dti

SMALL GENERATOR CONNECTION SURVEY

CONTRACT NUMBER: DG/DTI/00064/00/00

URN NUMBER: 06/879

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Contractor

British Power International Ltd

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1. Executive Summary

This survey aims to identify and examine any issues that might preclude or impede the developers of Small Scale Distributed Generation (SSDG) projects from achieving a connection to the distribution network. It also includes associated issues such as metering and settlement processes that might obstruct connection.

There has been a significant increase in energy costs in recent years accompanied by growing pressure - from government and at international level - to reduce carbon emissions. SSDG has the potential to contribute to achieving cost savings and delivering significant environmental benefits. A number of technological solutions such as wind power, photovoltaic cells (PV), micro-hydro generation and small combined heat and power (CHP) are now available. These technologies can offer efficient point-of-use generation solutions that are environmentally sustainable.

The basis for most of these technologies is to generate electricity, and in some cases heat, for consumption in the premise in which they are housed. Where there is a surplus of electricity it may be possible for this to be exported to the local distribution network.

If the SSDG is to be connected to the network then the local Distribution Network Operator (DNO) must be notified or, for larger installations, give approval as it owns, develops and maintains the network and has responsibility for ensuring equitable access, quality and security of supply for all users.

Considerable work has been done to improve the communications between the parties in accordance with Engineering Recommendations G59 and G83, and to develop standardised documentation. However, there remain issues to resolve if this market is to operate effectively and develop smoothly.

An early priority in this survey was to identify the stakeholders in the market and select a cross section that best represented the technologists, developers, suppliers and DNOs in the below 50kWe market.

Information was gathered by interviews. These were conducted face to face where possible, or by conference call where a personal visit could not be arranged within the timetable. Consistency was achieved through the use of a pre-prepared standard questionnaire (reproduced as Appendix A). A draft was piloted and refinements made drawing on the experience gained during the initial, exploratory interviews. A modified version of the questionnaire was used for the interviews with DNOs, whose interests might be perceived to be different, in some respects, from other stakeholders.

Of the twenty-one companies invited to take part, eighteen responded positively and were interviewed. A number of smaller companies were reluctant to participate in the formal questionnaire but were happy to comment on their experiences to date. Where appropriate they have been included. The results of the questionnaire were analysed and summarised with the objective of producing an overview of the current situation, identifying those areas that

are working well and those where change may be needed if the market is to operate and develop efficiently. Although each respondent had individual or organisation-specific problems and priorities, a common group of themes emerged and these are summarised below. Resolution of these will help ensure that the operational interface between the developer and the DNO does not hinder SSDG development and connection.

The common themes were;

There is a broad consensus that the procedures in Engineering Recommendations G59 and G83 are functional and do not need significant revision.

- Some developers – particularly those whose product falls outside the G83 parameters - would like to see the 16A level raised to make connection easier for them to manage; DNOs are generally not keen to accept this change.
- Most developers have a pragmatic relationship with those DNOs they interact with. They registered a concern, however, that there is not always consistency in terms of approach or pricing. It is understandable that there may be differences among DNOs (given the market structure) but that there should be differences within a DNO was less easy to explain.
- Typically, each DNO receives between fifty and sixty connection enquiries each year. Two principal questions were raised about how an increase in numbers would be handled; first, would DNOs have the resources available (essentially distribution planning expertise) to cope; and second, are DNOs taking a long term, strategic view of the compound effect of increased SSDG connections on the network?
- Respondents indicate that generally DNOs are replying within their licence obligations (currently a ten working day period for an initial response and three months for a design). However, these (particularly the design period) are considered by most developers to be unnecessarily long.
- In the view of most developers, metering and settlement remain as major obstacles. There are no reported technical issues but for many developers the cost is considered prohibitive and the administration lengthy and cumbersome.
- Import/export billing for SSDG is currently carried out manually by the supplier outside the settlements system. This is an expensive process for the supplier and if the SSDG market takes off as anticipated, automation will be needed to create a seamless interface with the settlements system. The cost of automation may further add to suppliers' reluctance to enter this market. The economics of installation therefore remain an obstacle to development of a mass market and the evidence suggests that most installations to date have been demonstration projects or heavily subsidised for brand/market development.

