Arrangements for Micro Generation

Consultation Paper

CER/06/190

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1. Introduction

1.1. Background

Over the last number of years there has been a marked increase in the number of smaller generator units connecting to the electricity network. In particular, advances in technology have meant that wind energy generators has become less expensive and more reliable and significant numbers of small wind generators are seeking connection to the distribution system. Interest in small generating units for domestic and business use is also increasing. These micro generators include very small wind generators, photovoltaic converters (PV) and domestic combined heat and power units (CHP).

The Commission for Energy Regulation (the Commission) has a duty under the Electricity Regulation Act, 1999[1] to promote the use of renewable, sustainable or alternative forms of energy. In addition, the Commission has a duty to encourage the efficient use and production of electricity. The promotion of the use of micro generation, as detailed in this paper, can help to achieve these goals.

There have been a number of significant developments at EU level which bode well for the continued development of micro generation. These include the recent Green Paper[2] on energy efficiency, the requirement to take due account of the benefits of embedded generation when determining the costs of connection for new producers and the need to take account of the positive impact on regional and local development opportunities especially the concerns of small and medium sized undertakings and power producers.[3]

Government policy in relation to renewable plant combined with technology advances and increased awareness of environmental issues will undoubtedly lead to greater penetration of smaller scale generation in the coming years. This will include more installations of micro generation installed in domestic homes and small businesses as customers seek ways to reduce their energy bills in a climate of increasing energy costs.

[1] Electricity Regulation Act, 1999, as amended, Section 9 "Functions of the Commission"

[2] http://ec.europa.eu/energy/efficiency/doc/2005_06_green_paper_book_en.pdf

[3] Recitals 19 and 20 of Directive 2001/77/EC

1.2. Structure of Paper

In light of the changing face of the generation environment and the developing legislative framework, the Commission now publishes this consultation paper regarding the arrangements for micro generation in Ireland. This paper sets out the framework for the installation of micro generation and seeks comments on arrangements for metering and payment of exported energy. It also publishes, for information only, technical aspects of micro generation.

This consultation document is structured as follows:

- **Installation Process – Section 2** discusses the proposed process for the installation of micro generator units on the network. This section also discusses briefly the Commission's responsibilities with respect to safety and the responsibilities of authorised installers. Other relevant issues relating to the installation of micro generators including licensing and the application of the Commission levy are briefly discussed in the section. Please note that the licensing of micro generators forms a part of a wider consultation on licensing by the Commission[4].
- **Metering and Commercial Arrangements – Section 3** discusses the issue of how the generator could be paid for exported electricity. Metering and commercial issues are discussed together due to the interdependent nature of these issues.
- **Technical – Section 4** sets out the technical requirements for micro generators in accordance with the draft European standard on this matter and outlines how they will be applied in Ireland. Please note that the Commission is **not** requesting comment on these standards but is merely publishing them for information.

1.3. Consultation Process

Interested parties are invited to comment on the proposals and issues raised in this paper by **5pm on Friday 3 November 2006**. The Commission requests that respondents structure their comments to address the specific proposals outlined in the document. Where possible, reference to the section number should be made with specific comments. The Commission regrets that it cannot undertake to provide individual responses to submissions on this paper. Responses may be published in full on the Commission's Web site; therefore respondents should clearly identify any confidential information in a separate annex. Submissions on this paper should be forwarded, preferably in electronic format, to:

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[4] Revised Process for the Authorisation and Licensing of Generating Stations, CER/06/195, 4 October 2006

2. Installation Process for Micro Generation

2.1. Technical Considerations

The Commission recognises that, over time, there could be a large volume of micro generators installed in domestic houses and small businesses. If these are exporting onto the network they could cause voltage rise problems particularly at times of low demand. For this reason, it is important that the installation of these units should be monitored so that appropriate controls can be put in place if necessary. The administration and cost of tracking these units could be onerous both for the end user and ESB Networks (ESBN)[5].

From a system perspective there are two scenarios for the installation of micro generation units which need to be considered. These are once off installations where a customer installs a unit on a single premise and planned multiple installations, such as new housing schemes, where micro generation is installed in a high proportion of premises. The latter also applies to existing housing schemes where, for example, a successful advertising and promotional campaign has resulted in a high take up by householders.

It is recognised that a high take up of micro generation in one area could adversely impact the capacity of the existing low voltage substation that supplies an estate or scheme. Therefore, ESBN proposes, in the interests of prudence, to initially set a limit of 40% of the total installed micro generation capacity on the existing low voltage substation. If accepted, it could of course, be revised upwards or downwards as experience of micro generation grows. In any event, the 40% figure is unlikely to be reached for a number of years.

ESBN is embarking on an internal project to look into the effects of voltage rises across the network both for micro generation and for larger generation units in the 10-20 kW range. As penetration of micro generation increases ESBN will monitor the impact on local networks. The limit of allowed total installed capacity relative to the substation may be revised following these studies.

Request for Comment

The Commission seeks comments on ESBN proposal to set initial penetration limits of 40% of the total installed micro generation capacity on the existing low voltage substation.

