Office of Utility Regulation

Buy-back rate Review

Consultation on the level of buy-back tariffs that would be appropriate for domestic micro-generation and the treatment of the charge for the installation of an export meter

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Executive summary

In June 2008 the States noted the Energy Policy Report, which amongst other issues, requested the Office of Utility Regulation ("OUR"), in partnership with Guernsey Electricity Limited ("GEL"), "to research the level of buy back tariffs that would encourage small-scale renewable electricity generation and whether the charge for the installation of the export meter should be abolished, and then to produce a joint report back to the Policy Council, via the Energy policy Group, on how such tariffs and costs may be amended to reflect the States Energy Policy".

The buy-back rate is the rate domestic consumers receive from GEL when they sell electricity back to GEL which has been generated using micro-generators. Micro-generators are used to generate electricity for the customer's own use, but in some cases, it is possible that more electricity has been generated than what is needed for own consumption. Examples of micro-generators are heat pumps, photo voltaics (e.g. solar panels), micro-wind turbines, micro-hydro and domestic Combined Heat and Power. Under the current arrangements, GEL customers could sell this excess electricity to GEL at a rate currently determined by GEL. This rate is currently set at approximately 5 pence per kWh.

The OUR, like the States, recognises the potential role micro-generation might play in the future and is therefore committed to ensuring that the current regulatory arrangements do not stop innovation and/or introduce barriers to micro-generators who would like to connect to the GEL network. In the view of the Director General ("DG") it is important to ensure that GEL charges are determined in a way that fairly reflects the costs and benefits of domestic micro-generation and that also contributes to achieving the wider goals the States has in respect to reducing carbon emission levels in Guernsey.

The DG has therefore decided to issue this consultation document to enable interested parties to engage in this review of the buy-back rate at an early stage in the process.

This consultation document discusses the various approaches which have been adopted in the UK, Jersey, Isle of Man and various other countries in order to increase the uptake of micro-generation. It outlines two broad options which could be adopted in order to determine the appropriate price for electricity sold back by micro-generators to the network. It outlines some of the possible advantages and disadvantages of these approaches, especially considering Guernsey's specific circumstances.

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1. Introduction

In June 2008 the States noted the Energy Policy Report, which amongst other issues, requested the Office of Utility Regulation ("OUR"), in partnership with GEL, "to research the level of buy back tariffs that would encourage small-scale renewable electricity generation and whether the charge for the installation of the export meter should be abolished and then to produce a joint report back to the Policy Council, via the Energy policy Group, on how such tariffs and costs may be amended to reflect the States Energy Policy".

The buy-back rate is the rate domestic consumers receive from GEL when they sell electricity back to GEL. Micro-generation refers to a number of different technologies such as Photo-Voltaics (PV - solar power), micro-Combined Heat and Power, micro-wind, micro-hydro, heat pumps etc. which have a generation capability with a maximum of 3.7 kW (one phase) or 11 kW (three phases).

The OUR, like the States, recognises the potential role micro-generation might play in the future and is therefore committed to ensuring that the current regulatory arrangements do not stop innovation and/or introduce barriers to micro-generators who would like to connect to the GEL network. In the view of the Director General ("DG") it is important to ensure that GEL charges are determined in a way that fairly reflects the costs and benefits of domestic micro-generation and that also contributes to achieving the wider goals the States has in respect to reducing carbon emission levels in Guernsey.

The DG has therefore decided to issue this consultation document to enable interested parties to engage in this review of the buy-back rate at an early stage in the process.

This consultation document outlines two broad options in determining an appropriate price for electricity sold back by micro-generators to the network. It outlines some of the possible advantages and disadvantages of these approaches, especially considering Guernsey's specific circumstances.

The purpose of this consultation is first and foremost to invite views on how GEL currently determines its buy-back rate and the most appropriate approach going forward. Based upon the response to this consultation the DG will consider the next appropriate actions that may be required. The DG and GEL intend to issue a report on the buy-back rate to the Energy Policy Group by early next year.

The DG wishes to record his thanks to GEL, E-Si and Rupert and Rosie Dorey for their help in the preparation of this consultation.

This document does not constitute legal, technical or commercial advice; the DG is not bound by this document and may amend it from time to time. This document is without prejudice to the legal position or the rights and duties of the DG to regulate the market generally.

2. Structure of Paper and Process

2.1 Structure of this paper

The paper is structured as follows:

- Section 3 describes the electricity regulatory regime in the Bailiwick of Guernsey;
- Section 4 discusses the different micro-generation technologies potentially suitable for domestic consumers;
- Section 5 discusses the approach taken in the UK market;
- Section 6 discusses the approach taken in a number of other European markets;
- Section 7 discusses the approach taken by Guernsey Electricity;
- Section 8 discusses options going forward; and
- Section 9 sets out the next steps in the process.

2.2 Procedure and Timetable

Responses to this document should be submitted in writing and should be received by the OUR before 5.00pm on 8 December 2008. Written comments should be submitted to:

Office of Utility Regulation
Suites B1 & B2,
Hirzel Court,
St Peter Port,
Guernsey, GY1 2NH.
Email: info@regutil.gg

All comments should be clearly marked: "Buy-back rate review".

In accordance with the OUR's policy on consultation set out in Document OUR 05/28 – "Regulation in Guernsey; the OUR Approach and Consultation Procedures", non-confidential responses to the consultation will be made available on the OUR's website (www.regutil.gg) and for inspection at the OUR's Office during normal working hours. Any material that is confidential should be put in a separate annex and clearly marked so that it can be kept confidential. However, the DG regrets that he is not in a position to respond individually to the responses to this consultation.

3. Background Information

3.1 Energy policy report

In their debate on the 25th June 2008, the States decided to note the Energy Policy report which was put together by the Policy Council's Energy Policy Group (EPG). The report identifies a large number of policies, initiatives and projects, many of which are interrelated. One of the issues raised in the report is the current level of the buy-back rate.

The buy-back rate refers to the rate GEL customers receive from GEL for selling electricity (which these customers have generated using micro-generators) back to GEL.

Examples of micro-generators are heat pumps, photo voltaics (e.g. solar panels), micro wind turbines and micro hydro. Micro-generators are used to generate electricity for the customer's own use, but in some cases, it is possible that more electricity has been generated than what is needed for own consumption.

Under the current arrangements, GEL customers could sell this excess electricity to GEL at a rate currently determined by GEL. This rate is currently set at approximately 5 pence per kWh.

In their energy policy report the EPG argues that if the buy-back rate was set at a higher level, then more customers would be incentivised to install micro-generators. The EPG is therefore of the view that the OUR should consider whether the current buy-back rate should be increased. It is also of the view that GEL should not charge for the provision or installation of the extra meter.

3.2 Legal Background

The legislation governing the Guernsey electricity market came into force in February 2002. The legislative framework underpinning the regulatory regime for the electricity sector is governed by:

- The Regulation of Utilities (Bailiwick of Guernsey) Law, 2001 (the "Regulation Law");
- The Electricity (Guernsey) Law, 2001 (the "Electricity Law");
- The Electricity (Guernsey) Law 2001 (Commencement and Amendment) Ordinance 2001; and
- States Directions to the DG adopted by the States of Guernsey[1].

[1] Billet D'Etat No. XVIII 2001, pages 1263 to 1264

The Regulation Law

The Regulation of Utilities (Bailiwick of Guernsey)[2] Law 2001 established the Office of Utility Regulation and sets out the overall functions and objectives of the DG. Section 2 of the Regulation Law sets out the general duties that the DG must have regard to when exercising his duties and functions all markets that are regulated by OUR including the electricity market. Under this Law, the DG has the power to examine and if deemed necessary, to determine the buy-back rate in order to protect consumers. The Law places a duty on the DG to protect consumers not solely in terms of prices but also in terms of quality, service levels, permanence and variety of utility services.

The Electricity Law

The Electricity Law sets out in more detail the framework governing the electricity market in Guernsey and in particular it defines three activities;

- generation of electricity;
- conveyance of electricity across the electricity network; and
- supply of electricity directly to homes and businesses.

3.3 Current Licensing Regime

The States of Guernsey have issued a number of States Directions to the DG in relation to the licensing of electricity activities in Guernsey. In accordance with those Directions the DG issued the first licences for electricity generation, conveyance and supply to the incumbent electricity company – GEL - on 1st February 2002.

Generation of electricity: open to competition

The market for generating electricity is open to competition. However, prospective new generators will have to apply for and obtain a generation licence.

There is one exception to this rule. In January 2002, the OUR published the Direction on Exemptions from the Requirement to hold a Licence[3] . This direction exempts, under certain circumstances, persons wishing to install generating equipment with an output rating of less than 500kW from having to hold a generation licence. In practice this means that domestic micro-generators generally speaking would not have to hold a generation licence and hence will not be subject to the associated licence fee.

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[2] http://www.regutil.gg/docs/regulatory_law.pdf
[3] http://www.regutil.gg/docs/our0206.pdf

Distribution and supply of electricity

In terms of conveyance, until the year 2012, GEL is the sole and exclusive licence holder for distribution and supply of electricity in Guernsey. This means that at least until 2012, no other operator can lay electricity cables and anyone generating electricity must therefore use the existing electricity network of GEL to convey that electricity from their generation plant to customers.

Also, until 2012, GEL has the exclusive right to sell electricity to end customers. Therefore, any generator of electricity who wishes to sell this electricity to other parties would have to sell this electricity to GEL.

This clearly puts GEL in a strong position as sole buyer of electricity and sole provider of the network.

Given the above, and more specifically given the DG's duties under the Regulation Law, there might be a role for the DG in the determination of buy-back prices and access arrangements if it was found that GEL's current approach to determining the buy-back rate and its approach to metering arrangements was deemed to be inappropriate.

4. Micro-generation: an introduction

One of the objectives of the energy policy paper is to assess the scope for encouraging domestic micro-generation using renewable energy sources.

Renewable energy is defined as energy from continuously available sources, which do not rely on fossil fuels, such as coal, oil and gas. The main renewable energy sources are wind, sun, water and biomass.

4.1 What is domestic micro-generation?

Micro-generation is defined in section 82 of the UK Energy Act 2004 as the small-scale production of heat and/or electricity from a low carbon source. The suite of technologies caught by this definition includes solar (photo-voltaics (PV) to provide electricity and thermal to provide hot water), micro-wind (including the new rooftop mounted turbines), micro-hydro, heat pumps, biomass, micro combined heat and power (micro-CHP) and small-scale fuel cells. Technically, micro-generation refers to electricity generation of up to 50 kWe.

Using the UK definition, domestic micro-generation refers to electricity generation up to 3.7 kW (single phase) or 11 kW (three phase).

4.2 Different micro-generation technologies

There are a number of micro-generation technologies which could be adopted for domestic usage. At present, the main technologies for consideration in a domestic setting are:

- Heat pumps (ground source, air, water)
- Solar photo-voltaics
- Micro-wind
- Micro-hydro
- Domestic CHP

In the next sections these technologies are discussed in more detail.

4.2.1 Heat pumps

There are three main types of heat pump, namely:

- Air source heat pumps
- Ground source heat pumps

- Water source heat pumps

Generally speaking, only air source and ground source heat pumps are likely to be used for domestic micro-generation. Heat pumps use electrical energy (from the normal electricity supply or an alternative supply, such as solar panels) to concentrate heat from low-grade sources (e.g. air, ground, water) into high-grade heat to heat the house and/or water heating. Although in a slightly different way, both fridges and air conditioners use heat pumps.