2. Introduction

2.1 Background

Developers of small generation projects (sub 50kWe) seeking to export power must be able to connect to the local distribution network in order to transfer their electrical output to a point of demand. Connecting a generation scheme to the distribution network is both scheme and site specific but in general terms the connection process can be divided into a number of stages beginning with planning and finishing with commissioning and energisation. At each stage significant interaction is necessary between the network operator, the developer and possibly an independent third party connection provider.

There are a number of issues which developers of small generation schemes report they are experiencing. Some of these are specific to this size of generation and the technologies involved, while others are shared with larger distributed generation schemes. The key challenges are:

- *Demands on the distribution network*. Until recently distribution networks have been designed and operated to support power flows from generators through the transmission and distribution systems to customers. Distributed generation requires the distribution network to become more "active" by allowing power flow in both directions.
- *Connection to the distribution network*. Under the current arrangements developers of SSDG schemes with individual units complying with G83 are required only to advise the DNO of their intention to connect. For multiple installations or connections greater than 16A the DNO must be consulted, irrespective of whether G83 or G59 applies. SSDG developers have reported difficulties in connecting to the distribution networks where DNO approval is required. Technical, practical and financial issues have arisen which have made schemes non viable. However, the introduction of G83 and the greater use of standard documentation have proven beneficial in reducing the entry barriers to smaller generators.
- *Technological issues.* There are a number of different types of distributed generation technologies available. Currently some technologies have issues, which are making it difficult to offer commercial propositions - such as the fuel cells or mid range CHP were the capital costs and lack of grants are making it unattractive.
- Electricity sales. Some developers of smaller schemes have experienced problems in reaching agreement with electricity suppliers to buy the power generated that is in excess of customer's requirements. There are also issues concerning the metering and collection of data associated with export energy and the requirements for ROCs and LECs. This point is expanded later in this report under metering and settlement issues.

Distributed generation has an important part to play in meeting the long term environmental targets of the Government. The Department of Trade and Industry is supporting work through a number of programmes and funded initiatives to facilitate access for distributed generation to the electricity

distribution network. A core theme is to encourage developments of all sizes - from the large wind farms that are emerging to single customer "microgen" installations. The work supports studies to develop a better understanding of the regulatory, commercial and technical issues in implementing a connection to the distribution network and establishing a market for electricity sales from small generation plant. This study forms part of that programme.

2.2 Aims of the study

The aim of the study was to survey a number of developers of small scale generation projects (output of less than 50kW) to create an understanding of the current difficulties and barriers to implementing a generator connection to the distribution network. In order to develop a balanced overview, representatives of other stakeholders were also invited to participate in the survey.

The outputs will help inform a discussion on any proposed changes to the current regime (and associated processes) which governs the connection of small scale distributed generation.

3. Current Activity in Small Scale Distributed Generation

There are a number of technologies being used in SSDG, some of which can be used to generate heat as well as electricity. Normally, the electrical connection from the generator operates connected in parallel with the DNO's network, with a tariff meter capable of registering import and export power flows. If heat is generated, it is typically connected to an on-site heating system for comfort heating and hot water supplies.