[5] For the avoidance of doubt ESB Networks is the owner and operator of Ireland's electricity distribution network and as such can also be referred to as the Distribution System Operator, or DSO. However, the term "DSO" is reserved in this paper to refer to any distribution network operator operating in Ireland or any other jurisdiction.

2.2. Notifying the Network Operator

At present there is no formal application process for micro generation connecting to the network in Ireland. The aim of this consultation process is to formalise this process in line with the draft CENELEC[6] standard[7]. The Commission considers that the installation process should be efficient, easily understood and fit for purpose. The process should not place an unnecessary burden on either the micro generator or ESBN.

The CENELEC standard as currently drafted proposes two approaches. Under the first process it is proposed that the installer must make the DSO aware of the micro generator installation at or before the time of commissioning and, in addition, must provide the DSO with certain information regarding the installation within 30 days of the micro generator unit being commissioned. This can be referred to as an "inform and fit" approach and is applicable in countries where inform and fit is allowed *without* the prior consent of the DSO.

The draft standard states that in all other countries prior consent of the DSO is necessary. This can be referred to as an "inform, *consent* and fit" approach. Here, the installer must make the DSO aware of the micro generator installation before installation occurs and must submit to the DSO the notification form contained in Appendix 1 and the **Type Certification Test Results Sheet (TCTRS)** contained in Appendix 2 of this paper at this stage in the process. The DSO will inform the customer if it does not approve of the installation as proposed.

ESBN propose that the latter approach be implemented in Ireland, i.e. "inform, consent and fit". From a network design perspective it is important to know the level of penetration of connected micro generation. This will help to identify potential voltage rise within particular low voltage (LV) groups, which could potentially drive local reinforcement works. In addition, the inform, consent and fit approach reduces the likelihood of non-compliant units being connected which could have safety implications. The following section sets out the inform, consent and fit approach that ESBN propose to adopt in Ireland in more detail. The Commission considers that this approach is prudent.

Request for Comment

The Commission is of the view that the approach adopted for the installation of micro generation units should ensure timely information is provided to ESBN minimising the risk that noncompliant units will be installed and aiding management of the networks in a climate of increasing micro generation.

The Commission requests comments on the "inform, consent and fit" approach from interested parties.

[6] CENELEC – European Committee for Electotechnical Standardization (www.cenelec.org)

[7] Please refer to Section 4 – "Technical Aspects of Micro Generation"

2.3. Inform, Consent and Fit

ESBN propose that an inform, consent and fit approach be implemented in Ireland for micro generation. The details of ESBN's proposals in this regard are set out in this section.

2.3.1. Informing ESBN of Installation

It is proposed that every new micro generator interface type and model shall satisfy the following:

- results of tests to verify the operation of all elements of interface protection;
- the interface protection settings on board the unit shall be as detailed in the final agreed standard;
- the methodology of these tests shall be carried out as outlined in the final agreed standard, and;
- these tests shall be carried out by or under the supervision of a recognised test laboratory.

Under the inform, consent and fit approach as proposed by ESBN the customer will be required to inform ESBN of its intention to install a particular micro generation unit (make and model). ESBN has proposed that the customer will be required to submit a completed notification form and a completed TCTRS for each installation at this stage in the process[8]. If the micro generation unit being installed does not meet the technical requirements as laid out by the draft standard then ESBN proposes to reject the application.

The Commission considers that ESBN's proposals as above would be onerous on customers and would be cumbersome for ESBN to manage. The Commission favours a register of approved types of micro generation and proposes that a list should be maintained and should be made available to the public. The Commission considers that ESBN would be the appropriate body to maintain this register. If the micro generator that the customer wishes to install is approved then the customer need only inform ESBN of the type and model of the generation unit that it wishes to install and some basic details as required in the notification form. If the micro generation unit is not on the approved list the customer must also provide the TCTRS. If the TCTRS shows that the unit is compliant with the standard then the unit will be approved and will be included it on the register of approved types.

Request for Comment

The Commission requests comments on ESBN's proposed approach to the implementation of the inform, consent and fit approach in Ireland. In addition, comments are requested regarding the Commission's alternative approach as outlined above and, in particular, whether a register of approved micro generation units should be maintained and if so who is the appropriate body to do this.

[8] For new applications to the network the intention to install a micro generation unit will be registered on the application form. Please refer to the application processes for a new domestic network connection or a new business network connection at http://www.esb.ie/esbnetworks/home/index.jsp

2.3.2. Consenting to Micro Generator Installation

In accordance with the principles of efficiency and ease of use outlined above, the Commission considers that the consenting process should be automatic in so far as possible. The consenting to micro generation by ESBN will differ depending on whether or not the application is for a single unit or for multiple units, and on the impact of the proposed installation(s) on the system.

At the outset, please note that, as detailed in Section 2.1, ESBN proposes that where an application for installation of micro generation would result in ESBN's proposed threshold of 40% of the total installed micro generation capacity on the relevant existing low voltage substation being exceeded, such an application would be rejected. In this case, the applicant will be advised on the reason for the rejection. Applicants may appeal to the Commission in cases of refusal.