How much CO_2 and energy savings could be made will depend on the efficiency factor (or coefficient of performance) of the heat pump, the temperature of the heat source (ground or air) and the required heating duty. The performance of heat pumps to heat the home is significantly better when used with under-floor heating compared with radiators as the former require a much lower water temperature compared with the latter. In the view of GEL, in a climate such as Guernsey's, at least three units of heat may be obtained for every unit of electricity consumed. At present there is no independent (audited) information in relation to the performance of heat pumps. However, the Energy Savings Trust in the UK is currently commissioning the first nationwide trials of heat pumps and the results of these trials are expected to be published by the end of 2009.

The European Performance of Buildings Directive requires that before the construction of new buildings over 1,000m^2 commences, the economic feasibility of heat pumps must be taken into account, which is a requirement that does not apply to Guernsey as the States of Guernsey's Environment Department's Building Control does not follow EU legislation. Clearly, this does not apply to individual domestic dwellings, but might apply to housing developments for example.

Air source heat pumps

How do they work?

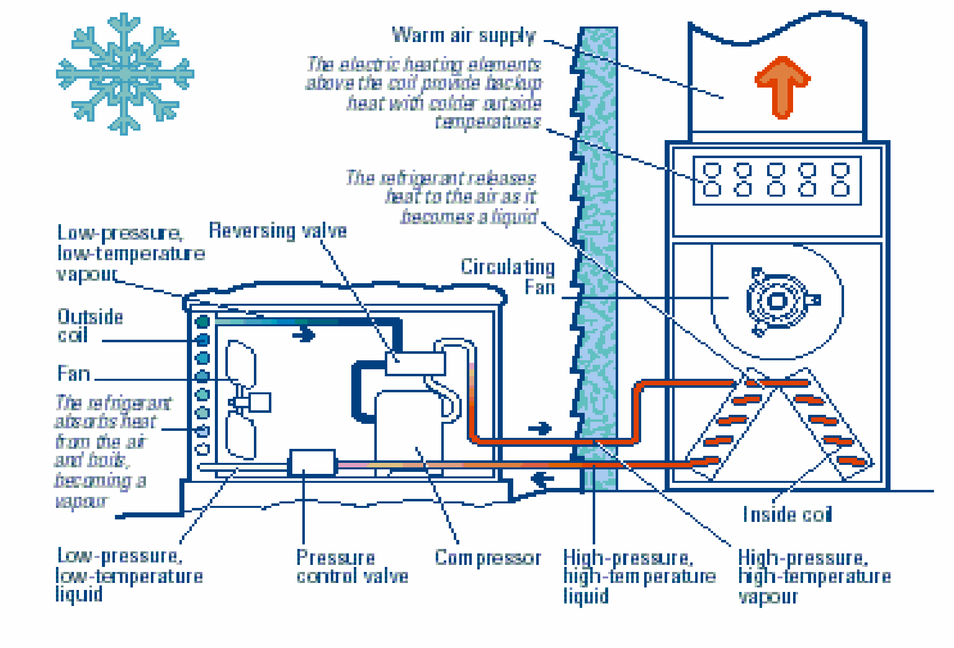
Air source heat pumps (ASHP) absorb heat from the outside to heat buildings. Even in situations where it is minus 15^{o}C it is possible for an air source heat pump to still extract heat from the outside air. Whereas a fridge extracts heat from the inside of the fridge, an ASHP extracts heat from the outside air to heat the inside of the house and possibly pre-heat domestic hot water.

An ASHP consists of three key elements:

- the evaporator coil
- the compressor pump
- the heat exchanger

The evaporator coil absorbs heat from the outside air. The compressor pumps the refrigerant through the heat pump and compresses the gaseous refridgerant to the temperature needed for the heat distribution circuit. The heat exchanger then transfers the heat from the refridgerant to either air or water. In an air-to-water system the heat is used to heat water, i.e. for under-floor heating/radiators and possibly to pre-heat domestic hot water (storage tank). If an air-to-air system is used then the warm air is circulated by fans to heat the building.

Figure 4.1 Air Source Heat Pump – Schematics[4]



In the view of GEL, air source heat pumps are particularly suitable for Guernsey since the incidence of very low or freezing air temperatures during the winter, which adversely effects performance, are low.

Figure 4.2 Air Source Heat Pump[5]

4 http://oee.nrcan.gc.ca/publications/infosource/pub/home/Heating_With_Electricity_Chapter2.cfm?attr=4
5 http://www.acscool.co.uk/heatpump.htm

How much do they cost?

In the UK, a typical 5 kW domestic system (suitable for a well insulated detached property) would cost approximately £6,000 to £8,000 installed. GEL estimates that in Guernsey a typical 8 kW domestic system (suitable for a well insulated detached property) would cost approximately £11,000 installed. In addition to these capital costs, the heat pump needs electricity to run. The running costs depend on the efficiency of the heat pump system, which is measured by its coefficient of performance (CoP). The CoP is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop[6]. The CoP is likely to range from 2.5-3.5, with the CoP at the top end of the range if used with underfloor heating. Generally speaking, the CoP will decline as the external air temperature declines.

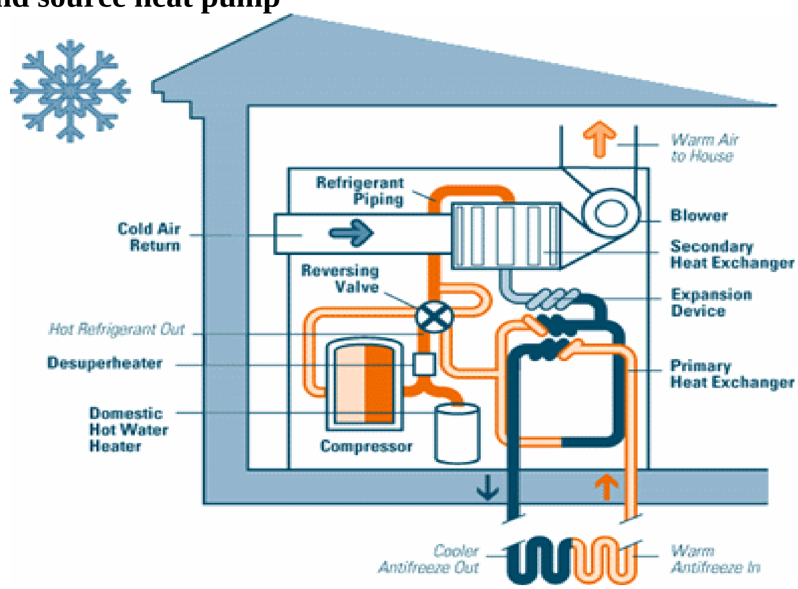
Ground source heat pumps

How do they work?

Ground source heat pumps (GSHP) transfer heat from the ground and into the house to heat the house and possibly also to pre-heat the domestic hot water.

GSHP consists of three key elements:
- the ground loop
- the heat pump
- the heat distribution system

Figure 4.3 Ground source heat pump[7]



[6] http://www.energysavingtrust.org.uk/generate_your_own_energy/types_of_renewables/ground_source_heat_pumps
[7] http://oee.nrcan.gc.ca/publications/infosource/pub/home/gif/heatpump_fig7_e.gif

The ground loop comprises of lengths of pipe buried in the ground, either in a horizontal trench or vertically through boreholes. Usually the pipe forms a closed circuit and is filled with a mixture of water and anti-freeze. This liquid is pumped around the pipe thus absorbing the heat from the ground.

The heat pump also has three parts, namely:

- an evaporator
- a compressor
- a condenser

The evaporator takes the heat from the water/anti-freeze mixture. The compressor moves the water/anti-freeze mixture around the heat pump and compresses the gaseous refrigerant to the temperature needed for the heat distribution circuit (e.g. it concentrates the heat). The heat distribution system consists of under floor heating and/or radiators for space heating and in some cases could also be used to pre-heat the water for the domestic hot water supply.

In GEL's view, ground source heat pumps are particularly favoured in areas such as Scandinavia where air temperatures may often be below zero, creating problems for the air source machines.

How much do they cost?

In the UK, a typical 8 kW system costs between £6,000 and £12,000 installed including the cost of the ground works necessary to install the collector plus the price of connection to the distribution system. According to GEL, in Guernsey, a typical 12 kW system costs between £16,000 and £18,000 installed including for the cost of the ground works necessary to install the collector. In addition to these capital costs, the heat pump needs electricity to run. The running costs depend on the efficiency of the heat pump system (which is measured by its coefficient of performance (CoP). The CoP is the ratio of units of heat output for each unit of electricity used to drive the compressor and pump for the ground loop. The CoP is likely to range from 3.0-4.0, but it is possible to reach a CoP close to 4 if the heat pump is used with under floor heating.

4.2.2 Solar Photo-voltaics

Solar photo-voltaics (PV) uses energy from the sun to create electricity. PV requires only daylight, not necessarily sunlight, in order to generate electricity.

Figure 4.4 Solar panels[8]

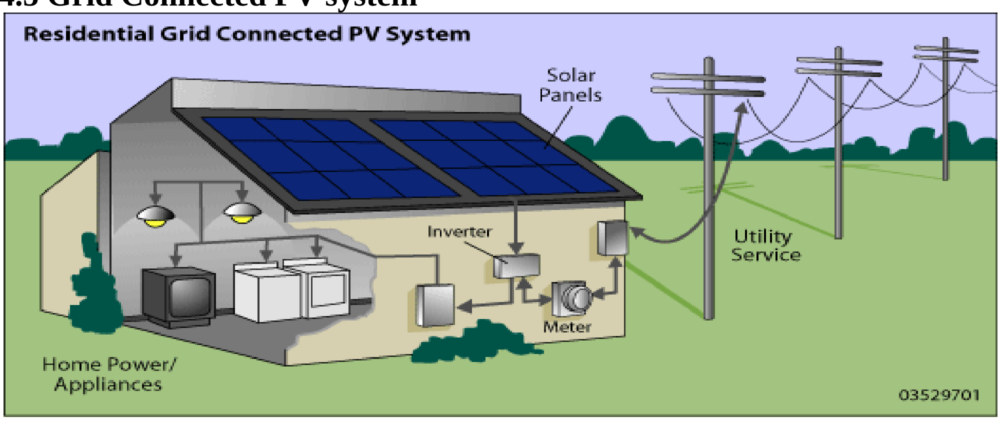
How does it work?

Photo-voltaic systems use cells to convert solar radiation into electricity. The PV cell consists of one or more layers of a semi-conducting material. The dominant technology uses crystalline silicon (based on 'wafer' technology), and has efficiencies of 14%-18%. New types of thin film technology which do not use silicon are also being developed.

PV arrays come in a variety of shapes and colours, ranging from grey 'solar tiles' that look like roof tiles to panels and transparent cells that can be used on conservatories and glass to provide shading as well as generating electricity. More conventional solar panels are not light and the roof must therefore be strong enough to take the weight, especially if the panel is placed on existing tiles.

When light shines on the cell it creates an electric field across the layers. This causes an electric current to flow. The greater the intensity of the light, the greater the flow of current and the greater the amount of energy delivered. PV systems can be used for a building with a roof or wall that faces within 90 degrees of south, as long as no other buildings or large trees overshadow it. If the roof is in shadow for part of the day the output of the system decreases.

Figure 4.5 Grid Connected PV system[9]



[8] http://www.heatmyhome.co.uk/images/pv-solar-panels-uk.jpg
[9] http://apps1.eere.energy.gov/consumer/images/residential_grid_pv.gif

What does it cost?