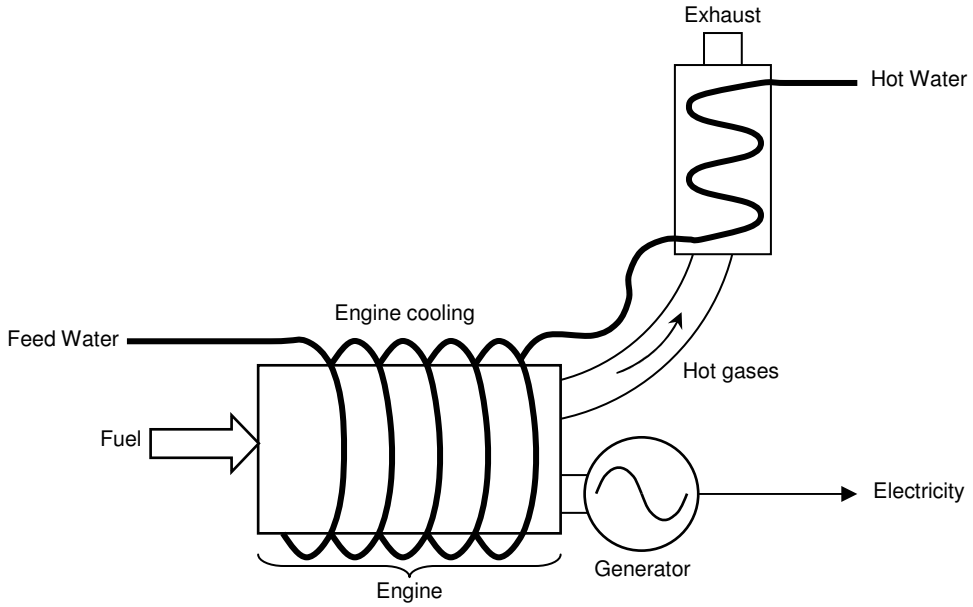
3.1 Domestic and small scale commercial CHP

CHP is a fuel-efficient technology generating both electricity and heat. Typically, domestic units are between one and five kilowatt electrical (kWe), with the larger units being used in commercial properties such as nursing and residential homes or small commercial buildings.

Units are normally fuelled by natural gas through a Stirling engine for the smaller units or by a reciprocating engine for larger sets. Other types of fuels can also be used on different units. SSDG CHP units are physically compact (typically the size of a domestic refrigerator or washing machine) and can replace a typical existing boiler system.

In most cases the electrical output generated by a SSDG CHP would be consumed on the premises but there are times when the unit could export surplus electricity to the distribution network.

However, CHP units require detailed maintenance (both electric and heat elements), which can add to the operational cost.



Typical CHP schematic

3.2 Small scale wind

Providing electricity generation only, these units require specific location to secure the maximum uninterrupted wind flow and hence optimise output. Typically weather conditions dictate that their availability is around 25% so a regular back up supply from the distribution network is required.

Generally wind generators are not favoured by planning authorities for installation close to residential properties. They have been installed in schools and service stations to good effect where they can fit relatively unobtrusively into the landscape. Although heavily dependent on weather conditions, they offer a very clean renewable energy alternative.

3.3 Micro hydro generation

Again providing electricity generation only, these units comprise a water driven turbine driving a generator.

Locations for these units are limited to those sites with consistent and adequate flowing water (typically found in the North of England, Scotland and parts of Wales) but in these situations they offer an environmentally sustainable source of energy with relatively simple technology.

3.4 Small scale PV arrays

Solar powered photovoltaic cells offer electricity generation only. They are popular with local authorities, commercial offices with some domestic installations. The technology offers an environmentally sustainable energy solution during daylight hours but requires an extensive surface area to be cost effective.

Having no moving parts, PV arrays provide a virtually maintenance-free renewable energy solution.

3.5 Fuel cells

The fuel cell technology in SSDG is comparable to that discussed under CHP SSDG, with hydrogen as the fuel used.

Fuel cell technology is still in its infancy as a small-scale energy source; research is in progress for improvement in the production of hydrogen (including from renewable sources), and for development of fuel cell SSDG units with very high efficiency. Fuel cell units offer considerable potential, but there remain technological and economic issues to resolve.

4. Survey Overview and Analysis

4.1 General Approach

In order to understand the concerns and barriers that developers are experiencing in connecting SSDG schemes to distribution networks, it was decided that a number of key players in this field should be interviewed. In order to gain maximum benefit from them, it was further decided that the interviews should be logically and formally structured, using a purpose designed questionnaire. The questions were initially drafted by the consultant (based on experience of the technologies and conducting power sector studies) and amended following discussions with AEAT and the DTI.