In cases where the proposed capacity exceeds 50kVA ESBN has stated that an analysis of the local network will be required. This will effect only applications for multiple units in an estate or area as by definition they cannot be single applications. Applicants may, in these cases, request ESBN to carryout a network analysis and ESBN may be in a position to quote the applicant for any reinforcement work necessary. Such applicants must wait for confirmation from ESBN that they may commence installation. This is the current practice with connections of this size.

For applications for micro generation units less than 50kVA the consent process will operate as follows:

- The customer will inform ESBN of their intention to install the micro generator by submitting the appropriate notification form in Appendix 1. For a new connection, the notification form and TCTRS (if appropriate) should be included along with the normal application for connection.
- If ESBN believes that the installation should not proceed because of any technical or location specific reason(s) then the ESBN will inform the customer within 20 working days of receipt of the notification complete with all required information.
- If the micro generator is not on the approved list a TCTRS for the micro generator should also accompany the application. If ESBN determines that further clarification or information is required then ESBN shall contact the customer and request any outstanding information or clarification
- ESBN will determine from the TCTRS whether or not the micro generation type meets the standard and if so it will include it in the approved type list.
- If the unit is not on the approved type list or, if having examined the TCTRS, ESBN decide not to put the unit on the approved type list, ESBN will advise the customer and will direct that the installation should not proceed.

The matrix for the process outlined above is shown in Table 3.1 below.

	Standard Application Form for new connection	Notification Form Single Micro Generator	Notification Form Multiple Micro Generator	Type Certification Test Results Sheet (TCRS)
New Connection with single micro generator Type Approved	✓	✓		
New Connection with single micro generator Type **not** Approved	✓	✓		✓
New Connection with multiple micro generators Type approved	✓		✓	
New Connection with multiple micro generators Type **not** approved	✓		✓	✓
Existing Connection adding single micro generator Type approved		✓		
Existing Connection adding single micro generator Type **not** approved		✓		✓
Existing Connection adding multiple micro generators Type Approved			✓	
Existing Connection adding multiple micro generators Type **not** Approved			✓	✓

Table 3.1 Matrix of Documents Required For Micro Generator Installation

Where a customer submits an application to ESBN for multiple units of micro generation not exceeding 50kVA[9], which is on the approved type list, in accordance with the approved application process they may install the unit after 20 business days unless they have received a letter to the contrary from ESBN.

Finally, please note that for all applications for micro generators which are not on the approved type list, the applicant must await confirmation from ESBN that they may commence installation.

2.3.3. Enforcement and Practical Implications

ESBN's proposals to implement an "inform, consent and fit" approach for the installation of micro generation in Ireland and the Commission's view regarding this approach are outlined above.

[9] Micro generation is defined as less than approximately 11kW. The 50kVA, therefore, only refers to multiple units.

The Commission is aware that there are practical difficulties in enforcing this principle. Nevertheless, there are safety and operational issues that need to be addressed and therefore it is imperative that ESBN is informed via a clearly defined process of the intention to install micro generation.

In the first instance the Commission believes that all parties in the chain have a role to play with regard to informing the end user of their requirement to inform ESBN. Manufactures, suppliers and installers should all play their part in this process. The exact mechanism for creating this awareness amongst customers is difficult to establish given that the market for micro generators is relatively new and what types of micro generators will be installed and how they will be sold to customers is not yet fully known. The Commission has been discussing this issue of compliance with ESBN. It is considered that where an authorised installer is involved in the installation they will be registered with an authorised body approved by the Commission and will comply with ETCI regulations. ESBN has opened discussions with ETCI on the requirements for micro generation and the inclusion of the regulations into the wiring rules[10].

It should be noted that customers are obliged through their connection agreement to comply with ESBN rules for connection. Therefore, ultimately, if an unapproved micro generator is installed and not removed on request, ESBN may de-energise[11] the customer. Even where the type is approved the customer is still obliged to inform and if they do not comply they may be de-energised. Thus, whilst there is a mechanism for enforcing compliance it does not solve the problem of how a customer is made aware of their responsibilities in this regard.

The Commission is aware that vendors are selling micro generators in Ireland through various channels. If these are not type approved the customers to which they have been sold may be de-energised, as discussed above. Therefore it is in the interest of the vendors to obtain the type approval prior to sale and inform the purchaser of the units. Hence there is an implicit obligation on vendors to provide the type certificate to their customers with an explicit instruction that this has to be completed and returned to ESBN. Manufacturers will be guided by the standard as to the necessary specifications for units to operate in Ireland. The "inform, consent and fit" is a requirement under this standard and therefore in turn have an implicit obligation to inform their customers.

The Commission understands that micro generator units are now being sold through retail outlets. The principle that the type certificate should accompany each unit still holds in these circumstances. As the penetration of micro generation increases it may be necessary for ESBN to engage in a publicity campaign informing customers of their obligations.