Prices of PV systems depend on the size of the system, the type of PV cell and the nature of the building on which the PV is mounted. In the UK, the costs of an average domestic system are likely to be in the £5000 to £7500 range per kWp installed. According to GEL, in Guernsey, installation costs for a domestic system would be in the region of £7500 to £9000 per kWp installed. Generally, domestic systems delivering 1.5 to 3 kWp would be suitable for an average household. Solar roof tiles are more expensive than solar panels. Solar panels that are integrated into a roof cost more than those that are mounted on top.

Apart from the capital costs, most grid connected systems require very little maintenance apart from keeping the panels clean and ensuring that trees don't shade the panels. Stand-alone systems with batteries are likely to require more regular maintenance.

4.2.3 Micro-wind

Modern wind turbines use the wind to turn aerodynamic blades that turn a rotor which creates electricity. One of the potential drawbacks often associated with micro-wind turbines is their visual impact on the landscape, and also the fact that they might generate noise.

How does it work?

Wind power is proportional to the cube of the wind's speed. As a result, relatively minor increases in wind speed result in large changes in potential output. Wind speed increases with height, thus the higher the turbine (e.g. the taller the mast or tower), the more electricity it is likely to generate. The ideal position would be on a smooth-top hill with a flat, clear exposure, free from excessive turbulence and obstructions such as large trees, houses or other buildings. Individual turbines vary in size and power output from a few hundred watts to two or three megawatts. A typical micro-wind turbine for domestic use would be 1 to 6 kilowatts, depending on the location and size of the home.

Figure 4.6 Domestic wind turbine[10]

[10] http://www.symscape.com/files/images/house_wind_turbines_1.jpg

What does it cost?

In the UK, systems up to 1kW (output) will cost around £1500 installed whereas larger systems in the region of 2.5kW to 6kW would cost between £11,000 and £19,000 installed. GEL estimates that in Guernsey a system of 1 kW (output) would cost approximately £5000 installed whereas systems in the region of 2kW to 3kW would cost between £9,000nand £13,000 installed. These costs are inclusive of the turbine, mast, inverters, battery storage (if required) and installation, however costs will vary depending on location and the size and type of the system.

Turbines are expected to have a life of up to 20 years but require service checks every few years to ensure they are working efficiently. For battery storage systems, typical battery life is around 6-10 years, depending on the type, so batteries may have to be replaced at some point in the system's life.

4.2.4 Micro-hydro turbines

Micro-hydro turbines require a source of moving water such as a river or a stream and hence the scope to install micro-hydro on Guernsey will be limited. The main issue with the installation of a micro-turbine (apart from cost) is to maintain the river's ecology by restricting the proportion of the total flow diverted through the turbine.

Figure 4.7 Micro hydro turbine[11]

How does it work?

How much electricity could be generated will depend on the water's flow rate (per second) and the height (or head) that the water falls. It also depends on the system's

[11] http://www.energyalternatives.ca/PB_Images/ESDLH100.jpg

efficiency level, i.e. how efficiently it converts the power of the water into electrical power (for small systems a 50 per cent efficiency level might be attainable).

What does it cost?

Hydro costs are very site specific and are related to energy output. Therefore no estimate of costs is included in this paper.

4.2.5 Domestic (renewable) CHP

Combined heat and power (CHP), also known as 'co-generation', is the use of a single piece of equipment to generate both heat and power. CHP is available in different sizes, varying from very large to micro-CHP which could replace the boiler in a single home.

CHP systems tend to produce more heat than electricity and both will have to be used at the same time. Generally, a CHP system will only meet part of the demand for electricity and hence another source of electricity would also need to be available.

Figure 4.78 Domestic CHP[12]

How do they work?

In its simplest form, a CHP system employs a gas turbine, an engine or a steam turbine to drive an alternator. The resulting electricity can be used either wholly or partially on-site.

[12] http://www.lowcarbonsolutions.com/images/Picture-1.jpg

The waste heat (produced during power generation) can be recovered in the form of steam or hot water via the use of a heat recovery boiler and thus can be consequently used for the provision of heating. The system can also potentially provide cooling facilities by the use of an advanced absorption cooling technology.

Most domestic CHP installations rely on a stirling[13] engine and use natural gas as fuel. However, there are also some domestic CHP installations available which use biomass (usually in the form of small logs, with the larger installations also accepting wood pellets and wood shavings). Diesel fuelled Stirling engines have also been demonstrated.

How much do they cost?

In the UK, PowerGen sell their WisperGen units for about £3,000. These units are able to generate approximately 8kW of heat and about 1.4 kW of electricity, which results in an efficiency of about 80%. Honda micro-CHP units generate about 3kW of heat and about 1kW of electricity, claiming an efficiency level of about 85%. The Honda CHP system has an installed cost of about £5,600.

[13] Invented by the Reverent Robert Stirling in 1816, the Stirling engine is an external combustion engine that works on the principle of thermal expansion and contraction of a fluid (gases or liquids). The basic component of the engine is a sealed cylinder containing the fluid (air, hydrogen etc). One end of the cylinder is heated, the other cooled. Along with the cylinder, the engine will have one power piston and one displacer piston, or two power pistons (these are the basic variants). The engines work on a cycle of Heat - Expand - Cool - Contract.

5. Micro-generation in the UK

5.1 Background

In the UK there are a number of subsidies and incentives in place to increase the contribution of renewable energy sources to the overall UK electricity supply and to reduce the amount of energy being wasted.

In March 2006 the UK government launched its Micro-generation Strategy with the objective of creating the conditions for micro-generation to become a realistic alternative or supplementary source of energy generation.

5.2 UK incentives framework: subsidies and fiscal measures

In the UK the energy sector is responsible for approximately 44% of the green house gas emissions. The UK aims to reduce its CO_2 emissions by 60 per cent by the year 2050.

The development of a low carbon energy sector has therefore been a priority for the UK government and has resulted in a large number of incentives and subsidies being put in place. In March 2006, the UK government launched the Micro-generation Strategy. The aim behind this strategy was to identify obstacles to creating a sustainable micro-generation market.

The UK government has introduced a large number of measures in the form of grants, other subsidies and fiscal measures in order to encourage the uptake of micro-generation.

One-off grants

Domestic customers are able to obtain capital grants to install micro-generators through the Low Carbon Buildings Programme (LCBP). The level of these grants depend on the type of technology being installed. These grants are administered on a first come first served basis.

There is a fixed annual subsidy level available for each technology. In the 2006 Budget an additional £50 million was announced to supplement the original £30 million, of which £10 million is available for householders and the remainder is aimed at Community groups, public and non-profit sector applicants.

So far, the take up of the grants has been slower than anticipated, with approximately £10 million committed to date. This is probably due to the high upfront cost of installing micro-generators. As a result, grant levels for all technologies have now been increased by 50 per cent (per April 2008).

Householders can apply for grants of up to £2,500 per property towards the cost of installing a certified product by a certified installer. These grants are subject to a number of conditions, such as a basic level of energy efficiency measures must already have been installed (e.g. appropriate levels of loft insulation, cavity wall insulation, energy efficient light bulbs, etc.) and in cases where this is necessary planning permission needs to already have been obtained. However, there is no longer any need to get planning permission to install solar panels, ground and water source heat pumps and biomass systems.

Table 5.1 One-off grants available for householders

Technology	Maximum Amount of Grant
Solar photo-voltaics	Maximum of £2,000 per kW of installed capacity, subject to an overall maximum of £2,500 **or** 50% of the relevant eligible costs, whichever is the lower
Wind turbines	Maximum of £1,000 per kW of installed capacity, subject to an overall maximum of £2,500 **or** 30% of the relevant eligible costs, whichever is the lower
Small hydro	Maximum of £1,000 per kW of installed capacity, subject to an overall maximum of £2,500 **or** 30% of the relevant eligible costs, whichever is the lower
Solar thermal hot water	Overall maximum of £400 **or** 30% of the relevant eligible costs, whichever is the lower
Ground source heat pumps	Overall maximum of £1,200 **or** 30% of the relevant eligible costs, whichever is the lower
Air source heat pumps	Overall maximum of £900 or 30% of the relevant eligible costs, whichever is lower
Automated wood pellet fed room heaters/stoves	Overall maximum of £600 **or** 20% of the relevant eligible costs, whichever is the lower
Wood fuelled boiler systems	Overall maximum of £1,500 **or** 30% of the relevant eligible costs, whichever is the lower

(Source: http://www.lowcarbonbuildings.org.uk/about/hfaqs/)

Other subsidies: Renewable Obligation Certificates

As part of its Micro-generation strategy the government wanted to see easier access to Renewable Obligation Certificates (ROCs) to further encourage the uptake of micro-generation. The Renewable Obligation obliges electricity suppliers to source increasing amounts of their electricity from renewable sources, up to 15% by 2015. If suppliers are not able to provide sufficient ROCs themselves (i.e. through the energy they have sourced) they will have to purchase additional ROCs, which are sold through a number of auctions. The cost of ROCs is included in the price of electricity, therefore through the renewable obligation scheme, electricity customers' money is used to subsidise investment in new renewable electricity generation technology.

Under the Energy Bill it is envisaged that micro-generation will qualify for 2 ROCs rather than the current 1 ROC per MWh of renewable energy generated. This should incentivise electricity supply companies to ensure that a reasonable proportion of their customers are micro-generators in order to help them fulfil their ROC targets.

Fiscal incentives

Most micro-generation products qualify for a reduced VAT of 5 per cent rather than the customary 17.5 per cent. Also, micro-generators who sell electricity back to the network don't have to pay tax on this income. Zero carbon homes of a value up to £500,000 are exempt from stamp duty payments, which would normally amount to up to 4 per cent of the sales price to be paid to Treasury upfront.

5.3 The level of the buy-back rate in the UK

In 2007 HM Treasury asked Ofgem to review the market arrangements for customers wanting to sell electricity back to energy suppliers. Ofgem published a report on 11 March 2008 titled "Review of the market for exported electricity from micro-generation"[14].

Chapter 2 of the Ofgem report deals with the level of buy-back tariffs. It notes that the main reason why consumers, who sell electricity back to their supplier, receive a price significantly lower than what they have to pay to purchase electricity from their supplier is the difference between the wholesale price of electricity and the retail tariff.

In a number of cases, consumers who sell electricity back to their supplier, receive the wholesale tariff. The retail tariff, at which consumers purchase electricity from their supplier, includes not only the cost of wholesale electricity, but also:

- the costs of transporting electricity on the network (including transmission and distribution use of system charges and losses);
- metering costs;
- costs to serve (e.g. billing costs, bad debt/late payments, answering enquiries, cash flow costs);
- costs of meeting environmental obligations such as Carbon Emissions Reduction Target (CERT) and the Renewables Obligation (RO).

Ofgem estimates that, in the UK, the wholesale cost is less than half of the average electricity costs charged to consumers.

[14] http://www.ofgem.gov.uk/Sustainability/Environmnt/Policy/SmallrGens/DomsScMicro/Documents1/Final%20MG%20report%2011%20March%202008.pdf

5.4 Suppliers' export tariff offers

In the UK, there is competition in the electricity supply market, with different suppliers offering different export tariffs to micro-generators. Most of the offers are dependent on the export customer also being an import customer from the supplier in question. All the major UK suppliers have offers to purchase electricity from micro-generators and these offers could be characterised as one (or more) of the following:

Metered export tariffs

These tariffs are paid on the metered amount of export electricity generated by a micro-generator. The level of these tariffs varies between 4.25 p/kWh to 18 p/kWh, depending on the supplier, the region in which the customer lives and the type of micro-generation installed. Different suppliers have attached different conditions to these tariffs, such as:

- They only apply to micro-generation installations which have capacity less than 6 to 11 kW depending on the supplier;
- An export meter needs to be installed at a cost of between £30 and £200. For many suppliers meter installation can take up to 2 months.