A list of potential companies and organisations was assembled by the consultant based on their current knowledge of activities in the small-scale distributed generation arena. This was also refined following discussions with AEAT and the DTI. The companies interviewed are detailed in Appendix C. Four of the smaller developers declined or did not respond to the questionnaire. Where possible they were contacted by phone for informal comments which were included if doing so gave a more balanced view.

4.2 Questionnaire

At a detailed level, connecting a small scale distributed generating scheme to the distribution system varies according to (among other things) the technology being used, size of generating plant and location. However, there are a number of broad and common stages from the initial concept to the final commissioning and operation. The questionnaire was broken down into these stages and focused on the connection to the distribution network issues in each. These stages are outlined as follows:

- Project preparation;
- Construction & commissioning;
- Contractual & relationship issues;
- General issues & additional material.

The terms of reference concentrated on interviewing developers of SSDG schemes with respect to connection issues. However in order to understand the barriers and challenges, it was considered necessary to interview other stakeholders and interested parties. Some of the questions were not relevant to all the organisations that were interviewed, but it was decided to use the same questionnaire. This offered two benefits in that the interviewees could appreciate the range of the study and it also facilitated comparison between groups. The exception concerned Distribution Network Operators, where it was decided to use a more specific set of questions.

4.3 Interviewees

The interviews were conducted either face to face where appointments could be arranged, or by teleconference. Following each interview, the interviewee

was sent a copy of the information given and comments recorded during their interview. They were asked to confirm that they were satisfied that the documented responses accurately reflected their interview and were invited to make amendments or add additional information. It was agreed that any information published from individual interviews would be non attributable and this will be respected.

Twenty one organisations, listed in Appendix C, were interviewed broken down into the followings categories:

- Developers (9)
- Manufacturers (3)
- End customers (2)
- Meter Operator (1)
- Distribution Network Operators (2)
- Trade Associations (3)
- Consultants & Research organisations (1)

4.4 Survey Findings

Overview

Significant increases in the cost of energy over the last 18 months to December 2005, coupled with the increasing awareness of environmental issues, have helped to focus attention on alternative generation possibilities for the smaller energy users.

The market for SSDG is gaining pace and manufacturers, developers and installers have considerable expectations for the increased penetration of this technology into the sub 50kWe market during 2006. Whilst the market is still primarily for individual units which have been installed subsidised for evaluation or demonstration, one company is committed to 500 plus domestic schemes during the next two years.

The technology is developing in line with market expectations and requirements, notably addressing the high capital costs and maintenance, which are still considerably higher than the alternatives. Domestic wind power for example has developed some innovative solutions with vertical axis generators and one that fits along the ridge tiles to form part of the roof structure. Domestic PV is struggling with the power to area ratios and the £ per kW costs.

The major push is in the micro CHP market but it still has the capital cost issue to overcome. By way of example the following was given to us by a major developer of micro CHP. They see the new and replacement boiler market offering the best potential for sales. From their research they would say a typical domestic condensing boiler installation would cost between £1,500 and £2,000, the alternative current micro CHP unit would be approx £3,000. They are working on a new technology, not currently available, that would reduce micro CHP costs dramatically and be a direct competitor to the boiler.

DNOs have commented on an increasing number of enquiries in this market, mostly single units, but noted that only a small percentage move forward to the design or project stage.

Whilst the stage is set for an increase in this market sector there are still some connection and metering issues that need to be addressed to allow the mass connection of SSDG to the network.