The Commission is discussing enforcement and compliance issues with ESBN and will continue to monitor the market and the penetration of units. Based on the Commission preliminary findings and discussions with industry new procedures and rules to ensure compliance with the regulations may be put in place.

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[10] "National Rules for Electrical Installations" - These rules implement the relevant technical content of the Harmonization Documents issued by CENELEC. These Rules specify the requirements for the design and erection of electrical installations so as to provide safe and proper functioning for the intended use.

[11] This involves cutting the electricity supply to the premises.

Request for Comment

The Commission requests comments on the proposed consenting and fit processes outlined above. Comments are also sought on the area of enforcement and practical considerations in relation to informing interested parties of the need to inform ESBN of the intended installation of micro generation.

2.3.4. Safety Requirements

As with any electrical installation the requirement is that micro generation units are installed in accordance with the appropriate standards. This is as the same problems potentially exist with such units as with any other electrical installations.

ESBN has its internal safety rules and procedures which are intended to cater for the safety of any persons working on or in close proximity to the network. These rules need to be robust to deal with the occasional situation where unapproved, unadvised and unprotected "rogue" generators are connected to the system. Instances of such connections have occurred in the past. As the procedures have to be robust enough to handle these situations, then they should also be adequate to handle the more controlled environment of technically certified microgeneration.

ETCI Wiring Regulations cover safety issues where they arise on the customer's side of the meter. With respect to safety, the Commission will be working with the ESBN and ETCI to address any safety requirements for the installation of micro generators.

2.3.5. Application Fees

ESBN will incur some expense in processing and monitoring micro generation units on the network. It is reasonable therefore, arguably, that a fee should accompany each application for connection of a micro generator. The introduction of an application charge (even if small) should ensure that all applications are genuine and that time is not wasted on speculative applications. It would also help ESBN to maintain accurate records of where units are installed on the network. However, this might be a disincentive to customer wishing to install units and processing fees may be cumbersome for ESBN.

Currently the application fee that applies to generators is covered by the schedule of charges approved by the Commission in 2005[12]. For a generator less than 4MW the application fee is €7,880[13]. However at that time little or no account was taken of micro generators connecting to the network. It is considered that any charges should be proportionate to the amount of processing required. The Commission proposes the following charges should apply to micro generator applications for connection to the network. The Commission proposes that the application fee would be submitted with each completed application form.

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[12]http://www.esb.ie/esbnetworks/downloads/Application_Fees_for_Embedded_Generators.pdf

[13] This fee applies to generators where there is no shallow works required i.e. there is an existing connection.

Application Type	Charge
Single Connections less than 50kVA	€20
Multiple Connections less than 50kVA	€10 per connection point up to a maximum of €500
Multiple Connections greater than 50kVA	By Quotation

Table 4.2 Proposed Application Fee for Micro Generator Installation

2.3.6. Licensing and Levy Order

All electricity generators in Ireland are required by law to have an authorisation to construct and a licence to generate electricity. The Commission is currently consulting regarding the authorisation and licensing by Order of generators below a defined threshold. The proposals set out revised process which will apply to micro generators if implemented. Please refer to this consultation for further detail[14].

The work of the Commission is funded through a Levy Order where participants engaged in electricity generation, transmission, distribution and supply pay a levy each year on the basis on the number of the electricity units of their business. All generators exporting to the network pay this levy. The Commission considers that micro generation is concerned primarily with production of electricity for use by the customer. In most cases little or no export may take place. Should the levy be applied, the cost of collection of monies from micro generators in respect of units exported could well exceed the monies received. Therefore it is proposed that micro generators should be exempt from paying the levy order.

Request for Comment

The Commission seeks comments on the principle and level of the proposed application fees and the exemption from payments in respect of the Levy Order for micro generators.

[14] "Revised Process for the Authorisation and Licensing of Generating Stations" , CER/06/195, October 4 2006

3. Metering and Commercial Arrangements

3.1. Introduction

Micro generators are intended for installation in domestic houses and small businesses and replace some of the imported electricity with own generation. This results in a benefit to the customer that has installed the micro generator to the extent that payment of the full retail tariff is avoided for units generated by the micro generator. However, a customer's demand for electricity varies throughout the day and the output of the micro generator may also vary. Therefore, at times the micro generator may be generating in excess of what the customer is consuming. Here, the micro generator may wish to export that which is surplus to requirements and obtain payment for the exports. The question arises as to how the micro generation customer is to obtain payment for any exported electricity and how this is measured.

The Commission has set out a number of options below in regard to metering and payment options and is seeking views on the most appropriate method. Each of the payment mechanisms must be supported by the relevant metering arrangements and these are outlined for each option presented.

The Commission considers that any measures implemented as a result of this consultation process will endure post the introduction of the Single Electricity Market (SEM) of Ireland and Northern Ireland which will come into effect in 2007.