Table 5.2 Metered Offers for Micro-generation Exports

Supplier	Key Features	Export Tariff	Import Tariff**	Meter Cost
British Gas	Customer self-reads quarterly and claims ROCs separately	5p/kWh	About 14p/kWh	£30 (dictated by local distributor/ installer)
EDF	Customer claims ROCs separately Limited to micro-generation less than 10kW	7.64p/kWh or 5p/kWh for small scale hydro	15.5p/kWh	Free - £250 (depending on region)
Npower	Limited to micro-generation less than 6kW NPower collects ROC entitlement	10.98p/kWh Rate depends on area	11.64p/kWh	£60
E.On – Solarnet	Customer self-reads Customer claims ROCs separately Limited to micro-generation less than 5kW Only available for solar panels	Solar: 8.79 to 11.26p/kWh depending on region	Depends on consumer characteristics	E.On does not supply meters
Scottish Power	Scottish Power collect ROCs but only pay out on exports	4.25p/kWh including ROC	Depends on consumer characteristics	Free of charge
Scottish and Southern Electricity	Price includes payment for exported power and ROCs Only available for solar panels with a limit of less than 5 kW	Solar Energy Plus: 18p/kWh Wind: 5p/kWh	Approximately 10p/kWh depending on area	Free of charge if an import customer

(Source: Suppliers, OUR, August 2008)

Unmetered offers

Some UK suppliers offer a fixed annual fee payable regardless of how much electricity is exported. Others offer an amount payable based on an estimate of export volumes for example based on specific characteristics such as house type, micro-generation technology, etc. In their report, Ofgem suggests that some of the unmetered offers might be a goodwill gesture to cover delays in obtaining and installing export meters.

Table 5.3 Un-Metered Offers for Micro-generation Exports

Supplier	Key Features	Tariff
British Gas – Eco-Save Scheme	Customer claims ROCs separately	Un-metered: £18 per year
EDF – Green tariff	Customer claims ROCs separately Limited to micro-generation less than 10kW	Un-metered: £10 per kW per year
NPower – Juice	Limited to micro-generation less than 6kW NPower collects and pays ROC entitlement on generation Import restricted to Juice tariff	Tariff: Same as follow on rate[15] applicable in region Tariff paid on *estimated volumes assuming 50% of generation is exported* Customer provides two generation readings per year
E.On	Customer self-reads Customer claims ROCs separately Limited to micro-generation less than 5kW Currently only available for solar panels but will include micro-CHP	Un-metered: export volume estimated from customer characteristics

(Source: Suppliers, OUR, August 2008)

Generation based offers

These offers are based on the Renewable Obligation Certificate (ROC) value of the total amount generated regardless of how much is exported. Suppliers often act as the ROC agent. As of 9 October 2008, the average ROC value was approximately 5.1 p/kWh, this is reflected in the offers made by Ecotricity and Good Energy. To reduce transaction costs consumers are required to provide generation meter readings.

[15] The follow-on unit tariff rate is whereby the subscriber is paid the same unit price for exported electricity as they pay npower for the follow-on rate for the electricity they purchase. The rates charged for imported and exported supply will vary with wholesale electricity prices in the UK and from region to region. In every region of the UK, different charges are levied for using the local 'wires' to supply electricity to peoples' homes. These varying charges are reflected in the ultimate cost of the supplied electricity. These charges are standard across all electricity supply companies in the UK.

Table 5.4 Generation Based Micro-generation Offers

Supplier	Key Features	Tariff
EDF	Customer self-reads the meter Customer is paid for all generation (including for own use)	Metered generation: 5p/kWh for generation less than 5kW 4.5p/kWh for generation greater than 5kW
Ecotricity	Customer self-reads the meter Customer is paid for all generation (including for own use) Ecotricity appointed as ROC agent Limited to less than 10kW	Metered generation: 9p/kWh
Good Energy – Home Generation	Customer self-reads Limited to installed capacity of less than 6kW and upper bound of total export (by all customers) is 5MWh per year Customer is paid for all generation (including for own use) Good Energy appointed as ROC agent	Metered generation: 9p/kWh
Green Energy – Sell Us Your Electricity (SUYE)	Green Energy appointed as ROC agent Tariffs dependent on volume of generation	Export = 5.5p/kWh £45/ROC = 4.5p/kWh However, in April 2009 this will rise to 9p/kWh

(Source: Suppliers, OUR, August 2008)

Some suppliers require consumers to have two additional meters (additional to the standard 'import' meter), namely a generation meter and an export meter. The generation meter measures how much electricity the micro-generation unit produces and the export meter measures how much electricity is not used on the consumer's property and is being sold back to the supplier.

Other available packages only require a generation meter to be installed and as part of these packages consumers are paid for every unit of electricity generated even if it is for the consumer's own use. Some suppliers use the total amount of energy generated by all its micro-generators (assuming they use renewable energy sources) to earn ROCs.

5.5 Ofgem's assessment of micro-generation offers

Ofgem's assessment is that suppliers offer fair value to their micro-generation customers given the infancy of the market but that better provision of information would be helpful to enable customers to find the best deal to suit their circumstances. It also finds that easier access to financial incentives would also be beneficial.

In its report, Ofgem suggests that based on its findings at the time suppliers might pass back more value to the micro-generator than the supplier itself receives from micro-generation. It points out that when assessing benefits from micro-generation for suppliers, export volumes will probably have to be above 1 MWh.

In Ofgem's view, it is to be expected that currently some offers are loss leaders and are probably justified on marketing and customer acquisition grounds. This could mean that these offers become unsustainable if the volume of take up by consumers significantly increases (unless the UK government makes significant changes to the values of the ROCs).

As pointed out by Ofgem, much of the potential economic reward of micro-generation comes from the financial support provided through government policy. If the Government indeed increases the number of ROCs for which micro-generators could qualify then this might potentially incentivise micro-generation more compared with the current situation. However, it would be important that the administration required for ROCs especially in relation to metering arrangements could be resolved. One way round this seems to be the Good Energy approach, where the supplier rather than the micro-generator earns the ROCs, with the supplier passing all or part of the benefit back to the micro-generator.

Another option currently under consideration by the UK government is a feed-in tariff arrangement. This would be a significant change compared with the current arrangements whereby there is competition in supply (and hence competition to attract micro-generators), with suppliers competing on the tariffs and tariff structures they offer. If a European style feed-in tariff was to be adopted then it would be highly likely that there would be a reduction in the scope for competition between electricity supply companies in attracting micro-generating customers, as the tariff which they would have to offer to their customers would be determined by government rather than by the companies themselves.

5.6 Connection issues

In October 2006, a Distribution Connection and Use of System Agreement (DCUSA) was introduced which supports the plug-and-play solution for domestic micro-generators. This makes it much easier and quicker for domestic micro-generators to connect to the electricity distribution network.

As a result, domestic micro-generators can now connect to the network without advance notice or any requirement to seek permission. Furthermore, domestic generators are exempt from paying any Use of System (UoS) charges, which is what the National Grid Company (NGC) charges generators, suppliers and directly connected customers to transmit electricity across its transmission network. The charge comprises of a fee for the Transmission Network Services (Transmission Network Use of System (TNUoS) charges) and a charge for balancing services (Balancing Services Use of System (BSUoS) charges). The NGC also charges for the assets which connect customers to its transmission network. These are known as connection charges.

5.7 Metering

In the UK, the Department for Business, Enterprise & Regulatory Reform (BERR) and Ofgem are currently investigating the introduction of smart meters alongside billing, real time display and energy efficiency information. The objective is to find out how people change their behaviour and the duration of these changes in response to different measures.

A trial, carried out by four major electricity suppliers, managed by Ofgem, involving 18,000 smart meters and 8,000 real-time display units is currently being carried out and is expected to be completed by 2010. The project is funded by £10 million from the Government with equivalent funding from the companies.

The trial assesses the impact on energy demand of:

- smart meters (electricity and gas)
- real-time display devices
- additional billing information
- monthly billing
- energy efficiency information
- community engagement

The trials are made up of different combinations of these interventions and involve approximately 50,000 different households, with smart meters installed in 18,000 houses and real-time display devices in 8,000 homes.

5.8 Increasing the uptake of micro-generation in the UK

According to the UK Government's Micro-generation Progress Report, which was published in June 2008, there are now approximately 100,000 micro-generation installations in the UK compared with 82,000 at the end of 2004.

Also, since April 2007 there has been a large increase in micro-generators accredited under the Renewables Obligations (RO) from 410 units to 1,329 units (1,047 of the latter through an agent). In June 2008, BERR published its "Micro-generation strategy Progress Report"[16]. In this report it states that the Government will decide whether to intervene in the level of buy-back tariffs currently being offered to customers who sell electricity back to the network, with their findings being published as part of the Government's forthcoming Renewable Energy Strategy (scheduled for Spring 2009).

[16] http://www.berr.gov.uk/files/file46372.pdf

One of the issues which the UK government will be considering is whether to put additional obligations on electricity suppliers in the form of micro-generation targets. In the view of the UK government, and in line with Ofgem's findings, the two key barriers to the uptake of micro-generation in the UK are still (1) cost and (2) lack of information.

6. Micro-generation in other European countries

Most European countries have based their policy on the aspiration to meet European targets to reduce green house gas emissions by a certain year. Most measures are aimed at increasing the share of renewable energy as part of the overall energy mix.

In most cases countries have adopted a number of measures. The most prevalent measure to encourage the uptake of domestic micro-generation is the ‘feed-in’ tariff (FIT).

A feed-in tariff ensures that micro-generators who sell electricity back to the network (e.g. export electricity) receive a premium price for this electricity which is not based on the value of their electricity from the perspective of their electricity supplier. This premium price therefore provides an explicit subsidy to those exporting electricity and the cost of this subsidy is either borne by all electricity customers or by the tax payer. The overall costs to customers and/or taxpayers tend to be uncertain. This is due to difficulties in predicting the total level of take up (i.e. how many micro-generators apply for the FIT). One way of addressing this uncertainty is by specifying a fixed budget in advance. Such an approach would imply that only micro-generators who apply whilst there is still sufficient budget would qualify for the FIT. Micro-generators who apply once the budget has been exhausted would therefore no longer qualify for the FIT.

There are different ways in which the size of the premium might be determined. For example, the premium can be defined as a share of the electricity price or indexed against fuel prices. In order for a FIT approach to be successful in terms of stimulating the installation of micro-generators the tariff will have to be set at a sufficiently high level to allow for an attractive return on investment. For this reason the FIT may vary with the technology of the micro-generator. Another consideration is whether the premium price should be fixed for a number of years to give investors in micro-generators greater confidence that they might recover their costs or whether it is more appropriate to assess the level of the premium more frequently, e.g. annually, so that the costs of wholesale electricity and/or changes in the costs of different renewable technologies could be taken into account.

Apart from the FIT, other popular measures to support the installation of micro-generators are financial and fiscal incentives which have been adopted in a large number of countries.

6.1 Portugal

Portugal introduced the first European FIT-type system in 1988. The scheme, called the ‘repurchase rate’ was aimed at Special Scheme Producers (SSP), whom produces electricity on a slightly larger scale to household micro-generation (connection of up to 100kVa to the public network). Table 6.1 below shows the growth of these small producers from 1989-2007.