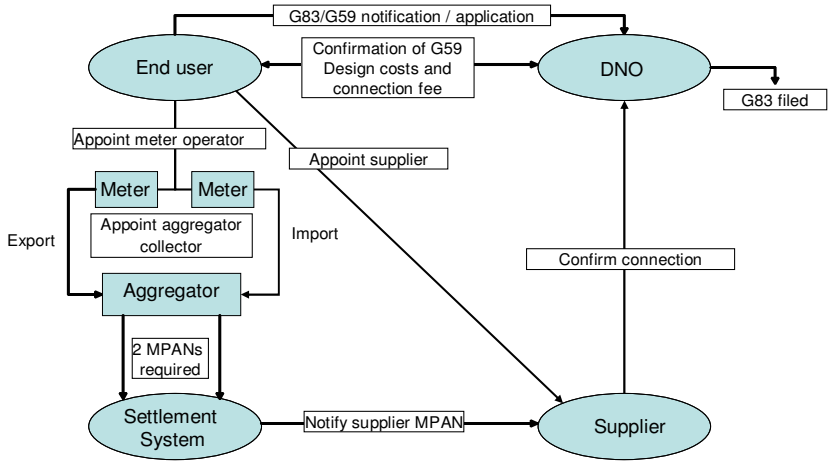
It was identified by a number of companies that nuisance tripping could become a problem as the number of installations increase, especially if they are connected in the same proximity and network. Only one developer had first hand experience of this and it was corrected in collaboration with the DNO. However the author believes that DNO's are not recording, or taking into account, the dispersion of SSDG on their networks and the time will come when this may become more of a problem

Networks are designed to flow in one direction, to the end customer. Generation can reverse this flow and alter the balance of the network in voltage and fault level. With the number of SSDG connections at present this does not represent a problem. DNOs are happy to accept a G83 connection, but as the numbers increase and the SSDG becomes more concentrated, the DNO will have to take this reverse power flow into account and consider whether they can continue to accept G83 connection without design considerations.

The connection process

Before a new connection or SSDG can be connected to the network it is important to understand the process that needs to be followed. The following schematic diagram shows the high level process.

Connection arrangements data flow



- The end user decides upon the size and type of connection required before any application is made to the supplier or DNO. (It is possible to

have an informal discussion with the DNO to outline intentions and discuss options available but it is unlikely that they would commit to anything over 16A per phase without a feasibility study which could cost in the order of £1200).

- If the SSDG is 16A or under then the user needs only to advise the DNO of the intention to connect under the G83 recommendation pre or 30 days post connection. It is worth noting that G83 is a recommendation, not an obligation so connection could still be refused.
- The DNO files the G83 notification and take no further action.
- If the connection is above 16A, or there are multiple installations such as a housing estate (or by agreement with the DNO) the user must apply for connection under G83 or G59. This application will incur feasibility, design and connection costs. There are some inconsistencies in the DNOs' approach and charging. (Reviewed later in this report).
- Before a connection can be made the end customer, the person using the SSDG output appoints a supplier and/or purchaser (if the output is to be sold)
- Normally the supplier and/or purchaser make arrangements for the meter operator and aggregator but the end customer may opt to do this direct.
- The DNO has the responsibility of allocating the MPAN numbers and advising the supplier and/or purchaser. If export is required and the end customer wants to claim export or ROC, then two MPANs will be needed and possibly two meters - with the resultant additional costs (more details in the metering section of this report).
- Once MPANs have been allocated the network connection can take place.
- For larger installations the DNO may wish to inspect and test the connection.

Relationship between Developers and DNOs.

From the questionnaire it would appear that most of the technical and logistical issues related to single installations requiring G83 notifications have run smoothly and, in general, there appears to be a good working relationship between those involved in the single installation projects. However there have been instances, particularly with the smaller developer, where the DNO has appeared to be less than helpful or it has been difficult for developers to pin point the right person to deal with.

Serious concern was expressed by developers that DNOs may not have considered the effect that this technology could have on the changing nature of the network, particularly at low voltage. Whilst the current numbers of enquiries received by DNOs for SSDG is low, the intention of developers is to target specific areas and market to socio-economic groups that they have identified as offering the greatest potential.

