

YOUR GUIDE TO

Connecting Micro-generation to the Electricity Network



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Connecting Micro-generation to the Electricity Network

Report prepared for Sustainable Energy Ireland by:
Econnect Ireland
January 2009

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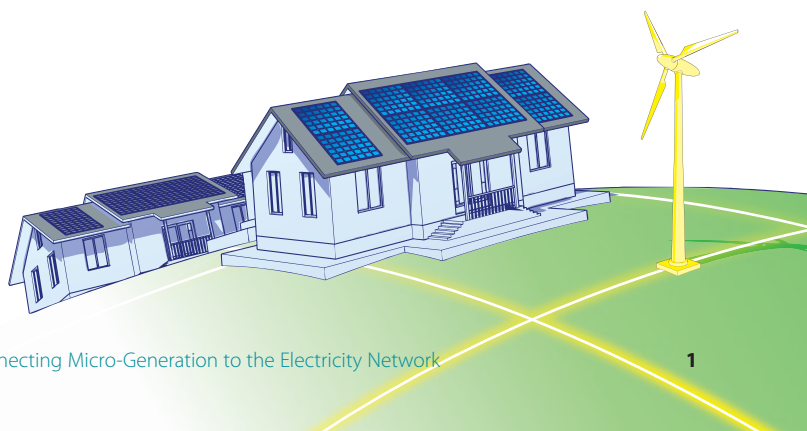
This Guide describes the connection process for micro-generators in place at the time of writing. However, the connection process is subject to change. The reader should be aware that in the event of any discrepancy between this Guide and the requirements of the CER or system operators, the requirements of the CER or system operators shall prevail. While this Guide has been produced with the guidance from ESB Networks, EirGrid and the CER it is not a definitive interpretation of the connection offer process.

ACKNOWLEDGEMENTS

This Guide has been produced with assistance from ESB Networks, EirGrid and the CER.

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Sustainable Energy Ireland (SEI) is a statutory authority set up by the Government in 2002 as Ireland's national energy agency with a mission to promote and assist the development of sustainable energy.

SEI's activities can be divided into two main areas:

- **Energy Efficiency** – Energy is vital to how we live our daily lives but most of us don't use energy as efficiently as we could. By assisting those who use energy, to be more energy efficient, SEI can help to reduce the amount of energy we use overall.
- **Renewable Energy** – Energy that is generated from renewable sources such as wind and solar power. It is clean and doesn't produce harmful greenhouse gases. By promoting the development and wider use of renewable energy in Ireland, SEI can help to further benefit the environment, in particular through reducing the threat of climate change.

SEI is also involved in other activities such as stimulating research and development, advising on energy policy and publishing energy statistics. Sustainable Energy Ireland is funded by the National Development Plan 2007–2013.

DID YOU KNOW?



- Approximately 7% of the electricity generated in large power stations is wasted in being transported to the consumer. Micro-generation offsets these network losses by generating electricity close to point of use.
- In 2007 9.4% of Ireland's electricity was generated from renewable sources.
- Each kilowatt hour of electricity from the Irish grid typically results in 600g of CO₂ emissions.

Today many households and small businesses are considering installing micro-generation. Micro-generation involves installing a small generator powered by either a renewable source such as wind, solar or biomass or using combined heat and power (CHP) technology (normally fuelled by natural gas).

Micro-generators reduce the amount of electricity that would otherwise have to be bought from the grid. By installing a micro-generator you can take action to address the issues of climate change, rising electricity prices and reliance on fossil fuels.

Central to the Government's energy policy is the promotion of renewable generation and efficient delivery of energy to homes and businesses. The Government has committed to a target of meeting 40% of our total demand for electricity from renewable sources by 2020. There is also a target for 800MW of CHP to be installed by 2020. Micro-generation is expected to make a contribution to meeting these targets.

