar thermal systems are large systems supplying buildings with a high hot-water demand. Payback period is between 3 to 5 years, the technology itself is mature and proven, not complex, with low maintenance costs. The cost of solar thermal systems is estimated to be between £3,000 and £6,000 (including a reduced rate VAT of 5%). These figures include installation costs and all parts (solar collectors, control panel, pipes, hot water tank). Installed costs for larger systems start at around £700/m² for flat plate collector.²

A solar thermal system for a small office would use around 4m² of roof space and would have an installed cost in the region of £3,000- £5,000, depending on nature of the specific installation. A system of those dimensions can generate between 2,000 and 4,000kWh of hot water each year, demonstrating an annual cost saving of about £100-£200. Additional income can now also be received from the RHI.

Support Schemes

RHI - Tariffs that apply for installations with an accreditation date on or after 1 July 2017 – Non-Domestic

Description	Total Installed Capacity (kW)	Eligible Tariff (pence per kWh)
Solar Thermal	Less than 200 kWth	10.44

Government Allowances and/or Exemptions

N/A

Funding available for Capital Costs

Home Energy Scotland renewables loan scheme - Interest-free loans

² Making Sens of Renewable energy Technologies. Carbon Trust. 2012

Technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information
AES Solar	<p>AES Supremacy Collector Models 1.5AR, 1.9AR & 2.5AR</p> <ul style="list-style-type: none"> • A high efficiency collector with anti-reflective technology boasting a 95.5% solar transmission level. • Tested to international engineering standard EN ISO 9806 for durability and performance. • Only 70mm thick. • Roof integrated options for tile and slate, seamless colour. • Portrait or landscape, range of sizes and fixing for almost any roof type, can be ground or wall mounted with a ballast option for flat roofs. 	<p>-Design</p> <p>-Install</p> <p>-Commission</p> <p>-Service</p>	<p>Tel 01309 676911</p> <p>info@aessolar.co.uk</p>
McCallum Water Heating	<p>McCallum Water Heating flat solar panels are manufactured in Scotland</p> <ul style="list-style-type: none"> • Life expectancy in excess of 25 years. • Constructed to EN12975 by ITW and have been tested in both Europe and the Far East. • Collectors can be custom made. Shapes, sizes and weights may vary. • Small to large domestic hot water systems, industrial process and swimming pool heating. 	<p>-Solar Panel Control Systems</p> <p>-Panel Mounting</p> <p>-Typical System Layouts</p>	<p>Phone : 0141 881 1051</p> <p>Fax : 0141 881 8275</p> <p>info@mccallumwaterheating.co.uk</p>

A comprehensive list of installers, products and services can be found at the following link:

<https://www.solarguide.co.uk/location/scotland/>



Solar Thermal

Economics

Ireland



Costs and economics

Solar water heating systems are generally sized to cover 50 to 60% of a household's hot water (about 1 to 1.5 m² of solar panel per person; 50 litres of water storage per m² of panel). Such a system will provide almost all of your house's hot water needs during the summer, and will cost between €4,000 and €6,000 to install.

A solar combi-system is based on the same type of components but sized to make a useful contribution (30 to 40%) to total heating requirement of the house (space and water heating). For an average house, this requires between 10 and 20 m² of solar panels and a storage tank of 800 to 1,500 litres. The sizing and design of a solar combi-system requires a careful analysis of the heating requirement of the house by an experienced technician. The cost to install a solar combi-system ranges between €8,000 and €15,000.

As it is not feasible to depend on solar energy at all time in Ireland, a solar water heater or a solar combi-system needs a back-up heating system such as a boiler, a heat pump or an electric heater.

For further information on solar thermal products and grants, click here:

<http://www.seai.ie/betterenergyhomes>.

[SEAI's Solar Thermal Benefits Calculator](#) helps you in assessing the economic and environmental benefits of installing a solar thermal system in your home. It also provides guidelines with regard to system sizing and costs.

Support Schemes

None in place but expected.