Table 6.1 Evolution of Small Producers in Portugal

Year	Number of connected units	Connection Power (kVA)	Energy generated in a given year (kWh)
1989	1	45	
1991	2	105	
1993	3	149	
1995	7	296	
1996	8	346	
1997	11	416	
1998	13	486	
2000	13	486	128 114
2001	13	486	212 112
2002	13	486	127 136
2003	15	591	219 676
2004	18	651	457 374
2005	26	793	279 049
2006	35	943	324 940
2007	38	955	381 421

(Source: EDP (Energias de Portugal), 2008)

Basic legislation that was passed in 2002 made it theoretically possible to enable the concept of micro-generation so that householders were able to produce electricity for their own consumption (with connection power of up to 150kW). However, it was not until April 2008 that the concept of micro-generation became a fully-implemented reality. The new scheme involves an initial €250 registration fee in order to connect the micro-generator to the public network. The electricity generated is measured by a bi-directional telemeter, which must be autonomous from the consumption meter. These connection costs are borne by the micro-generator. Once connected, the customer is paid a fixed price for the electricity sold back to the network.

Metering

The electricity generated is measured by a bi-directional telemeter, which must be autonomous from the consumption meter. These meter costs are borne by the micro-generator. We have only had one response of a meter manufacturer which indicated that a meter might cost around 250 euros.

Other incentives

In addition to the feed-in tariffs there are also a number of fiscal incentives in place to encourage the uptake of micro-generation, namely:

- Reduced VAT tax of 12% (normal VAT is 20%) when acquiring equipment for using renewable energy
- Exempt of income tax on income generated from micro-generation – up to a limit of €5,000/year.
- 30% of investments in renewable energy equipments are deductible against income tax, with a limit up to €777.00.

The Portuguese government aims to achieve 165 MW of installed power in micro-generation by 2015.

6.2 Netherlands

In 2008 the Dutch government published its new target to reduce CO_2 emissions: 30 per cent by 2020. To meet this new target, the Dutch Government introduced new legislation to further encourage the uptake of renewable energy, 'Stimuleringsregeling Duurzame Energieproductie' (SDE), this year.

The available budget for subsidies stands at 1,459 million euros for the year 2008 with the objective of installing an additional 633 MW renewable generation. This total budget is divided over the various renewable technologies with different subsidy levels and different feed-in tariffs for different forms of renewable energy and is paid out over a number of years depending on each renewable technology (see table 3 in Appendix 2). The objective of this is to ensure that the uptake of a specific technology reaches a specified figure. For example, the objective is to have 450 MW extra offshore wind installed during the 2008-2015 period and to have 70,000 existing dwellings with solar water heating, heat pumps and micro CHP by the year 2011. Each year a new budget will be determined with specific subsidy levels for each technology.

Subsidies are allocated on a first come first served basis. In order to qualify for the feed-in tariff, both households and small businesses have to go through an extensive certification process. For the year 2008, the budget for solar energy, biomass, and waste to energy has already been exhausted and no new applicants will be considered.

The Dutch feed-in tariffs only apply to new installations. Refurbished or modernised existing facilities are (unlike Germany) excluded.

Certification and metering

In order to qualify for a feed-in tariff, micro-generators have to go through an extensive and possibly quite lengthy certification process. On top of this they have to have appropriate meters installed. The cost of meters varies depending on the regional electricity supplier.

6.3 Germany

In 2008 the German government published a new framework for the revision of its Renewable Energy Act (Erneuerbare Energien Gesetz, EEG). The amendments aim at increasing the share of electricity from renewable sources from the current 13% to 30% by 2020.

Feed-in tariffs

In 1991 the German government passed the Electricity Feed Law. This has become the most important measure to promote renewable energy in Germany. It obliges electricity suppliers to purchase electricity generated using renewable sources (eg wind, solar, hydro, biomass and landfill gas) on a yearly fixed rate basis, based on the supplier's average revenue per kWh.

Other measures

Apart from the feed-in tariff, Germany has adopted a number of other measures to encourage the uptake of renewable energy, namely:

- Direct investment in R&D
- Direct subsidies
- Government-sponsored loans
- Tax allowances

This means that one technology can qualify for more than one form of government aid. For example, electricity generation using biogas is subsidised under the Renewable Energy Law (EEG) which ensures that the biogas-produced electricity fed into the network is purchased at a tariff that will remain fixed for 20 years (subject to some conditions). However, in addition it is possible to obtain subsidies for using renewable raw materials, for innovative energy technologies and for extracting the heat produced during electricity generation. As part of its Market Incentive Programme, the German federal government supports actively the installation of heat pumps in private dwellings.

6.4 Jersey

As of 1st May 2008, Jersey Electricity Company (JEC) has operated a buy-back tariff for those customers who run wind turbine, PV or CHP micro-generators and have surplus capacity to export units onto the Jersey Electricity Network.

In Jersey there is no feed-in tariff or other forms of subsidies to encourage the uptake of renewable energy.

Buy-back rate

JEC applies two different buy-back tariffs which depend on the time at which electricity is being sold back to the network:

- The day rate runs during the 12 hour day period from 7am to 7pm and offers 5.00 pence/unit
- The night rate runs during the 12 hour night period from 7pm to 7am and offers 3.00 pence/unit.

These buy-back rates represent the wholesale cost of the electricity and are therefore considerably lower than JEC retail tariffs.

The retail tariff consists of the wholesale tariff plus the cost of electricity transmission, (e.g. the cost of transporting electricity over the high voltage network and the cost of associated losses), distribution (e.g. the cost of transporting electricity over the low voltage network including the cost of associated losses), the cost of maintenance and general operation of the business (including metering, billing customers, dealing with bad debt, etc.).

JEC's approach to determining the buy-back rate can therefore be characterised as an avoided cost approach.

Additional service charge for export customers

JEC charges an additional daily service charge of 2.66p for domestic and single phase commercial customers and 6.46p for three phase commercial customers who already subscribe to a multi-rate tariff such as E7 or comfort heat.

Metering

The 'buy-back' meter is available free of charge from JEC. However, if the existing meter is indoors, it is required to be moved outdoors, in which case a standard charge will be applied.

Planning permission and other issues

In order to install renewable micro-generation, interested parties have to obtain planning permission from the States of Jersey. One of the current issues faced in Jersey is the lack of locally based certified installers.

6.5 Isle of Man

Buy-back rate

The Isle of Man has a Home Generation Tariff which is implemented through a net metering based approach for consumers who want to be able to sell electricity back to the network. This tariff only applies to consumers whose micro-generation capacity does not exceed 3.6 kW (single phase) or 11 kW (three phase).

If a customer exports electricity to the network its meter is running backwards thus reducing the billed amount for electricity purchased from Manx Electricity Authority (MEA). It basically means that the buy-back rate is equal to the price the customer has to pay to buy electricity from MEA. For example, if 1,000 units are consumed from the MEA network and 200 units are exported to the MEA network, then the customer will receive a bill for 1,000 minus 200 is 800 units at the home generation tariff purchase rate. Thus, the 200 units of exported electricity would then be priced at the electricity retail price of 12.44 pence.

However, if 1,000 units are consumed compared to say, 1,200 units exported onto the MEA network, the micro-generator is refunded with net 200 units at the home generation tariff sales rate, which is significantly lower than the purchase rate (e.g. 3.58 pence per unit compared to 12.44 pence per unit).

Further charges

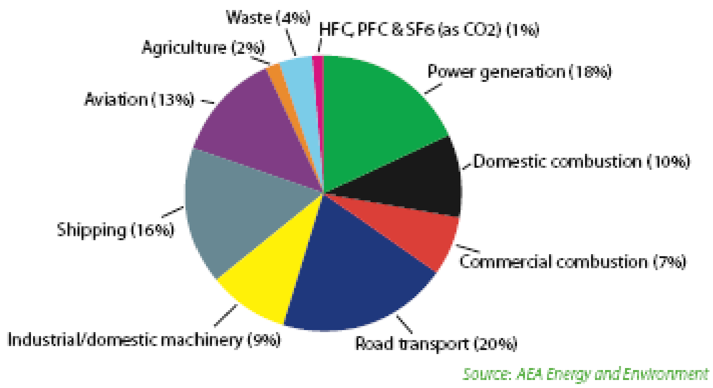
Micro-generators are charged a one-off £235 (inc. VAT) to cover the meter change and administration costs. Should any alterations to the network be necessary, the micro-generator is responsible for the absorption of these costs. Furthermore, although the MEA also require customers to pay a domestic standing charge of 11.51 pence a day (the equivalent to £42 a year), all customers are currently able to receive a government-funded standing charge rebate, which consists of £42/year until 31 March 2014.

Micro-generators are also required to pay an additional home generation standing charge of 80.00 pence a day (the equivalent of £250 a year). MEA claim the standing charge is in place to recover a contribution to MEA's fixed costs where connection to the MEA electricity supply is retained.

7. Micro-generation in Guernsey

Whilst in the UK the energy sector is responsible for 44% of green house gas emissions, in Guernsey power generation is responsible for approximately 18% of green house gas emissions according to the Guernsey Facts and Figures 2008[17]. Approximately 92 per cent of the electricity imported through the submarine cable link is carbon free. In Guernsey, road transport is the biggest contributor to green house gas emissions at 20%[18].

Figure 7.1 Carbon emissions per sector (2006 figures)[19]



7.1 GEL's determination of the buy-back rate

GEL offers a buy-back rate to domestic consumers who would like to sell electricity produced using domestic micro-generators back to the GEL network. GEL uses an avoided cost approach for determining the appropriate buy-back rate.

The key cost which GEL avoids when a consumer sells electricity back is the actual cost of that amount of electricity if GEL was either to purchase it from EDF or generate that amount of electricity itself using its on-island generators. In practice, this means that the buy-back rate is equated to the wholesale cost of electricity, which tends to be approximately half of the retail cost of electricity.

GEL calculates its buy-back rate on a monthly basis and pays the consumer through a quarterly bill. This does mean that the customer does not know in advance what the buy-back tariff is, unlike in most other jurisdictions, but it also means that customers receive

[17] The contribution of the electricity sector to Guernsey's overall carbon emissions does however depend on how much electricity is generated using on-island generators and how much electricity is imported through the cable link.
[18] Source: http://www.gov.gg/ccm/policy-and-hr/facts-and-figures/2008-facts-and-figures-booklet.en, page 69
[19] http://www.gov.gg/ccm/policy-and-hr/facts-and-figures/2008-facts-and-figures-booklet.en, page 69

the benefit (or disbenefit) of any upward (or downward) movements in prices on a more regular basis.

Table 7.1 GEL buy-back rates during the last 12 months

month	Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08	Sep 08
p/kWh	4.744	4.680	4.700	4.753	4.816	4.887	4.962	4.973	5.361	5.153	5.159	5.216

(Source: GEL, October 2008)

Heat pump tariff

GEL also offers a heat pump tariff for customers with an air source or ground source heat pump. This tariff is currently 7.56 pence per kWh and 215 customers are on this tariff. In order to qualify for this tariff a separate meter needs to be installed. The supply to the heat pump might be disconnected without notice for periods not exceeding one hour in any day.

However, the heat pump tariff only applies to the heat pump, and any other electricity the customer might need (e.g. for lights, washing machines, cooking etc.) is to be purchased on one of the other GEL tariffs, such as Super Economy 12, standard tariff or one of the maximum demand tariffs.

Standby tariff

The standby tariff is aimed at customers who have their own generation capability of 3 kW or more. In practice, this tariff is applicable for businesses with large CHP generators, such as hotels.