The benefits of micro-generation include:

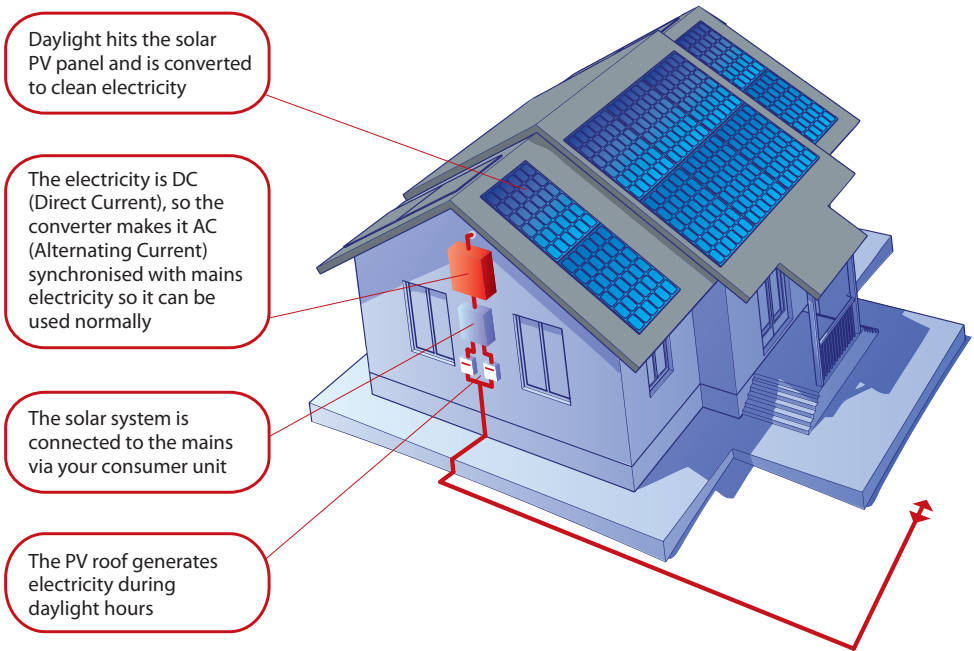
- Lower electricity bills
- It hedges against future electricity price rises
- Less greenhouse gas emissions
- Reduced reliance on fossil fuels
- Reduced electrical losses on the ESB Network
- Your Building Energy Rating [1] is improved

2.1 Connecting your micro-generator to the electricity network

This Guide is intended to give information on connecting micro-generators to the electricity network. ESB Networks has put in place a simplified process for connecting micro-generation to the network. This process applies to generators that produce less than 5.75 kW (single phase connection to the house) or 11 kW (3 phase connection to the house) of electrical power. For those wishing to connect larger generators to the grid a separate Guide is available on the SEI website.

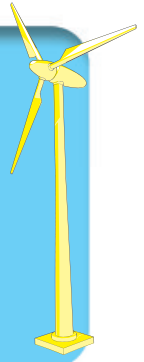
Figure 2.1 shows a typical connection of micro-generation to the electricity grid.

Figure 2.1: Example: Connecting a Solar PV micro-generator to the electricity network



THE KEY POINTS FOR A SUCCESSFUL CONNECTION ARE:

- Select a micro-generator that uses an interface certified as meeting the required ESB Network settings.
- Notify ESB Networks that you intend to network connect micro-generation using their standard form.
- Purchase the micro-generator from a reputable supplier.
- Use a qualified installer and registered electrical contractor to install and connect the micro-generator.



Many types of micro-generator technologies are commercially available. These include; generators that produce electricity from wind, solar, hydro, biomass and micro-CHP. In terms of connecting to the grid, the process is the same regardless of the technology used.

All electrical installations are potentially dangerous. It is vital that the micro-generator is installed and connected correctly and safely by a qualified installer and registered electrical contractor. ESB Networks must be informed of the intention to install a micro-generator. The equipment used to form the interface between the generator and the electricity network must be of a type previously approved by ESB Networks.

2.2 What this Guide does not cover

This Guide provides information on connecting micro-generators to the low voltage electricity distribution network. However, micro-generators can also operate without being connected to the ESB network. These generation schemes may include battery banks for energy storage; such off-grid generators are not covered in this Guide. Similarly, generators that are used for a standby electricity supply (for example diesel standby generators) are not covered in this Guide.

DID YOU KNOW?