3.2. Criteria for Evaluation

In reviewing the reward options the Commission will consider the responses received and the following evaluation criteria:

- any arrangements implemented should be simple, transparent and easily understood by customers;
- any arrangements implemented should not impose disproportionate administrative costs on the micro generator, ESBN or suppliers;
- any arrangements implemented should be cost effective;
- any arrangements should be compatible with the SEM;
- consistency with the Commission's Statutory duties, and
- micro generators should receive a fair reward via a cost effective mechanism.

3.3. Payment Options

Micro generators are by their nature very small generation units. The primary benefit to customers is that micro generation replaces imported energy and thereby reduces customers' electricity bills. At times the on-site generation may be greater than the customer demand and electricity may be exported (or spilled) onto the network. The customer may wish to get payment for these units and the question arises as to who should pay the customer. The options are the wholesale market, the supplier, or ESBN. The alternative is that no payments are made for exported units. The issues associated with each of the options are discussed below.

3.3.1. Sales to the Wholesale Market

The SEM will come into operation in 2007. Consultations are on-going regarding participation of small generators in the SEM wholesale market[15]. The Commission considers that participation in the wholesale market may not be cost effective for micro generators and therefore the focus of this consultation is on payment and metering options for non participants.

3.3.2. Supplier Purchases Spill

A pragmatic way to compensate micro generators for spilled energy is to get the electricity supplier to buy back the spilled energy. The advantage here is that there is a ready purchaser and the customer can be 'compensated' relatively easily by adjusting their electricity bill. However, suppliers may be unlikely to favour this as they will incur costs associated with the monitoring of the spilled energy and additional billing costs. Furthermore, these micro generation customers will be consuming less than the average customer so the supplier will potentially face additional costs for less reward. The option of selling spill to a supplier other than the customer's own supplier may not be cost effective, and therefore unattractive to the supplier, given the small amounts of spill anticipated and the costs associated with collecting the data and payment.

3.3.3. ESBN Purchase Spill

Spilled electricity may benefit the distribution system by reducing local losses. It could be argued, therefore, that ESBN should pay for any such benefits but paying customers directly for the spilled amount may not be very cost effective given metering, data collection and payment costs. It is sometimes suggested that a reduced Distribution Use of System (DUoS) standing charge could be introduced for micro generation customers. However any such reduction would have to be specific to the technology type (i.e. vary depending on wind turbine, micro CHP, etc) and there would be considerable complexity in establishing an appropriate remuneration level. Furthermore, the above assumes that all micro generation units installed will stay installed and stay working. If this were not the case some customers would be paying lower standing charges but there would be no system benefit. Inevitably, this free rider situation will arise over time.

More importantly, it should be noted that some DUoS charges are recovered through units consumed and not just standing charges. Micro generators will use fewer units than the average domestic customer but the wires to their premises and the operating costs associated with these will be the same. Therefore, ESBN will under recover their revenues for micro generation customers and the short fall will have to be taken up by all other customers and DUoS charges will rise. If there is a benefit to ESBN from spilled units this may compensate for revenue losses and could serve to mitigate price rises for other customers.

3.3.4. Non Payment for Spill

The point above argues that non payment for spill may be justifiable to counteract subsidies by other DUoS customers. Another reason why non-payment may be appropriate is the cost of metering and settling the amounts payable. Since the exported quantities are anticipated to be low the costs may outweigh any payment benefits.

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[15] http://www.allislandproject.org/2006/AIP-SEM-74-06.pdf

If micro generators are to be paid on the quantities spilled then a meter which records exports will be needed. An alternative to this is net metering which subtracts the exports from the consumed quantity. To be equitable, export meters should take account of the time spilled and any price paid should reflect the price of electricity at the time of spilling. The question is whether there is any metering and settlement system which is cost effective. The issues with the various metering options are discussed below.

3.4. Metering Options

The following are the metering options considered by the Commission and the payment possibilities are discussed under each option.

- Standard Domestic Metering
- Net Metering
- Non Interval Import/Export Meter in conjunction with Profiles
- Interval Meter with Import/Export Channel
- Smart Meters

3.4.1. Standard Domestic Meter

The simplest and cheapest option for micro generation is to use the standard meter. Thus, there will be no cost for installation and no additional data collection costs. However, these meters come with a backstop which prevents the meter from running backwards. Therefore, they do not record the energy flowing onto the network. In this case, the benefit to the customer of installing micro generation arises due to the replacement of imported electricity with electricity generated on site. The extent of the benefit will depend on the degree to which the micro generation unit meets the customer demand. This could be significant depending on the size of the unit and the consumption profile of the customer.

The advantage of this approach is that there is no change to metering or data collection and therefore no additional costs arise. Under this option, there is no facility for the micro generators to get paid for the spilled electricity and ESBN would get the benefit of the spilled units. Regarding the latter, please note the issues highlighted in section 3.3.3 above.

3.4.2. Net Metering

Net metering involves the removal of the backstop in the standard domestic meter so that the meter will run backwards when electricity is being exported. Thus, the number of exported units will be netted off the consumption.