If the developer's targets are reached there could be a significant number of clustered installations that may impact on the network stability and give rise to

nuisance tripping. This may cause problems for the DNO in managing voltage regulation and power flows in real time, especially on rural networks. The potential impact on fault levels and protection coordination in the urban networks is of further concern.

One developer interviewed reported three instances of nuisance tripping with larger SSDG units. These were dealt with but are a cause for concern for the larger volume market. DNOs accept that this is a possibility but they do not see it as a serious issue at the current time, the intention being to deal with it on a project specific basis.

There is also a concern that if the growth of SSDG is in line with projections, DNOs may need to review network design standards, which could in turn affect the economics of connection and extend the design lead times.

The DNOs' view is that all applications for larger scale or higher volumes of SSDG connections would be reviewed in line with current connection policy, and appropriate action taken in line with their licence requirements, in other words it is "taking the party line". There is a perception from the larger developers that the DNOs do not to want to consider the implications of a step increase in the number of installations and the resultant implications on the LV network as this could lead to stranded assets or abortive design time. Whilst this may be true it is almost impossible for the network designer to take into account all the "what if" scenarios when the developers are unable to give any indication as to their connection requirements or number. However the author would support the developer's comments that the DNO should record individual G83 installations on the network so that it may monitor the increase in activity and be more proactive than reactive.

There was broad agreement that the G83 and G59 requirements worked reasonably well for those projects that fell clearly into the respective regulation and that as a consequence, there was no immediate need to alter the existing arrangements given the present level of activity. However some developers reported that DNOs did not appear to have a consistent approach to those projects just outside the G83 limit. Some DNOs allow developers to increase the 16A limit, requiring only the standard notifications, whilst others require a full-fee design approach. The author would accept that there is some merit in reviewing the G83 16A limit to say 32A thereby capturing more of the domestic applications and making a more consistent approach by the DNO and has put this forward as a recommendations.

Some of those interviewed expressed concern at the variation in fees charged by DNOs. The G83 16A single installation requires notification only and no DNO fees are incurred at present. Where G59 or multiple G83 installations are involved most DNOs require an administration, feasibility or design fee. This fee appears to be project specific (none of the developers or DNOs was readily able to provide details of charges against specific projects). There is a general recognition that there is no standard method of costing. Some of the developers held the view that these costs should be waived, or at the very least regulated to ensure that they do not hinder the connection of SSDG. Currently costs in the ranges of £1000-£1200 for feasibility studies and £2500-£3000 for

design are being quoted. These are comparable with, and could even exceed the capital costs of SSDG installations.

With regard to the connection cost there has been some movement to assist SSDG through the implementation of the new DNO connection policy. Since 1st April 2005 SSDG connecting to the network has only attracted a 'shallow' connection charge with a generation use of system charge. The GUoS charge is currently zero in the case of SSDG but the DNO reserve the right to charge.

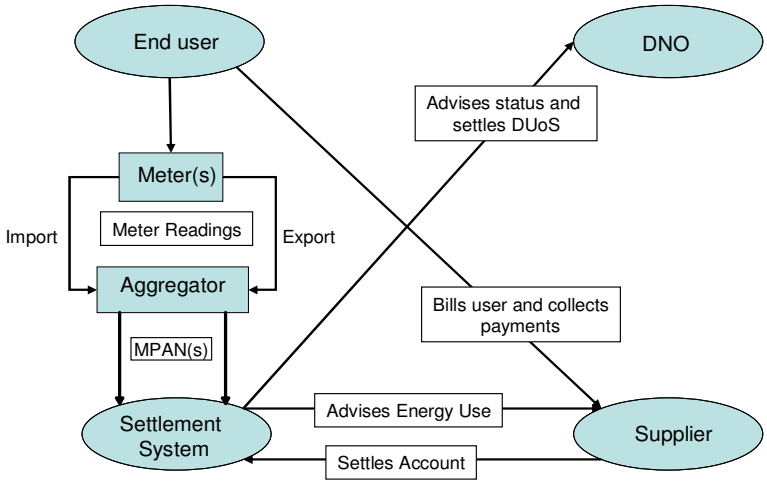
There was some concern amongst developers about response times from DNOs for designs, but generally it was accepted that DNOs did respond within the licence condition requirements, nominally 3 months. Developers would like to see this time period reduced.