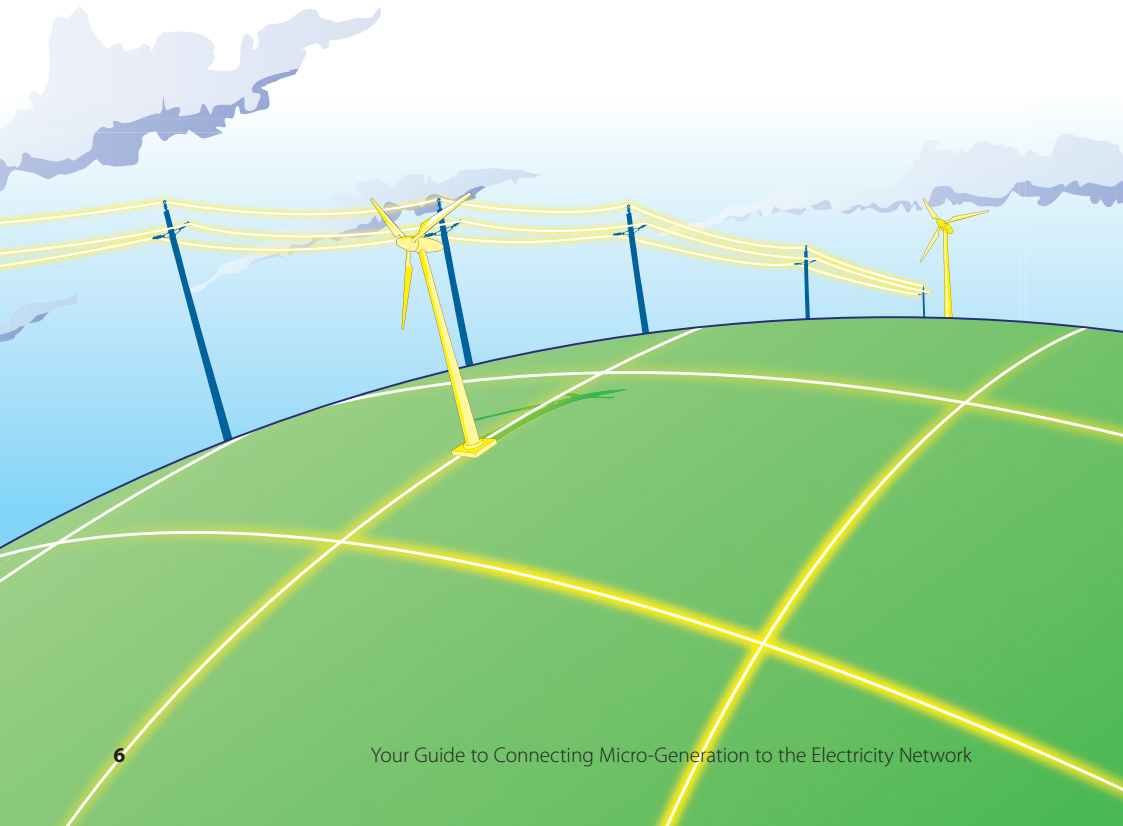
- Currently most of the electricity generated in Ireland is produced in large power stations from fossil fuels such as gas, coal, peat, and oil.



In addition to getting a network connection, many other elements of a micro-generation installation have to be dealt with in order to get the generator operational. These include:

- Deciding on the micro-generation technology;
- Deciding on the optimal siting and size of micro-generator to install;
- Obtaining planning permission for the project if it is not exempted from this requirement, information can be found on the Department of Environment, Heritage and Local Government [2] website;
- Planning and financing the project;
- Health and safety.

These issues are outside the scope of this Guide. However, further information can be obtained from the contacts listed in Appendix A.



Micro-Generation is currently defined by ESB Networks in their Conditions Governing Connection and Operation of Micro-Generation [3] as a source of electrical energy with an equipment rating of:

- (1) Less than 25A – single phase connection to the house – this is equivalent to a maximum output of 5.75 kW, or
- (2) Less than 16A – 3 phase connection to house – this is equivalent to a maximum output of 11 kW

All electrical equipment should display a rating stating the electrical voltage, current and power ranges that it can safely operate within. Electrical power is measured in Watts (W) and kilowatts (kW) (being a unit of 1,000 Watts). Typical load ratings of household appliances are shown in Table 3.1.