Current level of electricity export

At present two consumers sell approximately 150 kWh of electricity back to GEL, resulting in total buy-back costs for GEL of approximately £7.

7.2 Metering

In the UK, the Department for Business, Enterprise & Regulatory Reform (BERR) and Ofgem are currently investigating the introduction of smart meters alongside billing, real time display and energy efficiency information. The objective is to find out how people change their behaviour and the duration of these changes in response to different measures.

GEL is presently “rolling out” Automatic Meter Reading (AMR) meters across Guernsey. Currently, over 15,000 customers have an AMR meter and it is intended that the entire island will be on AMR meters by the end of financial year 2011. AMR customers do not receive estimated accounts as all their bills are based on the actual amount of electricity which has been used in the preceding period.

However, the AMR meters installed by GEL do not enable customers to instantaneously see the impact of their energy use, as there is no real time display in an easy accessible area such as a kitchen/utility room. Thus if an AMR customer would like to have information about their consumption pattern, he or she will have to contact GEL. GEL has advised the OUR that it does not charge for producing a report or providing information to its customers at present. GEL has also advised OUR that it intends to make the energy consumption data from customer's meters available to customers, but that the delivery mechanism for this data has yet to be determined, but that it is most likely to be an on-line service. However, it is OUR's understanding that GEL is only expecting to progress this work once it has completed the roll-out of AMR.

GEL requires the installation of an export meter in order for domestic micro-generators to be able to sell excess electricity back to the GEL network. For customers who have been switched to an AMR meter, it is currently not possible to use the same AMR meter for both import and export of electricity. GEL has informed the OUR that it is not possible to be specific about what changes to the metering system may be necessary, because the solution will be specific to the installation. However, generally, the cost of an export meter will range from £40 to £100. As long as there is sufficient space on existing meter boards to fit the metering equipment required by GEL, it is possible for customers to have an Economy 12 tariff, a heat pump tariff and export electricity back to GEL.

7.3 Planning permission

With respect to planning laws in Guernsey, the installation of any type of micro-generator within a household dwelling is subject to the approval by the Planning Department of the States of Guernsey Environment Department. Depending on the type of micro-generator, the Planning Department may need to consult the Health and Safety Department of the Commerce and Employment Department, as a full assessment may need to be undertaken with regards to factors such as noise. The outcome of an application would take an average of about 6-8 weeks. However, this might vary as it largely depends on the type of application, the scale of the application and the level of detail within the application. Applicants who have their submission rejected are able to appeal the decision through the courts.

7.4 Tax treatment of micro-generation revenue

In the UK, micro-generators who sell electricity back to the network don't have to pay tax on this income. One of the work streams coming out of the States of Guernsey Energy Policy Report was for the Treasury and Resources (T&R) department to investigate the possibility of exempting income generated by the sale of surplus electricity back to Guernsey Electricity, from income tax. The OUR understands that as part of T&R's Business Plan, the Tax Department has been asked to investigate this. The outcome of this review is expected to be announced at the time of T&R's Budget Proposal in December.

8. Options going forward

In the view of the DG, there are two broad options to consider: an approach which reflects costs or an approach which is based on paying a premium.

Currently GEL pays customers who sell electricity back to the network a buy-back rate based on its calculated avoided cost. There are different ways in which avoided costs can be calculated. The most straight forward way is to equate avoided cost to the electricity wholesale price which GEL either has to pay to EDF for electricity imported through the cable link or the price of electricity generated by GEL itself, both depending on the time of the year and time of the day. This is the approach adopted by both JEC and GEL (Option 1).

Another approach which has been adopted in a number of European countries is to pay a premium to customers who install micro-generators and then sell electricity back to the network. This premium is set well in excess of the true value of the electricity sold back to the supplier of the electricity network. The premium is therefore a subsidy from the tax payer to the micro-generator or from all other electricity users to the micro-generator (Option 2).

Going forward, a decision needs to be made which of the above approaches is more suitable for Guernsey: the current approach (option 1) or the alternative approach (option 2). It is important that the implications of these options are carefully considered, especially given Guernsey's specific circumstances. The potential advantages and disadvantages of these two broad options are discussed in the next sections.

8.1 Option 1: Buy-back rate based on an avoided cost approach

One option going forward is to continue with the current approach, which could be described as an 'avoided cost' approach. In this approach, the buy-back rate would reflect the costs which GEL avoids due to micro-generators generating their own electricity.

GEL has a large number of different cost categories and the key challenge when adopting an 'avoided cost' approach is to decide which of these cost categories should be included when estimating the value of micro-generation to GEL. At present, GEL only takes into account the wholesale costs of electricity. JEC as well as a number of the UK electricity suppliers have adopted a similar approach. As table 8.1 shows, currently, the amount of micro-generated electricity sold back to GEL is negligible.

Table 8.1 Micro-generation exports in 2007-2008 (calendar years)

	2007	2008 (to date)
Number of micro-generators selling electricity back to GEL	2 customers	2 customers
Total amount of electricity exported	151 units	92 units
Total amount of electricity exported at peak	Not measured	Not measured
Total cost of buying back electricity	£6.92	£4.16

Given that at present domestic micro-generation's contribution to meeting Guernsey's electricity demand is negligible, it is unlikely that GEL can avoid any other costs, such as electricity transmission and distribution costs, costs due to losses, etc. Appendix 1 discusses various cost categories and the scope for micro-generation to affect these costs in more detail.

Meters

The two customers currently using network connected micro generators were connected in 2005 and 2007. GEL has pointed out that given that such connections are so unusual, GEL has treated both of them as experimental and did not charge for the additional metering. GEL has also indicated to the OUR that such treatment should not be considered its policy and that in the event of more widespread adoption a charge for the metering would be made in the order of £40 to £100 depending on the size and nature of the micro-generator.

Advantages and disadvantages of an avoided cost approach

Advantages

The main advantages of a buy-back rate based on an avoided cost approach are:

- More cost reflective, better use of scarce resources
- More transparent
- Less risk of large investment in what may turn out to be obsolete or inappropriate technology in a few years time (given the immaturity of many renewable micro-generation technologies and the considerable scope for innovation, e.g. solar thin film)
- More equitable – avoids the risk of less well off customers having to cross-subsidise well off customers
- More tailored to Guernsey's specific circumstances as;
    - Guernsey already has a very high level of electricity generation capability; and

    - In Guernsey the energy sector is not as large a contributor to green house gas emissions as the energy sectors in other countries.

Disadvantages

The main disadvantages of adopting an avoided cost approach in determining the buy-back rate are:

- Less investment in the short term in domestic micro-generation
- Only affluent consumers are likely to be able to make investments in micro-generation
- Requirement to have an additional meter installed

If the objective of policy makers is to encourage the uptake of domestic micro-generation whilst keeping the buy-back rate cost reflective, then it might be worth considering other financial subsidies such as grants to help with the initial capital expenditure. This also enables policy makers to attach conditions to obtaining a grant, such as first having appropriately insulated a home and adopted other energy saving measures (e.g. energy saving light bulbs, loft insulation, cavity wall insulation etc.).

This is the approach taken in the UK, where both central and local government give grants towards part of the cost of installation of solar boilers, solar panels, heat pumps, wind turbines, etc. which are conditional on energy saving measures already being in place.

8.2 Option 2: Feed-in Tariff

The second broad option going forward is to have some form of a feed-in tariff. The objective of this would be to encourage the installation of domestic micro-generators which, without subsidy, would not be cost effective.

Also, a related objective in several countries which have adopted such an approach, most notably Germany and the Netherlands, is to stimulate the manufacturing industry by creating a home base for new products. However, given Guernsey's small size this is highly unlikely to be a realistic driver for promoting such technologies.

Advantages and disadvantages of a Feed-In Tariff

Advantages

The key advantages of a feed-in tariff approach are:

- Simplicity
- Provides greater investment certainty

- Very effective in increasing the amount of domestic micro-generation
- Marginally less reliance on electricity imports through the cable link during Summer and off peak winter periods and marginally less reliance on on-island generation during peak winter periods

Disadvantages

The key disadvantages of a feed-in tariff approach are:

- Costly, especially to current GEL customers and/or tax payers who do not install micro-generation themselves
- Likelihood of less well-off customers cross-subsidising well-off customers
- Risk of promoting what in a few years time transpires to be the ‘wrong’ technology
- Move away from a least cost approach for GEL
- Quite arbitrary to determine how high a feed-in tariff should be especially if linked to different micro-generation technologies, changes in capital costs of the technologies can lead to over or under subsidisation
- Investment uncertainty (if it turns out to be significantly more expensive than envisaged or if the general economic situation worsens, governments/regulators might change their minds and change the duration and/or rate of the feed-in tariff)
- Cost of administration
- Further increases the already significant level of electricity generation capability on the island
- Given the small contribution likely to be received from micro generators, the true beneficial impact on the environment is likely to be very small

One of the key disadvantages of such an approach is that it would oblige GEL to buy renewable electricity from micro-generators at above market rates. This raises the issue of how this should be financed.

A feed-in tariff could be financed by all GEL customers cross-subsidising those households who install micro-generators or it could be financed through general taxation.

Currently, most European feed-in tariffs are paid for through general taxation. Initially, both the Netherlands and Germany financed their feed-in tariff through a levy on all electricity customers, but due to high levels of take up this became unsustainable and hence it was decided that it would be more appropriate to pay through general taxation. Also, the Netherlands decided to set strict limits on the subsidies in an attempt to control costs (it is to be suspected that the key reason for the sudden abolition of the MEP in the Netherlands were the spiralling costs of the programme). The key difficulty with financing a feed-in tariff is the high level of uncertainty surrounding the potential level of take up and the potential very high cost to customers/tax payers if the scheme proves more successful than envisaged.

It is also worth noting that feed-in tariffs on their own might not be sufficient for consumers on a lower income to install domestic micro-generation. Given the high initial costs involved in installing micro-generation, it is likely that without additional grants and/or access to low interest loans to less affluent households, only affluent households will be able to install micro-generation. This could mean that if a feed-in tariff is funded by all customers, the less well off customers will actually be cross-subsidising the better off customers.

Net metering approach - Simplified version of a feed-in tariff

The adoption of a net metering approach to micro-generators could provide a simplified version of a feed-in tariff. Net metering implies that the customer is only billed for the amount of electricity supplied minus the amount of electricity sold back to the network.

If net metering was to be adopted there might not be a need for the installation of additional meters if customers still have ordinary domestic (disc type) meters. For example, in Isle of Man, the same meter is used for export and import of electricity. However, such an approach would only be implementable if the customer is on a standard tariff.

In Guernsey, a net metering approach would be more difficult to implement for customers with a new AMR meter due to the fact that the new AMR meters are not able to deal with both import and export of electricity. Hence, one option would be to replace the new AMR meter by an ordinary domestic (disc type) meter or it might be possible to fit an additional meter.

However, given that the retail price is significantly higher than the export price currently paid by GEL a net metering approach could involve a significant subsidy to the micro-generator with the subsidy being paid by all GEL's customers unless reimbursed by the States. The scale of this subsidy would depend on how much the micro-generator generates and how much electricity it imports.

In situations where the micro-generator generates more electricity than for its own use and becomes a net exporter it would need to be decided which tariff might apply. For example, the Isle of Man, who has adopted a net metering approach, adopts a lower tariff in such cases.