Metering and settlement issues.

The developers interviewed were, to varying degrees, dissatisfied with the metering and billing system and see this as a major hurdle to future SSDG connections if the generation output is to be exported. Currently most suppliers/purchasers are using manual systems to record and bill energy import/export from SSDG. For the settlements system to record data automatically it requires code of practice metering to be in place for both import and export. Similarly to be eligible for ROCs or LECS OFGEM require data to be recorded via an approved meter

The smaller the SSDG the less likely it is that it would be economical to export – the benefit comes through reducing the cost of importing electricity. However there is a problem, identified by the meter operator interviewed, in that if the SSDG is run in parallel then there would inevitably be some spill (the non recorded export of electricity) that would affect the metering in the manner described below.

Billing and Settlement data flow



The diagram above shows the current process for metering and billing of SSDG if export to the network is required or for the recording of LECs or Renewable Obligation certificates ROCs.

- The SSDG end user appoints a supplier and/or purchaser who in turn normally appoints and manages the data handling and settlements;
- If it is decided to export electricity from SSDG then two meters (to record the import and export) may be needed together with two MPANs.
- Normally the meter operator/aggregator would have a service level agreement for installation and maintenance with the supplier;
- The data is collected and passed to the settlements system that in turn advises and allocates accounts to the specified DNO and supplier;
- The supplier calculates the import and export use and bill accordingly.

Currently there are other metering and settlements options under review by OFGEM involving netting off calculation and the measurement of the generation output on site and crediting against import or looking at calculations based on indicative profiles. No alternative data collection options have been adopted at the time of preparing this report and none are believed to be imminent.

If export is not required normal domestic metering arrangements apply - with some exceptions. Under the terms of G83 the SSDG would be connected in parallel with the existing DNO supply. With this arrangement a mechanical meter is unsuitable as it may reverse or hit its back stop when exporting, which

remains possible, and so reduce the registered import kWh (i.e. 'net off' the registered consumption and reduce the supplier sales income DNO use of system charge).

There are currently so few installations in this category it has not materialised as an issue but may do so if the market expands.

If an electronic meter is fitted it would indicate a meter tampering signal and instigate a meter operator investigation, for which the meter operator could charge a call out fee.[1]

Existing metering in the recipient building will be unsuitable for the requirements of SSDG and needs to be addressed. There are standards and procedures in place to cover the metering and settlement requirements but it would appear that they are either not being used or are unsuitable for this market. The indications are that meter operators recommend a national framework agreement for metering and settlement to cover the SSDG market incorporating the current standards and procedures.

Suitable import/export meters are available at a cost of around £15 but there is concern, from developers and installers, over the cost of installation, maintenance and settlements, which they believe may represent a serious economic barrier in the process of connecting SSDG.

Ownership of the meter is also an issue causing concern and confusion. Currently there are a number of service level agreements in place between meter operators and suppliers to cover various options for metering. Suppliers are currently absorbing the costs of metering and settlements as there are only a small number but if the market develops they may wish to review their position.

When the market develops it is unlikely that the supplier will be able to absorb this cost unless they are able to secure a supply contract of significantly longer term than the present 28 day norm. If the supplier does not retain accountability for the (not insignificant) metering costs, these will be shared or passed on to the user.

Major suppliers can secure very favourable metering and installation prices based on its considerable purchasing leverage or simply absorb the costs into its infrastructure. A non energy supplier entering the market could expect to pay considerably more for metering services than the major energy suppliers and would have to pass the cost through to the user so increasing the capital costs.

Supplier - user relationship

The majority of SSDG developers have formed alliances or joint ventures with suppliers to enable them to enter the market and use the supplier's resources. This relationship is helping to start the SSDG process by facilitating an easier route to users and network operators through established channels.