This option has the advantage of only requiring one meter, but it would still need to be an additional new meter as current meters in Ireland are not designed to run backwards. This does not suggest that meters capable of running backwards are installed. However the suggestion is that separate recording of import and export be recorded with this being netted off in the billing system.

With net metering it is not possible to split the import and the export or the times when these occur. Therefore, it is not possible to have different charges for import and export or for different time periods. It is possible that the unit is

exporting during low price periods and the importing during high price periods. Thus the micro generators may be over compensated for the exported units.

A further issue with net metering is that the meter register can have a lower number than the last time the meter was read if exports exceed imports. This could impose costs on meter reading and billing systems that are designed to highlight apparent discrepancies such as this. It also could make theft detection more difficult.

With net metering the customers reward for spilled energy would be automatic and no third party would need to be contracted. ESBN would benefit from the spilled energy. Regarding the latter, please note the issues highlighted in section 3.3.3 above.

The Commission deems the disadvantages of this approach as highlighted above to be significant enough to preclude net metering being considered as an option for micro generation.

3.4.3. Non-Interval Import/Export Meter with Profiles

The installation of a non interval import / export meter in place of standard, domestic meters can facilitate payments for exports either:

- by a supplier based on profiled output
- directly from the market based on profiled output

This metering arrangement allows for accurate assessment of volumes of electricity imported and exported, but not for the times when these volumes were imported or exported. In this situation the standard meter would be replaced by an import/export meter. This would record separately the energy imported and the energy exported by the customer. In this way different commercial and market prices could be applied to the import and export quantities.

With this option profiles would be required to estimate the time when energy was being imported and exported. A profile takes the total gross import energy, and converts it into a series of half-hourly values which can be related to the half-hourly price of energy in the wholesale market. Reliable profiles would need to be developed for the different types of customers, e.g. rural domestic, urban domestic, 24 hr and night saver, and would have to be based on the technology type of the micro generation, e.g. wind, PV, or micro CHP. The difficulty and cost of developing profiles for the various micro generation technology types must be considered here. Note also that the cost for developing and maintaining profiles would have to be borne by all consumers. Cross subsidisation across categories and between customers with and without micro generators may arise under this approach due to the application of profiles. Finally, the cost of settlement and reconciling actual meter reads could reduce the cost effectiveness of this option.

3.4.4. Interval Meter with Import / Export Channel

The installation of an interval meter in place of standard, domestic meters can facilitate payment for exports either:

- by a supplier based on half hourly output
- directly from the market based on half hourly output

This metering arrangement records all import and export electricity flows for each quarter hour period. It therefore allows for accurate assessment of volumes and also the times of these volumes.

This option facilitates accurate payment for all the energy exported onto the network. It provides an incentive to export at times of high energy prices assuming these high prices are reflected in the price the micro generator receives for its output. The micro generators would be paid at the market price, or some agreed price, for each quarter hour for the exported electricity.

It is considered that the extension of the current interval metering and settlement systems would be an expensive option in terms of metering, billing, back office and settlement costs. There would also be some central metering systems costs to handle the extra number of interval meters that being polled. These costs would be shared across all electricity customers.

3.4.5. Smart Meters

There have been considerable developments in metering technology over the last number of years largely driven by the opening of the electricity market. Electronic meters provide increased functionality compared with the electro-mechanical meters which are standard for domestic and small business customers in Ireland. Prices for these meters have dropped significantly and they are now becoming a real option for smaller customers. 'Smart meters' have as standard import and export channels and time of use metering.

The Commission is examining the use of smart meters for all customers and will shortly issue a consultation document on the issue[16]. The Commission is of the view that the introduction of smart meters in the future may be the best way to facilitate payment for exported electricity. In the event that smart meters are rolled out to domestic and small business customers in the near future, it may be prudent not to introduce any alternative metering options for micro generation at this time.

3.5. Commission's View

The Commission considers that net metering should not be introduced for micro generation for the reasons outlined. While interval metering provides the best technical solution for exported units it is an expensive option and is not considered to be cost effective for the small amount of units which may be exported. While non interval metering is less costly, profiles will be required and the costs of developing and maintaining up to date profiles could be onerous. Additionally costs of settlement and reconciliation of metered data could potentially outweigh any benefits accruing to the customer.

In light of the above the Commission is drawn to the view that explicit compensation for exported units may not be advisable at this juncture. This would mean that the standard domestic meter could be used and the customer would not incur meter replacement or settlement costs. As already stated the customer will benefit from the replacement of imported electricity units with electricity generated by on site micro generation. The Commission considers that, in the future, smart metering may provide a cost effective method of measuring and settlement for exported units from small scale generation. In the meantime, customers may spill any excess units onto the network. Any benefit

[16] "Smart Metering, Demand Side Management and energy Efficiency" (Working Title)

to ESBN in terms of reduced losses can be used to off set losses in DUoS revenue from customers with micro generation.

Request for comment

The Commission requests comments on the payment options for exported energy and metering options outlined above and any other proposals on payments.