Government Allowances and/or Exemptions

ACCELERATED CAPITAL ALLOWANCE SCHEME (ACA)

The [ACA](#) is not a grant, but rather a tax incentive for companies paying corporation tax and aims to encourage investment in energy efficient equipment.

The ACA offers an attractive incentive whereby it allows companies to write off 100% of the purchase value of qualifying energy efficient equipment against their profit in the year of purchase. Eligible equipment can be chosen from the Triple E register (See solar databases – [Triple E](#)) and includes solar heating and electricity technologies.

Solar thermal support is available for communities under the SEAI Better Energy Communities Scheme. http://www.seai.ie/Grants/Better_Energy_Communities/

Solar thermal support is available for householders under the SEAI Better Energy Homes Scheme. http://www.seai.ie/Grants/Better_energy_homes/

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.

Technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information
Grant Efficient Heating Solutions	<p>The GRANT Solar water heater encompasses many unique components, including the Sahara flat collector, multifunctional controllers with LCD displays and various mounting arrangements, including In-Roof, On-Roof and Flat-Roof options.</p> <p>The Solar Pump Station incorporates an air eliminator that allows the system to be both filled and purged of air in a single operation.</p>	<p>-Training</p> <p>-Guarantee</p> <p>-Aftersales Services</p>	<p>Telephone(057)912 0089</p> <p>Fax:(057) 912 1060</p> <p>info@grantengineering.ie</p>
Kingspan	<p>Solar Evacuated Tube Collectors</p> <p>Thermomax HP400 is a highly efficient Heat Pipe collector, HP400 is a 'Dry System' recommended especially for domestic use. The dry connection between manifold and tubes means tubes can be easily fitted and replaced, without affecting the entire solar thermal system.</p> <p>Thermomax DF400 is a highly efficient Direct Flow collector, providing perfect solution when the ideal installation position is not available. It is a fully pumped 'Wet System' and is recommended especially for industrial and commercial use. This versatile product can be installed on facades or flat roofs both horizontally and vertically.</p> <p>Varisol Evacuated Tube Collectors are the first solar evacuated tube collector with no rigid manifold offering high performance as well as total flexibility. The revolutionary new design of Varisol offers a modern and flexible alternative to traditional rigid manifold collectors.</p> <p>Flat Plate Panels</p> <p>Kingspan solar thermal panels are robust and flexible in installation. A range of fixing brackets allows for the panels to be installed on all types of roof tiles including concrete, slate and clay peg.</p>	<p>Design & Manufacture.</p> <p>Installed by registered installers in Ireland, UK & Europe.</p>	<p>solarinfo@kingspan.com</p> <p><u>00 353 42 9690022</u></p>



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Finland



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Costs and economics

Costs and economics of solar thermal systems in Finland ([Finsolar 2016](#)):

System size (collector area m ²)	Investment cost of the system installed €/collector-m ²	Operational costs, % of the investment cost /collector-m ²	Solar heat production price €/MWh, when production is 0,4 MWh/m ²	Solar heat production price €/MWh, when production is 0,5 MWh/m ²
Small-size system (collector area 4–20m ²)	500 – 1000 €/m ²	10 %, 50 – 100 €/m ²	46 – 92 €/MWh	37 – 73 €/MWh
Medium-size system (collector area 20–100m ²)	500 – 750 €/m ²	8 %, 40 – 60 €/m ²	45 – 68 €/MWh	36 – 54 €/MWh
Large system (collector area 100 - 1000m ²)	400 – 500 €/m ²	5 %, 20 – 25 €/m ²	35 – 44 €/MWh	28 – 35 €/MWh
Industrial system (collector area 15,000m ²)	280 – 340 €/m ²	Approximate 20 €/m ²	–	20 – 24 €/MWh

Support Schemes

- Energy support for Solar thermal: 20 % (TEM, Ministry of the Employment and the Economy via TEKES Finnish Funding Agency for Innovation), support is not available if the end-user converts from the district heating to the own solar thermal system.
- Farms can apply investment support from the Rural Development Programme. The funding rate is 35-40%, and the support is allocated via local Centres for Economic Development, Transport and the Environment.
- Communities can apply LEADER financing (up to 60%) to the renewable energy projects.
- Households can have tax deduction of 50% or maximum of €2400 (2017) of installation costs.