Table 3.1: Typical load ratings

Appliance	Rating (W or kW)	Current (A) flowing at this power (single phase)
Microwave oven	600 W	2.6 amps
Television	200 W	0.87 amps
Single bar electric fire	1000 W (1 kW)	4.35 amps
Kettle	3000 W (or 3 kW)	13.04 amps
Electric shower	8000 W (or 8 kW)	34.78 amps

Electricity consumption, as reflected in electricity bills, is measured by an ESB meter. The unit of electricity is the kilowatt-hour (kWh). For example, a unit of electricity, 1 kWh would be the amount of electrical energy used by a 1kW electric heater that was operating for one hour. On average, Irish households use 5,000 kWh of electricity per year.

Micro-generators can produce electricity from a number of different fuel sources. These include the following:

Wind turbines

Wind turbines produce electricity from the wind. The blades of a wind turbine drive a generator that produces electricity.

Photovoltaic Cells (PV)

PV cells convert sunlight falling onto them into electricity through the use of semi-conducting material. PV cells are most commonly situated on the roofs of buildings. Typically, 7m² of PV will yield a maximum of 1 kW of electrical power.

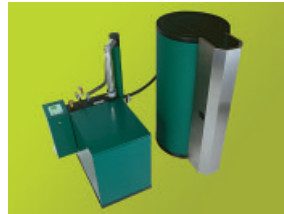
Hydro power

Hydro power converts the flow of water into electrical energy. The water flowing along rivers or from a reservoir can turn a generator which will then produce electricity.

Micro Combined Heat and Power (CHP)

Micro-CHP devices can produce both electricity and heat for a house or small business. They can be fuelled by gas, diesel or biomass.

Figure 4.1: Some examples of micro-generation – PV cells, wind turbine, micro CHP unit



Choosing the right micro-generator for you is likely to be influenced by factors such as;

- feasibility of obtaining planning consent
- availability and price of fuel (e.g. wind is free but unpredictable)
- cost of equipment and installation
- suitability of the site for chosen renewable technology.

The SEI website includes a section on Practical Guidelines for buyers when selecting a supplier or installer of renewable technology. It would be advisable to follow these guidelines [4] before purchasing a micro-generator.

Once a suitable technology has been selected it is advisable to make contact with a number of suppliers of the technology. The suppliers will be able to provide advice on the type and size of generators that are available and appropriate to your premises and needs.

4.1 Questions to ask your supplier and installer

Equipment

- Is the required interface unit included with the micro-generator?
- Do the micro-generator and interface unit bear the CE Mark? The CE Mark indicates that a product complies with all relevant EU standards.
- Are the micro-generator and interface unit certified by a non compulsory quality label?
- Does the interface unit have a type test certificate meeting ESB Networks requirements?
- Can the supplier provide the Interface Compliance Test Certificate?
- Will the installation, including the interface unit, meet all the requirements set out in the ESB Networks document 'Conditions Governing the Connection and Operation of Micro-Generation'?
- How often will the micro-generator require servicing and will the supplier provide this?

Installation

- Will the dealer install the micro-generator?
- How many years has the supplier/installer been in business?
- How many micro-generators that are connected to the ESB Network has the dealer installed? Are references available?
- How much of the installation will be sub-contracted?
- Who is ultimately responsible for what segments of work?
- Is the installer a registered electrical contractor?
- Will the installation conform to ETCl and ESB Networks requirements?
- Will a wiring diagram be provided for the installation?
- What are the earthing and lightning protection requirements?
- Have all the correct labelling and warning notices been attached?
- Will the installer provide a Certificate of Completion recognised by the ETCl?
- Is full documentation, including an operation manual, provided with the system(in English)?

ESB Networks have developed a dedicated connection process for “one-off” micro-generators; this is detailed in Figure 5.1.

This simple process applies to micro-generators:

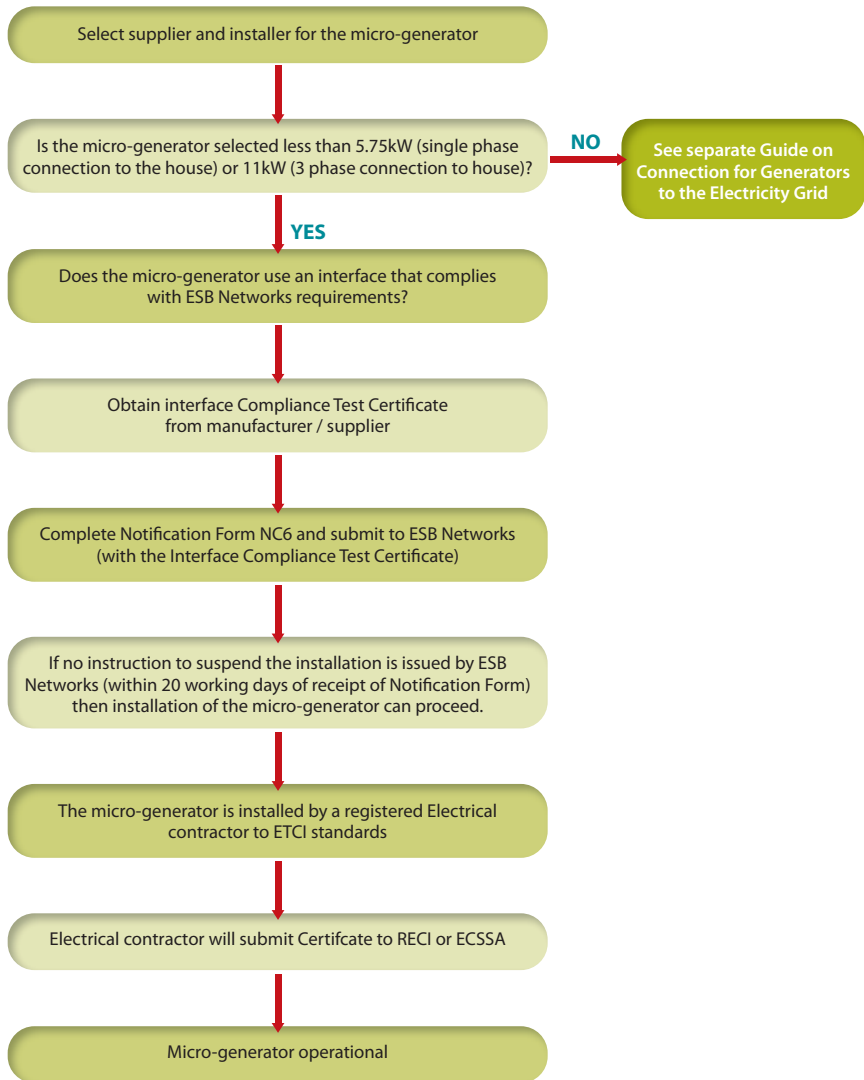
- that have a maximum output of less than 5.75 kW (single phase connection to the house) or 11 kW (3 phase connection to house)
- which use an interface that has an Interface Compliance Test Certificate acceptable to ESB Networks

If the micro-generator satisfies the above criteria then the customer simply has to inform ESB Networks in writing of the intention to install a micro-generator. This requires the customer to complete the ESB Networks’ Micro-Generation Notification Form NC6 [7]. Section 5.1 explains how to complete this one page form. The completed form should be returned to Generator Applications, ESB Networks, P.O. Box 29, Garrycastle, Athlone, Co. Westmeath. A copy of the Interface Compliance Test Certification must accompany this application form. The equipment supplier will be able to provide you with the relevant certificate. If no instruction to suspend installation is received from ESB Networks (within 20 working days of receipt of Notification Form), then installation can proceed.

If you are considering installing more than one micro-generator into the same connection point, the sum of the ratings of all the generators must be less than the 5.75 kW (for single phase supplies to the property) or 11 kW (for three phase supplies to the property) as per the limits specified in the ESB Networks “Conditions Governing Connection and Operation of Micro-generation” [3]. Combined generation larger than the above are not considered micro-generation and are managed by a different connection process (please refer to “Guide to Connecting Renewable and CHP Electricity Generation to the Electricity Network”).

If the intention is to connect multiple micro-generation installations, such as those associated with new housing estates, then such projects would be treated as a single large development. The connection of such installations should be progressed as part of the connection application for the overall development and, as such, the inform and fit process, does not apply. In the event that studies indicate that any network upgrades are required due to the connection of such generation, these costs will be borne by the developer.

Figure 5.1: Micro-generation flow chart



5.1 ESB Networks micro-generation notification form

Completion of the ESB Networks Micro-generator Notification form NC6 [7] requires the submission of the following information:

- site name and address
- site co-ordinates
- applicant name and contact details
- Meter Point Reference Number (MPRN) number
- installer/consultant contact details
- details of micro-generator interface
- details of micro-generator

Figure 5.2 shows the layout of the micro-generation form.