4. Technical Aspects of Micro Generation

This section deals with the technical aspects of micro generation. It sets out the specifications as detailed in the draft product standard EN 50438. Draft deviations from the standard specific to Ireland are discussed. These deviations take account of inherent differences between the Irish network and networks in other jurisdictions.

4.1. Standard EN 50438

Standard EN 50438 has been established by CENELEC and is currently in draft format. It is anticipated that it will become a European Standard in early 2007. The Commission is not seeking comments on the standard but rather is highlighting certain aspects in the draft for information purposes. Each country proposed national deviations to the standard. In the case of Ireland the deviations proposed by ESBN have been incorporated in the draft. The deviations are discussed below.

Micro generation is defined, by the standard as a source of electrical energy and all associated equipment, rated up to and including:

- 25A at low voltage [230V], when the network connection is single phase
- 16A at low voltage [230/400V], when the network connection is three phase, and,
- designed to operate in parallel with the low voltage system.

In practice this means that a micro generator will be rated at 11kW or less[17].

The intention of this standard is to ensure that micro generators satisfy appropriate provisions for:

- safety of persons;
- requirements of the Distribution Network Operator in each member state, e.g. network protection;
- information for electricians working inside the house;
- quality of supply, and
- electrical protection of the generation unit.

The following aspects are included in the scope of EN 50438[18]:

- all micro generation technologies are applicable, and
- operation independently of the distribution grid is intended.

The following aspects are *excluded* from the scope of EN 50438:

- multiple units that exceed 16 A per phase in aggregate, for one installation;
- issues of revenue rebalancing, metering or other commercial matters;

[17] Assuming a voltage of 400V with a three phase connection the power rating would be 11kW. For a voltage of 230V with a single phase connection the power rating is 6kW

[18] Draft EN 50438, Section 1, Scope

- co-generators never to be connected to the supply networks, and
- requirements related to the primary energy source e.g. matters related to gas fired co-generator units.

4.2. Interface Protection

4.2.1. Irish Specifications

In accordance with the draft standard, each micro generator will be required to have interface protection, as specified, which will include the following elements:

- Over Voltage
- Under Voltage
- Over Frequency
- Under Frequency
- Loss of Mains [LOM)

The interface protection shall cease to energise the distribution network when any parameter exceeds the applied operating setting, i.e. it will be automatically disconnected. Disconnection is required in case of a hardware malfunction. ESBN has inserted a national deviation to accommodate Irish G10 settings and explicit requirement for Loss of Mains (LOM). These will appear in an annex of the final document. Acceptance by CENELEC of the deviations means that the Irish G10 standard will comply with the standard. Table 4.1 below shows the national deviations that have been submitted to and accepted by CENELEC.

Parameter	Trip setting	Clearance time
Over voltage	230 V + 10 %	0,5 s
Under voltage	230 V – 10 %	0,5 s
Over frequency	50 Hz + 1 %	0,5 s
Under frequency	50 Hz - 4 %	0,5 s
An explicit Loss of Mains functionality must be included. Established methods such as, but not limited to, Rate of Change of Frequency, Vector Shift or Source Impedance Measurement may be used. Where Source Impedance is measured, this must be achieved by purely passive means. Any implementation which involves the injection of pulses onto the DSO network shall not be permitted.		
ROCOF [where used]	0,4 Hz/s	0,5 s
Vector Shift [where used]	6 degrees	0,5 s

Table 4.1 – Micro Generation Interface Setting (Ireland specific)

4.2.2. Disconnection (Cease Energise)

The interface protection shall cease to energise the distribution network when any parameter exceeds the applied operating setting, i.e. it will be automatically disconnected. Disconnection is required in case of a hardware malfunction.

4.2.3. Mechanical / Solid State Isolation Device

The disconnection discussed above shall be achieved either by the separation of mechanical contacts or by the operation of a suitably rated solid state switching device. The micro generator unit will monitor the functioning of the solid state switching device. In the event that the solid state switching device fails to interrupt the current, the micro generator shall disconnect. The solid state switching device shall be specified in accordance with the over voltage category of the micro generator as specified by the manufacturer and have a leakage current in the off state of not more than 0.1 mA.

4.2.4. Accessibility of Isolation Device

Under the ETCI wiring rules there is a requirement that a generator be isolated from the public supply. Also the means of isolation must be accessible to ESBN at all times. However, it is recognised that micro generators are a special case by virtue of their inherent nature. Therefore it is acceptable to dispense with this requirement for the isolator to be accessible at all times. But, this is subject to the provision that there are two means of automatic disconnection with a single control. At least one of the means of disconnection must be actuated by the separation of mechanical contacts.

This interface protection can either be incorporated within the micro generator or by separate external devices. In either case the interface protection shall meet the relevant standards and the manufacturer of the micro generator must declare that the combination of the generator and interface device fulfils these requirements.

4.2.5. Change of Settings of Interface Protection

The end user will not be able to alter the interface protection settings on the micro generator, i.e. they will be factory set. The interface protection settings may only be altered, from those in place at the time of commissioning, with the written agreement of ESBN and then only in accordance with the manufacturer instructions.