Government Allowances and/or Exemptions

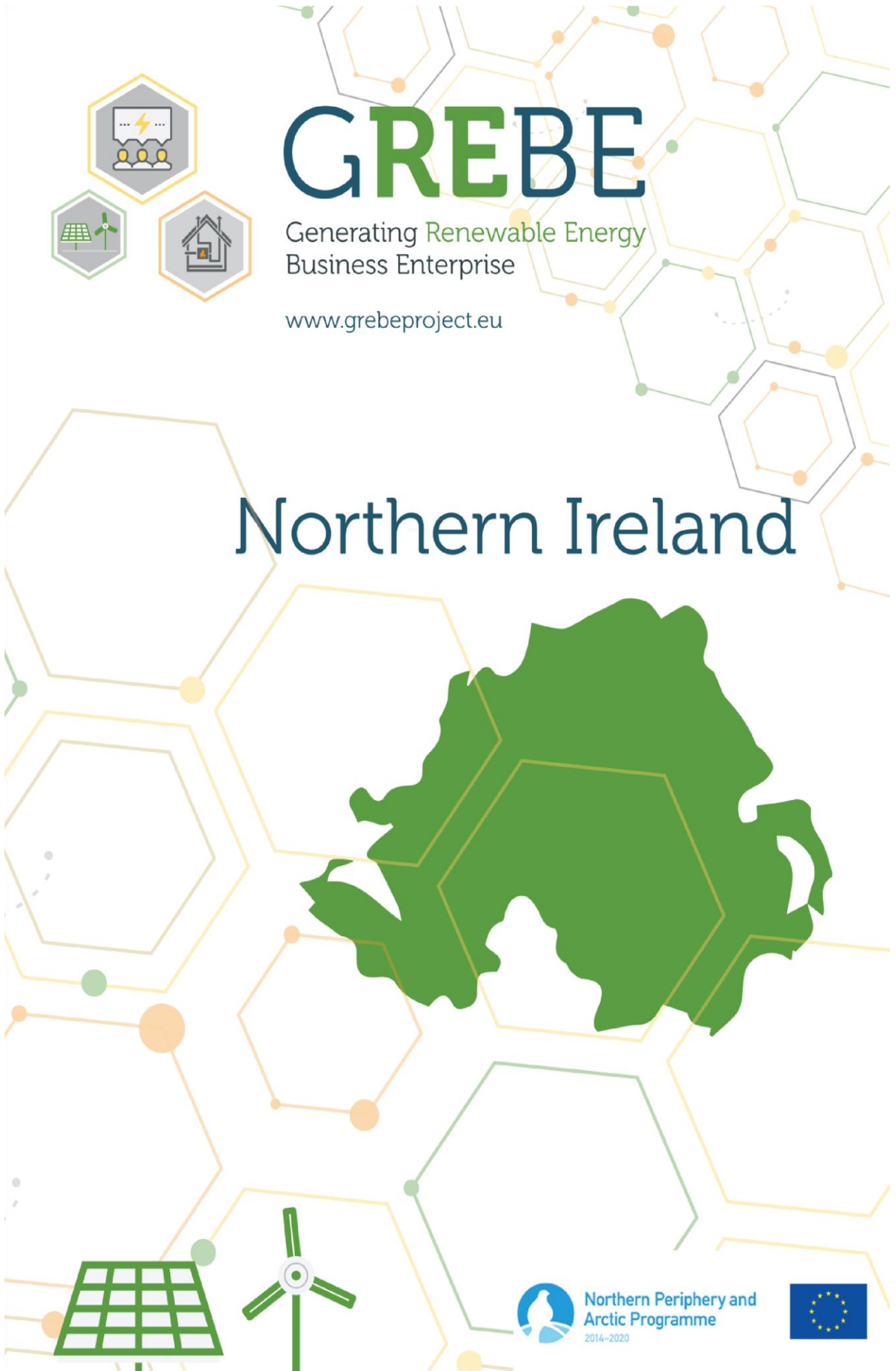
N/A

Funding available for Capital Costs

Some system suppliers have leasing options and power purchase agreements (PPA) available. There are not yet reference cases of these in North Karelia.

Technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information
Lämpöpartio Oy, Joensuu	Solar thermal systems and hybrid heat accumulators	Installations, services/support	http://www.lampopartio.fi/
Lämpökarelia, Kitee ja Joensuu	Solar thermal systems and hybrid heat accumulators (Wagner flat-plate collector)	Installations, services/support	http://www.lampokarelia.fi/
Putki-ykkönen, Joensuu	Flat-plate and vacuum-tube collectors (Nova), hybrid heat accumulators	Installations, services/support	http://www.putkiykkonen.fi/
Joen Ecotec Oy, Joensuu	Solar thermal systems and hybrid heat accumulators	Installations, services/support	http://www.ecotec.fi/
JH-Lämpö Oy, Joensuu	Solar thermal systems and hybrid heat accumulators	Installations, services/support	http://www.jh-lampo.fi/
LVI Putki-Karjala Oy, Joensuu	Solar thermal systems and hybrid heat accumulators	Installations, services/support	http://www.putki-karjala.fi/
Ruukki Oy, rautakaupat	Solar thermal systems and hybrid heat accumulators	Installations, services/support	https://www.k-rauta.fi/rautakauppa/ruukki



Costs and economics

The cost of solar thermal systems varies, but normally you can expect to pay between £3,000 and £6,000 (including a reduced rate VAT of 5%). These figures include installation costs and all parts (solar collectors, control panel, pipes, hot water tank). The price of your system will depend on the type and quality of the panels. A typical well-insulated twin coil cylinder system will be priced at around £4,500 according to the Solar Trade Association. It is also possible to buy DIY solar thermal kits with all the necessary hardware, which normally cost between £1,500 and £2,500, though these are not immediately eligible for government support. Your system will need to be installed by an MCS accredited installer to benefit from the RHI.

Installing solar thermal hot water could save you up to £40 per year on your hot water bills, according to the Energy Saving Trust. (More would be saved if another incentive scheme gets introduced like a feed-in-tariff.

In fact, Solar Water Heating will typically save you about one third of your oil or gas bill, which for most households means an extra £500 in your pocket, year after year.

Typical outputs from a domestic solar water heating system are in the range of 1000kWh to 2500kWh per year.

Support Schemes

The RHI scheme used to cover solar thermal but as the incentive has now closed, it does not. Domestic customers before could benefit from the NI Renewable Heat Incentive (NI RHI) which provided a £320 one-off grant followed by annual payments for 7 years! This will continue for those who applied before the deadline of the RHI cutoff.

Government Allowances and/or Exemptions

First-year Allowances / Enhanced Capital Allowances

A business can claim 100% First-Year Allowances (i.e. you can effectively write off all the capital costs against your trading profit). This allowance can be claimed without using up any of your annual investment allowance limit. And this qualifying enhanced capital allowances include solar thermal, as well as other energy saving equipment.

Funding available for Capital Costs

Solar PV installations accredited before the 31st of March 2017 would have received ROC payments for their energy generation. The ROC bandings have changed over time as the incentive for the solar panels has decreased. Before September 2015 a system would be in the 4 ROC banding meaning that they would receive 16p/kW. Before September 2016 a system would be in the 3 ROC banding meaning they would receive 12p/kW. Then until the incentive closed in March 2017 a person would be in the 2 ROC banding meaning they would receive 8p/kW.

The incentive now is closed but a new scheme could be brought in within the next 3-4 years.

Technology suppliers, products and services they offer

Supplier	Product	Services	Contact Information
Solmatix	Provide installations of solar thermal systems.	Design and install renewable energy systems.	Tully Road, Nutts Corner, Co Antrim, BT29 4SW, Northern Ireland sales@solmatix.com 028 9082 4000



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Project Partners

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



About GREBE

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