Advantages and disadvantages of a Net Metering approach

Advantages

The key advantages of a net metering approach are:

- Simplicity

- Transparent
- Provides greater investment certainty
- Likely to increase the amount of domestic micro-generation
- Marginally less reliance on electricity imports through the cable link during Summer and off peak winter periods and potentially a marginal decrease in the need for on-island generation during peak winter periods
- Easy to administer - no need to determine the appropriate export price
- Possibly no need for additional meter to be installed resulting in lower capital costs

Disadvantages

The key disadvantages of a net metering approach are:

- Costly, especially to current GEL customers and/or tax payers who do not install micro-generation themselves
- Likelihood of less well-off customers cross-subsidising well-off customers
- Risk of promoting what in a few years time transpires to be the 'wrong' technology
- Move away from a least cost approach for GEL
- Further increases the already high level of electricity generation capability on the island
- Given the small contribution likely to be received from micro-generation, the true beneficial impact on the environment is likely to be very small
- Potentially more costly to implement if the customer has an AMR meter (as this would necessitate the installation of an additional meter)

9. Next Steps

It will be important that what may seem to be conflicting objectives of the States – promoting sustainable competition and improving choice for consumers versus protection of the environment – are balanced so as to enhance the social and economic wellbeing of the Bailiwick. The DG therefore believes that it is important to develop an approach tailored to Guernsey's specific circumstances.

Whereas in a number of countries the energy sector contributes a significant percentage of green house gases emitted, this is not the case in Guernsey. Approximately 92 per cent of electricity imported through the submarine cable link is carbon free. However, the level of green house gas emissions emitted by GEL critically depend on how much electricity is generated on-island versus how much electricity is imported through the cable link. The former clearly results in significantly higher emission output levels compared with the latter. The on-island generation versus importing through the cable link decision depends on three key factors:

- the amount of capacity of the cable-link available to GEL (JEC has first call on largest part of cable link capacity and only if JEC uses less than its negotiated share GEL is able to use more than its negotiated share);
- the marginal costs of on-island generation versus the marginal costs of importing electricity, given that GEL has a requirement to decide whether to import or generate based on lowest marginal costs;
- the amount of electricity GEL generates using its on-island generators to sell to EDF for French customers.

As discussed in this document there are two main options in determining the buy-back rate, namely, an approach based on avoided costs and a feed-in tariff approach. A net metering approach such as adopted in the Isle of Man could be seen as an alternative to a feed-in tariff approach. However, as explained in this consultation, such an approach might be less suited to Guernsey for a number of reasons, including the fact that AMR meters are not suitable for net metering unlike the older disc type meters which they replaced.

The DG invites views on any of the issues raised in this document. The closing date for this consultation is 8 December 2008.

As set out at the start of this document, under the Regulation Act, the DG has a duty to promote a number of objectives. Where these objectives conflict the DG has to strike a balance between them.

After consideration of responses to this document and any other relevant evidence, the DG and GEL will endeavour to submit a report to the Policy Council.

ENDS

Appendix 1 Valuing the benefit of micro-generation to GEL

One of the main methods to assess the potential benefits to GEL from micro-generation is to estimate the costs which GEL does not face as a result of the installation of micro-generation, e.g. an 'avoided cost' approach.

At present, GEL purchases electricity from EDF and/or generates electricity itself using its on-island generators. GEL uses a transmission network to transport its extra high voltage electricity (e.g greater than 22 kV) and high voltage electricity (e.g. 1 kV or greater but less than 22 kV) and a distribution network to transport low voltage (e.g less than 1 kV) to its end customers. Transmission and distribution networks comprise of overhead lines, underground cables, transformers, switchgear and other equipment to facilitate the transfer of electricity to customers' premises from the transmission system (including cable link) and on-island generators.
In assessing the potential costs GEL might avoid as a result of micro-generators exporting electricity back to GEL a number of different cost categories might be considered:

- Electricity wholesale costs
- Transmission costs (transportation costs in relation to the submarine cable link) and distribution costs (transportation costs over the GEL distribution network, including metering)
- Losses in relation to electricity transmission and electricity distribution
- Reduced need for network reinforcement
- Reduced operating costs for on-island generation

Electricity wholesale costs

If customers sell x units of electricity back to the network, then GEL needs to purchase/produce less electricity (e.g. x units of electricity less). This means that GEL avoids the costs of having to buy x units from EDF or in case it would have generated these units itself (e.g. winter peak) it would avoid the costs of having to generate these x units.

GEL's current approach to the buy-back tariff reflects this by setting the buy-back tariff equal to the wholesale costs.

Transmission and distribution costs

Transmission costs refer to costs incurred by GEL as a result of having to transport high voltage electricity through the submarine cable link to Guernsey. Usually these costs refer to the capital costs of the infrastructure needed to transport the electricity as well as the operating costs of transporting electricity over a transmission network.

Distribution costs refer to the costs incurred by GEL as a result of having to transport low voltage electricity from its electricity sub stations to its customers.

Both in the case of transmission and distribution, GEL will face the capital costs associated with transporting electricity even if it transports fewer units. Whilst the operating costs of the transmission and distribution networks might be lower in theory if less units are transported, in practice the small numbers of units likely to be produced from micro-generation, and the uncertainty surrounding when those units will need to be transported – which is inevitable with generation from renewables – renders any savings in this area neglible.

Losses

Losses are defined as the difference between the metered units of electricity entering the GEL's network and those leaving GEL's network paid for through electricity accounts, whether estimated or metered. This difference is made up of a mixture of physical technical losses and unaccounted for consumption. The latter is normally referred to as commercial losses and is caused by theft, un-billed accounts, estimated customer accounts and errors due to the approximation of consumption by un-metered supplies (such as street lighting).

Technical losses are the electrical system losses caused by impedance, current flows and auxiliary supplies. They refer to units that are transformed to heat and noise during the transportation of electricity and therefore are physically lost.

Technical losses occur at all levels, from generation, through transmission and distribution, to the customer and the meter. However, it is normally the distribution network where the majority of avoidable losses occur.

Technical losses can be divided into two main categories: (i) variable losses and (ii) fixed losses. Variable losses, often referred to as copper losses, occur mainly in lines and cables, but also in the copper parts of transformers and vary in the amount of electricity that is transmitted through the equipment. Variable losses are proportional to the square of the current. Consequently, a 1 per cent increase in current leads to an increase in losses of more than 1 per cent. Generally speaking, between 2/3 and 3/4 of technical losses on distribution networks are variable.

Fixed losses, or iron losses, occur mainly in the transformer cores and do not vary according to current. These losses take the form of heat and noise and occur as long as a transformer is energised. Between 1/4 and 1/3 of technical losses on distribution networks are fixed. Fixed losses depend on the type of transformer (i.e. which core material has been used) which is installed, the use of transformers (i.e. if there are two transformers of a certain size in a substation it might be possible to switch one transformer off during periods of low demand).

It will be clear from the above, that there will always be some technical losses on a distribution network due to the physics of transporting electricity. However, the level of the losses will to a large extent depend on the characteristics of the network (urban or rural, proportion of underground cables to overhead power lines), employed plant and equipment, voltage levels, system utilisation, load management and how the system is managed. Less electricity is lost through underground cables compared with overhead power lines. For a given capacity a 1 per cent increase in load will increase losses by more than 1 per cent.

Although there are difficulties both in measuring technical losses and in estimating what level of losses is optimal or efficient, generally speaking it is to be expected that the closer the generating source is to the end-customer the smaller the technical losses will be. Micro-generators who use their own electricity therefore face only very small technical losses. However, micro-generators who export electricity also contribute to a reduction in losses as they are likely to be closely situated to other end-customers, especially given the small scale of Guernsey and especially if they export at peak demand periods. The latter is important because variable losses increase over-proportionally to the current. Thus if GEL has to distribute an additional 10 kWh at peak times it will result in a greater increase in losses than an additional 10 kWh in off-peak periods.

At present, the level of export by micro-generators is too low to affect this cost category and hence it does not seem to be appropriate to include it in the buy-back tariff. However, this could change if domestic micro-generation was to become more significant especially at peak times.

Reduced need for network reinforcement

Generally speaking, if demand for electricity increases (either due to new developments or more intensive energy use) there might be a need for GEL to increase its existing network capability. The network could be reinforced through laying larger or additional cables, installing transformers, switch gear or other equipment. This is generally referred to as 'network reinforcement' and should be distinguished from network maintenance, in which cables, transformers, switch gear or other equipment might need to be replaced because they are at the end of their economic life, damaged etc.

The extent of network reinforcement depends on a number of factors, such as the location of new/additional demand and the level of spare capacity of the network. If the need of network reinforcement could be reduced due to micro-generation then this would present another benefit to GEL, in terms of another avoided costs. This might be especially the case if a new housing development was to include micro-generation.

However, there might also be circumstances were micro-generation could actually give rise to the need for network reinforcement. For example, if a domestic micro-generator is able to export significant amounts of electricity there might be circumstances that the cabling to the customer's house would need to be upgraded to deal with the larger current. In practice, this is most likely to occur when an existing customer has installed more than one micro-generator and its existing cabling is relatively low capacity (for example a small old property which has been extensively extended).

Reduced operating costs for on-island generation

GEL makes its despatch decisions based on a merit order approach with means that it decides whether to import electricity or use on-island generation based on the marginal costs involved. The despatch regime is critically dependant on the relationship between the wholesale price of electricity in Europe and the price of heavy fuel oil. This relationship is subject to price volatility, which means that the despatch regime might vary considerably from year to year depending on which contracts are in place. However, it is fair to say that in the last years the costs of off peak electricity imported through the cable link with France are lower than the marginal costs of on-island generation.

Imports are also subject to technical limitations resulting from the limited power import capacity between Jersey and France. There is an allocation agreement which governs how much of the submarine cable link's capability has been firmly allocated to GEL. Table 1 shows the allocations for the years 2008 – 2010.

Table 1 Allocation of cable link capacity to GEL for 2008-2010 period (MW)	**2008**	**2009**	**2010**
January	**21**	**18**	**17**
February	**21**	**18**	**17**
March	**22**	**18**	**17**
April	**27**	**23**	**22**
May	**42**	**39**	**38**
June	**48**	**45**	**42**
July	**45**	**45**	**42**
August	**48**	**45**	**42**
September	**48**	**42**	**41**
October	**37**	**30**	**28**
November	**22**	**17**	**16**
December	**20**	**17**	**16**

The above allocations were agreed by the Channel Islands Electricity Grid Company (CIEG) and JEC and GEL in the years 2007 and 2008. The submarine cable link between Jersey and France has a maximum capability of 145 MW and the cable link between Jersey and Guernsey has a maximum capability of 60 MW.

At times where JEC is not using its fully allocated cable link capacity, GEL is able to import more than its allocated share, although GEL is not able to import more than 60 MW in total given that this is the maximum capability of the Jersey-Guernsey cable link.

Given that Jersey's allocated cable link capacity often exceeds its expected maximum demand, GEL is often able to import more electricity through the cable link than its monthly minimum allocated capacity. In practice this means that frequently during off peak periods GEL is able to fully meet demand by importing electricity through the cable link. However, at peak times, especially during the winter, most demand is met through on-island generation. For example, GEL has pointed out that it is not readily appreciated that a power allocation of only 16MW can actually provide over 40 per cent of Guernsey's electrical energy.

From 2012 onwards

From 2012 onwards, a new cable link between France and Jersey is expected to become operational. However, at this time no decision has been taken on any involvement by GEL in this project and it is not clear if this would have any impact on GEL. Also, given the already very high level of on-island generation capacity, there could be a question mark whether capital investment in even more capacity would be deemed efficient or not.