DID YOU KNOW?

- ESB Networks is the company that owns, operates and develops the electricity distribution network in Ireland. The distribution network consists of medium and low voltage networks. All domestic and the vast majority of commercial customers are connected to the distribution network.



Figure 5.2: Micro-Generation Notification Form

MICRO-GENERATOR NOTIFICATION FORM

Please return this form to:
 Micro-Generation Notification,
 ESB Networks, P.O. Box 29,
 Garrycastle, Athlone, Co. Westmeath

Please fill in all sections in BLOCK CAPITALS

Site Details:	Site Name: _____ Site Address: _____ _____ _____ Site Co-ordinates: Easting: Northing:	2																				
Applicant Details:	Full Name of the applicant: _____ Address of the applicant: _____ _____ MPRN Number(if available) _____ Telephone No Mobile: _____ EmailAddress: _____ Installer/Consultant: Phone No _____	1																				
Micro-generation Interface details	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;"></th> <th style="width: 10%;">Unit 1</th> <th style="width: 10%;">Unit 2</th> <th style="width: 10%;">Unit 3</th> </tr> </thead> <tbody> <tr> <td>Micro-generation interface unit manufacturer / model / type</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Serial number of micro-generator interface unit</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Are Interface protection settings as per Table 1 in *Conditions Governing the Connection and Operation of Micro-generation?</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		Unit 1	Unit 2	Unit 3	Micro-generation interface unit manufacturer / model / type				Serial number of micro-generator interface unit				Are Interface protection settings as per Table 1 in *Conditions Governing the Connection and Operation of Micro-generation?				3				
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Type of prime mover and fuel source [wind, solar, micro-CHP, diesel, if others specify]																						

Form NC6

1 MPRN Number: This is a unique 11-digit number that is assigned to every electricity connection / meter in the country. If the micro-generator is to be connected to an existing electrical connection, then the relevant MPRN number can be found on your electricity bill. If the micro-generator is to be installed in a new building that does not yet have an MPRN number then this field can be left blank, but the ESB Networks Micro-Generation Notification NC6 form should accompany the application for a new electrical connection that would be submitted in the usual manner. Please see ESB Networks website for information on applying for a new electrical connection.

A photograph of the ESB Networks Micro-Generation Notification NC6 form, tilted slightly to the right. The form is white with blue text and includes various sections for personal details, site information, and a table for additional notes.

2 Site co-ordinates: The site co-ordinates requested in this form are the Easting and the Northing co-ordinates of the premises in which the micro-generator would be installed. These can be found from a 1:50,000 Discovery Series Ordnance Survey (OS) map. Easting co-ordinates are the numbers on the horizontal axis. Northing co-ordinates are the numbers on the vertical axis. Information on 'How to give a grid reference' can be found in a panel on the right hand side of all OS Discovery Series maps. Alternatively, you can obtain the longlat references from a satellite navigation system (satnav) and use the convertor available on the OSI website [5].

A second photograph of the ESB Networks Micro-Generation Notification NC6 form, identical to the first one, tilted slightly to the right.

3 Your supplier will be able to provide you with the details of the micro-generator and interface unit required to complete this form. In addition to this information, a copy of the Interface Compliance Test Certificate should be enclosed along with the application form.

If ESB Networks do not respond to the ESB Networks Micro-Generation Notification NC6 form within 20 working days then the micro-generator can be installed.

A third photograph of the ESB Networks Micro-Generation Notification NC6 form, identical to the previous ones, tilted slightly to the right.

5.2 Installation of micro-generation

All micro-generation installations should be installed by a qualified installer and connected by a registered electrical contractor. Currently in Ireland there are two organisations that are responsible for the registration of electrical contractors; Register of Electrical Contractors of Ireland (RECI) and Electrical Contractors Safety and Standards Association (ECSSA). These organisations will be able to supply a list of registered electrical contractors in the local area where the micro-generation is to be installed.

The electrical contractor should install the micro-generator in accordance with the ETCI National Rules for Electrical Installations and all ESB requirements including those set out in Conditions Governing Connection and Operation of Micro-generation [3]. The electrical contractor should take particular care to ensure the correct earthing and lightning protection for the micro-generator is in place. They should also ensure that the installation is labelled correctly as per Conditions Governing Connection and Operation of Micro-generation [3].