4.2.6. Loss of Mains Protection

An explicit Loss of Mains functionality must be included. Established methods such as, but not limited to, Rate of Change of Frequency, Vector Shift or Source Impedance Measurement may be used. Where source impedance is measured, this must be achieved by purely passive means. Any implementation which involves the injection of pulses onto the network shall not be permitted.

The trip setting shall ensure a cease energize state within the prescribed clearance time irrespective of where on the distribution network the interruption takes place. This requirement is deemed to be satisfied by passing the test as described in Appendix 2 – Type Test Certification Test Result Sheet.

4.2.7. Automatic Reconnection after a Network Outage

The interface protection shall ensure that feeding power to the distribution network will only commence once the voltage and frequency on the distribution network are within the limits of the interface protection settings.

These limits are a minimum of:

- 3 minutes for mechanical ac generation (e.g. wind turbine);
- 20 seconds for inverter based systems (e.g. PV cell).

5. Conclusion and Next Steps

The Commission would like to hear the views of market participants, suppliers, the public and any interested parties on the issues raised in this consultation.

As discussed in the document the Commission is also consulting on the authorisation and licensing by Order of generators below a defined threshold with the inclusion of micro generators.

The Commission will also be consulting on the area of smart metering, demand side management and energy efficiency in the near future.

Following the closure of this particular consultation the Commission will consider any comments received and report back detailing the next steps.

Appendix 1

Micro-Generator Notification Form

Site Details:	Site Name:
	Site Address:
	Site Co-ordinates: Easting: Northing:

Applicant Details:	Full Name of the applicant:
	Address of the applicant:
	MPRN Number: (If available)
	Telephone No.: Mobile:
	Email Address:
	Installer/Consultant: Phone No.:

Micro-generation Interface details			
	Unit 1	Unit 2	Unit 3
Micro-generation interface unit manufacturer / model / type			
Serial number of micro-generator interface unit			
Are interface protection settings as per Table 1 in "Conditions Governing the Connection and Operation of Micro-generation?			
Micro-generator details			
Micro-generation rating (kVA)			
Single or multi-phase			
Type of prime mover and fuel source [wind, solar, micro-CHP, diesel. if others specify]			

Appendix 2

Type Test Certification Test Result Sheet

Micro-generator details

MICRO-GENERATOR Type reference		
Maximum continuous rating [19)]		
Manufacturer	Tel	Address
	Fax	
Technical file reference No.		

Test house details

Name and address of test house	
Telephone number	
Facsimile number	
E-mail address	

Test details

Date of test	
Name of test Engineer	
Signature of test Engineer	
Test location if different from above	

Power quality

Harmonic current emission								
	Maximum permissible harmonic current as per EN 61000-3-2 Class A							
Harmonic	2nd	3rd	5th	7th	9th	11th	13th	15th ≤ n ≤ 39th
Limit	1,08	2,3	1,14	0,77	0,4	0,33	0,21	0,15 [a] (15/n)
Test value								
[a] 50 % or some other declared value close to the mid point between minimum and maximum.								

Voltage fluctuations and flicker	
	Maximum permissible voltage fluctuation (expressed as a percentage of nominal voltage at 100 % power) and flicker as per EN 61000-3-3

19) The full load electrical output of the unit minus the appliance's own consumption.

	Starting	Stopping	Running	
Limit	3,3 %	3,3 %	P_{st} = 1,0	P_{lt} = 0,65
Test value				

	Power factor		
Protection limit	+ 0,95 – 0,95 at three voltage levels		
	210 V	230 V	250 V
Test value			
[a] 50 % or some other declared value close to the mid point between minimum and maximum.			

Under / Over frequency tests

	Under frequency		Over frequency	
Parameter	Frequency	Time	Frequency	Time
Protection limit (from Table 1 or Annex A)	XX Hz	XX s	XX Hz	XX s
Actual setting (as applied to interface protection)				
Trip value (test result)				

Under / Over voltage tests (single stage protection)

	Under voltage		Over voltage	
Parameter	Voltage	Time	Voltage	Time
Protection limit (from Table 1 or Annex A)	XX V	XX s	XXX V	XX s
Actual setting (as applied to interface protection)				
Trip value (test result)				

LoM test

Method used			
Output power level [a]	Min.	Medium	Max.
Trip setting clearance time			
Trip value clearance time			
[a] Indicative values are shown for minimum, medium and maximum power levels.			

Fault level contribution

Short-circuit current at micro-generator terminals
Short-circuit applied to micro-generator at normal running condition 0 – 2,0 s plot

Micro-generator short-circuit parameters [20)]

Parameter	Symbol	Value 1	Value 2	Value 3	Value 4	Value 5
Peak short-circuit current	i_p					
Initial value of aperiodic component	A					
Initial symmetrical short-circuit current	I_k					
Decaying (aperiodic) component of short-circuit current	i_{DC}					
Reactance/Resistance ratio of source	X/R					

Comments

20) According to EN 60034 series.