Appendix 2 Micro-generation in a number of European countries: background information

Portugal

There are two remuneration systems in place when selling surplus electricity back to the network – *advantage* and *general*.

The Advantage regime

The Advantage regime applies to renewable energy sources with a maximum generation power of 3.68 kW. An additional requirement is that the micro-generation system must include some form of *solar thermal collector* that enables *water heating* in the consumption system.

The General regime

The General regime applies to all producers who have no access to the advantage regime.

Each micro-generator of the advantage regime has a unique reference tariff:

- For the first 10MW of power connected to the network, the reference tariff is €650/MWh, i.e. €0.65/kWh.
- Then for each additional 10 MW of power connected, the reference tariff will decrease progressively by 5%
- The 10MW threshold of power connection is an annual limit for the first year of implementation i.e. 2008, however, each year, the annual limit will be increased by 20%.
- These reference tariffs apply differently according to the type of renewable energy source – 100% to solar energy, 70% to wind energy, 30% to water energy and to biomass co-generation (a weighted average applies where there are multiple sources of energy generation).
- These conditions apply to solar energy up to a limit of 2.4 MWh/year and for the other renewable energies the limit is 4 MWh/year.

Uptake of micro-generation in Portugal

The Geology and Energy General Directorate is responsible for the management of the Portuguese Micro-Generation Registry System (MGRS). The first phase of registration started in February 2008. It was decided that registrations would be closed when the monthly annual threshold limit (the advantage regime limit is set at 10%) of 10 MW of power connection (the equivalent of 2 MW) was achieved. To-date, this threshold has been achieved within one day of registrations being opened. Tables 1 and 2 below show the uptake and total power generated from the two regimes in Portugal.

Table 1 Portuguese Advantage Regime

Advantage Regime			
Registration		National Total	
Phase	Date	Quantity	Power (kW)
1a	2/4/2008	655	2255
2a	2/5/2008	701	2261
3a	9/6/2008	632	2175
4a	7/7/2008	767	2705
	Total	**2755**	**9396**

(Source: http://www.renovaveisnahora.pt/30 (Portuguese only))

Table 2 Portuguese General Regime

General Regime	
National Total	
Quantity	Power (kW)
6	19

(Source: http://www.renovaveisnahora.pt/30 (Portuguese only))

The National Plan of Action for Energy Efficiency aims for 58,000 micro-generators to be installed by 2015, which the intention they would have a total power connection of 165 MW (with 10MW being installed each year to produce a growth rate of 10% a year).

The Netherlands

In 2008 the Dutch government introduced the 'Stimuleringsregeling Duurzame Energieproductie' (SDE). The SDE is broadly similar to its predecessor, the MEP (Milieukwaliteit en electriciteit productie).

The MEP resulted in a very significant increase in the installation of renewable micro-generation especially by small to medium businesses. Due to its success, it was discontinued for new applicants in August 2006, as new statistics showed that the Dutch renewable electricity objectives for 2010 were already on target to be achieved. The sudden decision to abolish the MEP was subject to a legal challenge which the Dutch government won.

One of the key differences between the MEP and its successor the SDE is that clear subsidy limits for renewable generation as a whole and each specific technology have been established under the SDE. This is probably due to the high demand for these subsidies which would otherwise make it very costly for the taxpayer.

The objective of the SDE is to encourage the uptake of renewable micro-generation technologies which would not be financially viable without a subsidy. The SDE applies to the generation of renewable electricity (e.g. onshore wind, photo voltaics, biomass), renewable gas (e.g. biogas) and renewable heat generation (e.g. solar water heating, heat pumps, micro CHP).

Level of the feed-in tariff

The actual level of each feed-in tariff paid to micro-generators for exporting electricity to the network is determined on an annual basis by the Minister of Economic Affairs. The level of this tariff takes into account the electricity price of conventionally produced electricity as well as the cost of installing renewable generation. In practice, this means that if the electricity price increases the subsidy level decreases.

Table 3 Dutch feed-in tariffs (2008)

Type of technology	**Total annual subsidy available for 2008**[20]	**Feed-in tariff for 2008**	**Maximum duration of subsidy**
Photo Voltaics (solar energy)	83 million euros[21]	0.33 euros/kWh	15 years
On-shore wind	796 million euros	0.045 euros/kWh	15 years
Biomass (from fruit/vegetables/garden waste/animal manure)	325 million euros[22]	0.045 euros/ kWh based on a basic gas price of 0.14 euros/ kWh	12 years
Green gas generated from fruit, vegetable and garden waste and animal manure	84.5 million euros	0.044 euros/ kWh based on a basic gas price of 0.14 euros/ kWh	12 years
Waste to energy (afvalverbranding)	16 million euros	0.053 euros/kWh	12 years
Renewable heat technologies (solar water heating, heat pumps, micro CHP)	62 million euros	Not applicable as no electricity is sold back, receive a subsidy instead	To be determined

[20] http://www.senternovem.nl/mmfiles/Regeling%20aanwijzing%20categorie%C3%ABn%20duurzame%20energieproductie%20-%2028-02-08_tcm24-254253.pdf

[21] http://www.senternovem.nl/mmfiles/Nieuwe%20productiecategorie%20en%20verhoging%20van%20de%20subsidiebudgetten%20voor%20zonnepanelen%20en%20biomassa_tcm24-275447.pdf

[22] http://www.senternovem.nl/mmfiles/Nieuwe%20productiecategorie%20en%20verhoging%20van%20de%20subsidiebudgetten%20voor%20zonnepanelen%20en%20biomassa_tcm24-275447.pdf

Case study: Feed-in tariff for Photo Voltaics (solar panels)

In this section we look closer at the approach to encourage photo voltaics. The same approach also applies to other qualifying technologies and there are specific parameters (e.g total subsidy level, feed-in tariff for 2008, duration of subsidy are shown in table 3). The feed-in tariff for photo voltaics (e.g. solar panels) has been set at 0.33 euros per kWh for the year 2008. The feed-in tariff is paid for the total amount of generated electricity (i.e. it includes electricity generated for own use). On top of that if electricity is sold back to the electricity network a price for this electricity of approximately 0.23 euros per kWh will be paid.

The feed-in tariff is determined annually and is linked to the costs of the investment. This means that if future installations of photo voltaics become cheaper, it would be likely that the feed-in tariff would be set at a lower level. This would then apply to both existing and new projects. The government has also decided to link the feed-in tariff to the electricity price.

For photo voltaics, the subsidy will be available for a 15 year period. The subsidy is only available for photo voltaic installations which are larger than 0.6 kWp and smaller than 3.5 kWp.

For the year 2008 the budget for subsidies for photo voltaics was initially set at 46 million euros, which was subsequently increased to 83 million euros. The moment this budget has been reached no more subsidies will be available for this year. The approach is based on a first come first served basis during the application window which runs from April 2008 until August 2008. Already in June 2008, the Minister of Economic Affairs announced that 8100 applications for solar energy subsidies had been received for a total of 17.8 MW, however, there is only sufficient subsidy for 15 MW.

In order to qualify consumers will already need to have the required paperwork, including planning permission and a certificate that the produced electricity is ‘green’ electricity. The process to obtain the green certificate (‘garantie van oorsprong’) involves the micro-generator having to register with CertiQ (this involves a process in which all kinds of information has to be supplied) and to get approval from the electricity distribution company. The latter has to be given four weeks to come to a view. All in all the whole process seems quite extensive. The various registrations will involve registration fees as well. Whilst the customer is going through this process there won’t be any guarantee that the customer ultimately will obtain a feed-in tariff given the strict budget which has been set for each technology.

Germany

During the 1990s the German focus was mainly on encouraging wind energy. For example, remuneration to wind producers was set as 90% of the average retail electricity rate, for other renewable sources the rate was between 65-80% depending on plant size:

the smaller the plant, the higher the subsidy level. In addition, new wind power developments could get low interest, government guaranteed loans.

In April 2000, the German government adopted the Renewable Energy Act (EEG). The objective of this law was to encourage a step change by dramatically increasing the renewables' share in the country's overall energy mix. Rather than basing export tariffs on the average revenue per kWh, a fixed regressive feed-in tariff approach was adopted. One of the features of this approach was that low-cost producers received less subsidy than high-cost producers of renewable energy. In addition network operators were obliged to purchase power from local producers with a nationwide equalisation scheme to spread the cost. This law increased the tariffs which utilities had to pay to renewable energy producers by approximately 10% in most cases, but by as much as 500% in the case of solar photovoltaic power. This especially encouraged the uptake of domestic micro-generation as it made it financially viable for many households to install solar panels. It also gave a major boost to Germany's manufacturing industry, with Germany now being the second largest producer of solar panels after Japan.

Table 4 shows the new feed-in tariffs for different technologies from the start of 2009 onwards.

Table 4 German feed-in tariffs (2009)

Type of technology	**Share of capacity**	**Feed-in tariff from 2009**
Photo Voltaics (solar energy) for export	up to 30 kW 30kW-100kW	0.4301 euros/kWh 0.4091 euros/kWh
Photo Voltaics for own use	up to 30 kW	0.2501 euros/kWh
On-shore wind		0.092 euros/kWh for first five years then declining to 0.0502 euros/kWh
Biomass (from fruit/vegetables/garden waste/animal manure)	up to 150 kWe	0.1167 euros/ kWh additional bonus of 0.06 euros/kWh for cultivated biomass
Green gas generated from fruit, vegetable and garden waste and animal manure	up to 150 kWe	0.1167 euros/ kWh additional bonus of 0.11 euros/kWh if at least 30% farmyard manure slurry or additional 0.09 euros/kWh if plant material is predominantly from landscape conservation Also additional bonus available for innovative plant technology and CHP bonus
Geothermal	up to 5 MWe	0.16 euros/kWh with heat cogeneration bonus of 0.03 euros/kWh available
Hydropower	up to 500 kW	0.1267 euros/kWh

This law resulted in a reduction in the payback time on renewable technologies to less than 10 years and offered a return on investment of 8-9%. The cost is spread by generating companies among all users and has increased the typical household bill by approximately 5 per cent, e.g. an extra €3 (£2) a month. For the country as a whole, the cost was 7.7 billion euros in 2007, an increase of 38 per cent compared with 2006.

In addition there are feed-in tariffs for a number of other categories such as landfill gas, sewage gas, mine gas, offshore wind. There are not only subsidies available for new facilities but also for modernised existing facilities. The feed-in tariffs are regressive, e.g. they decline over time (often over a 15 to 20 year period).

Abbreviations

ASHP	Air Source Heat Pump
BERR	Business Enterprise and Regulatory Reform
CERT	Carbon Emissions Reduction Target
CHP	Combined Heat and Power
CIEG	Channel Islands Electricity Grid Company
DCHP	Domestic Combined Heat and Power
DCUSA	Distribution Connection and Use of System Agreement
DG	Director General
EEG	Renewable Energy Act in Germany
EPG	Energy Policy Group
FIT	Feed-in tariffs
GEL	Guernsey Electricity Limited
GSHP	Ground Source Heat Pump
JEC	Jersey Electricity Company
kW	kilo Watts
kWe	kilo Watts electrical
LCBP	Low Carbon Buildings Programme (UK grant scheme)
MCHP	Micro Combined Heat and Power
MWh	Mega Watt hour
MEA	Manx Electricity Authority
MEP	Milieukwaliteit en electriciteit productie
OUR	Office of Utility Regulation
PV	Solar Photo Voltaics (technology used in solar panels for example)
ROC	Renewable Obligation Certificate
SDE	Stimuleringsregeling Duurzame Energie productie
UoS	Use of System charges