Once work is complete, the electrical contractor is required to provide a Certificate of Completion recognised by the Electro-Technical Council of Ireland (ETCI). This Certificate must then be sent to their Registration body (i.e. RECI or ECSSA). The customer should also receive a copy of this Certificate of Completion.

5.3 Costs

There are presently no costs associated with processing an ESB Networks Micro-Generation Notification NC6 form; it is not typical for micro-generation connection to provoke the need for network upgrades. In the unusual event that network upgrades are required, ESB Networks will inform the customer after the ESB Networks Micro-Generation Notification NC6 form is submitted.

5.4 Metering

Usually the existing ESB meter can continue to be used but it will not record any electricity that is exported onto the grid. To record the exported electricity a smart meter or an interval meter needs to be installed.

Smart metering is an emerging technology in Ireland, see Figure 5.3. A smart metering pilot project commenced in 2008 under the management of the Commission for Energy Regulation. It has been agreed that micro-generators are to receive priority in the roll out of smart meters [8].

As an interim measure before the roll out of smart meters, ESB Networks can provide interval meters to micro-generation installations. An interval meter records the electricity that is imported or exported every 15 minutes. A limited number of micro-generators (the first 100 to apply) will only be required to pay the installation cost in order to receive an interval meter. Additional micro-generators will be required to pay the full cost of both the meter and installation. The current charges are available on the ESB Networks website (in 2008 the installation cost was €258 but this is subject to change) [9]. To apply for an interval meter, the Micro-Generation Interval Metering Application Form NC7 [10] should be completed and returned to ESB Networks with the installation fee.

Figure 5.3: Smart meter



Smart meter: A smart meter is an advanced modern electricity meter that has many functions including:

- detailed measurements of how much electricity is imported / exported
- information on the time of day that electricity has been imported / exported
- connection with the system operator through a communications network – this can include functionality to permit the system operator to remotely switch the electricity supply or to take a remote meter reading.

6 SALE OF ELECTRICITY

With the introduction of interval and smart metering the facilities are now in place to record any exported energy. Rules have also been introduced in the electricity market to allow electricity supply companies to purchase from micro-generators. A full list of electricity supply companies that are active in the electricity market can be found on the CER website¹.

¹ At the time of printing this guide no electricity supply company is offering to purchase electricity from micro-generation. **SEI anticipates that measures will be place in the future to provide for the sale of the exported electricity.**

7.1 ESB Networks Micro-generation Documents

- [1] Directive 2002/91/EC of the European Parliament and of the Council on the energy performance of buildings
http://europa.eu.int/eur-lex/LexUriServ/site/en/oj/2006/L_114/L_11420060427en00640085.pdf
- [2] Information Planning Exemptions for Renewable Technologies from Department of Environment, Heritage and Local Government
<http://www.environ.ie/en/DevelopmentandHousing/PlanningDevelopment/Planning/TopicalIssues/Renewables/>
- [3] Conditions Governing the Connection and Operation of Micro-generation
http://www.esb.ie/esbnetworks/downloads/conditions_governing_the_connection_and_operation_of_microgeneration_131106.pdf
- [4] SEI Practical Guidelines for Buyers
http://www.sei.ie/Grants/GreenerHomes/Homeowners/Practical_Guidelines_for_Buyers/
- [5] OSI Coordinates Converter'
<http://www.osi.ie/en/alist/co-ordinate-converter-tool.aspx>
- [6] EU Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market
http://eur-lex.europa.eu/pri/en/oj/dat/2001/L_283/L_28320011027en00330040.pdf
- [7] Micro-generation Installation Notification Form - NC6,
http://www.esb.ie/esbnetworks/downloads/form_nc6.pdf
- [8] Smart Metering, The next step in implementation,
<http://www.cer.ie/en/electricity-retail-market-current-consultations.aspx?article=01b6318d-3876-4630-8bb5-f54fb368be16&mode=author>
- [9] ESB Networks Standard Charges for services regularly provided by ESB Networks
http://www.esb.ie/esbnetworks/downloads/standard_charges_quick_reference.pdf
- [10] Micro-generation Interval Metering Application Form – NC7,
http://www.esb.ie/esbnetworks/downloads/form_nc7.pdf

Sustainable Energy Ireland

Glasnevin
Dublin 9
Tel: +353 (0)1 836 9080
Fax: +353 (0)1 837 2848
Email: info@sei.ie
Web: www.sei.ie

Commission for Energy Regulation

The Exchange
Belgard Square North
Tallaght
Dublin 24
Tel: +353 (0)1 4000 800
Fax: +353 (0)1 4000 850
Email: info@cer.ie
Web: www.cer.ie

ECSSA

Electrical Contractors Safety
and Standards Association Ltd.
Coolmore House, Park Road,
Killarney
County Kerry
Tel: +353 (0)64 37266
Fax: +353 (0) 64 37269
Email: info@ecssa.ie
Web: www.ecssa.ie

ESB Networks

Generator Connections
PO Box 29
Garrycastle
Athlone
Co. Westmeath
Tel: 1850 372 757
Fax: 0906479329
Email: dsogenerators@esb.ie
Web: www.esb.ie/esbnetworks

Irish Hydro Power Association

Email: info@irishhydro.com
Web: www.irishhydro.com

Irish Wind Energy Association

Killowen House
Southernlink Business Park
Jigginstown
Naas
Co. Kildare
Tel: +353 (0)45 899341
Fax: +353 (0)45 889616
Email: office@iwea.com

MEGA

Micro Electricity Generation
Association
Charleville Castle
Tullamore
Co. Offaly

RECI

Register of Electrical
Contractors of Ireland
Unit 9, KCR Industrial Estate
Ravensdale Park
Kimmage
Dublin 12
Tel: +353 (0)1 492 9966
Fax: +353 (0)1 492 9983
Email: info@reci.ie
Web: www.reci.ie

Renewable Energy Installer Academy

c/o Action Renewables
Innovation Centre
NI Science Park
Belfast
BT3 9DT
Tel: 028 9073 7866
028 9073 7865
Fax: 028 9073 7825
Email: info@reinstalleracademy.org

Solar Energy Society of Ireland

c/o Focas Institute,
Dublin Institute of Technology
Kevin Street
Dublin 8
Email: sesireland@gmail.com

The Irish CHP Association

c/o bmf Business Services
Clifton House
Lower Fitzwilliam St.
Dublin 2
Tel: +353 (0)1 661 3755
Fax: +353 (0)1 661 3786
Email: info@ichpa.com

Table 10.1 Explanation of key terms**Micro-generation**

Micro-generation describes the production of electricity using small generators. Micro-generation is typically associated with installations in domestic or small business properties.

Renewable energy

Renewable energy refers to electricity generated from a renewable and sustainable fuel source. Renewable energy currently generated in Ireland includes energy derived from the wind, biomass, solar, hydro and marine.

Combined Heat and Power (CHP)

Combined heat and power is the simultaneous production of heat and electricity. Although not always fuelled from renewable sources, CHP is very efficient as it uses both the heat and electricity produced onsite and is considered to be a low carbon source of energy.

Alternating Current (AC)

The current received by the customer from ESB Networks is generally AC. This means that the current waveform alternates in the direction that it flows.

Direct Current (DC)

This means that the current waveform flows in a constant direction. The current produced by micro-generators is generally DC. Micro-generators connected to the grid will require an inverter to convert the current from DC to AC.

Interface unit

An interface unit is the equipment that ESB Networks require for micro-generation to safely connect to the electricity network. It includes protection equipment to disconnect the micro-generator should any electrical fault occur either in the micro-generator or on the electricity network. An inverter may also be included in the interface unit.

Inverter

This is a device that converts current from DC to AC.

Kilowatt (kW)

A kilowatt is a measurement of electrical power. It is used to express how much electrical energy a device can produce or consume.

Voltage

Voltage is a measure of electrical potential between two points. For micro-generation applications it is generally measured in Volts (V) or kilovolts (kV).

Single Phase

The supply to domestic dwellings is generally a single phase supply. The voltage for single phase supply in Ireland is 230 volts.

Three Phase

A 3 phase supply has 3 conductors which each carry an AC current. The voltage for 3 phase supplies in Ireland is 400 Volts. Some commercial premises and farms may receive a three phase supply.





Sustainable Energy Ireland

Glasnevin
Dublin 9
Ireland

T. +353 1 8369080 | info@sei.ie
F. +353 1 8372848 | www.sei.ie



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