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[1] Typically in the region of £100.

One energy supplier involved in developing SSDG is known to be planning 500 SSDG installations during 2006, and is prepared to put an inclusive proposal to users covering the capital installation, metering and settlement charges, in a single fixed price. This is expected to target the boiler replacement market. The aim of this offer is to secure long term gas and electricity supply business in the domestic and small commercial market. The user is likely to be expected to commit to long-term supply agreements to take advantage of this offer.

From our preliminary review, it seems that an independent developer or installer has little prospect of matching this type of offer. They are unlikely to obtain a supply agreement or power purchase agreement for the excess energy from a supplier(s) and will be unable to negotiate or match equivalent metering and settlements costs. This was pointed to as a major barrier to smaller, individual projects in the SSDG market.

Value of export

Based on the costs associated with export, and comments from the companies interviewed, it is unlikely that the smaller domestic installation will find it economic to export - any excess will spill[2] onto the network. The main reason for this is the cost of administration, compared with likely value of export. At the current time, the smaller domestic SSDG are likely to be CHP and as such, will not attract ROCs or LECs so the value is limited to the export kWh unit sales.

The value of exported energy, when added to the ROCs (applicable only to renewable energy such as PV, hydro and wind), becomes slightly more attractive to the supplier. One interviewee suggested that a LECs type of bonus for domestic SSDG would encourage generation for export. Even taking into account the ROCs, which is worth more than the energy value, the returns are considered so small compared with the administration costs that most energy suppliers do not regard it as a viable proposition.

[2] 'Spill' in this context means the unrecorded export of electricity to the distribution network.

5. Conclusions

The market may still be in its infancy but the technology is available to make a rapid expansion into the sub 50kWe market possible, provided the barriers to entry can be overcome.

From the developers interviewed the major effort is being focused on the domestic housing boiler replacement market which will probably form the majority of SSDG installations. Typically these installations are sub 3kWe and fit comfortably into the framework set by the G83 recommendations.

Our investigations suggest that the DNO/developer interface is working reasonably well and the G59/G83 recommendations are adequate for the current level of activity. However, some developers believe that the G83 16A level should be increased to 32A to cover the majority of domestic installations or alternatively an additional engineering recommendation introduced to cater for the above G83 domestic installations. Whilst this may appear to be desirable it is unlikely that the DNOs would accept an additional ER willingly without a more complex application and design requirement, along with additional costs. The author would suggest it would be easier and less costly to increase the G83 level and has put this forward as a recommendation.

Currently it is at the DNO's discretion as to whether or not they accept an automatic connection above the 16A limit; unfortunately these decisions can vary by DNO and lead to annoying inconsistencies. The FES project No 1386 "Banding of Connection Standards for Distributed Generation" supports this reports findings concerning G83 and alternative ER but gives a more in depth analysis of options and remedies available.

There is a divergence among DNOs concerning the application of the regulations, their systems for handling enquiries and documentation used. This leads to inconsistency in the way in which enquires are handled. In some instances evidence of differences between different regions/managed units within the same company was presented.

Charges for feasibility, design and connection also differ between DNOs (and occasionally regions within DNOs) for broadly similar projects, which leads to confusion - particularly an issue among developers operating at the smaller end of the market. In some cases quoted, it was suggested that DNO charges had the effect of making projects non-viable.

Metering and settlement is also an issue for developers. In the case of export or the recording of ROCs, the administration and costs of settlements may outweigh the benefits. Several suppliers, who would normally absorb the metering costs, may require the end customer to fund, own and maintain the meter which would add an additional cost to the project, far outweighing any savings. In all probability most domestic installations will not export energy unless incentives are given (and costs reduced).

If the existing meter is retained it is possible that the SSDG will reverse the recording or flag up fraudulent use conditions. The meter operator interviewed expressed a view that there was a need for a national framework agreement to

cover all metering options in the SSDG market, even though there are standards in place that could be used.

Currently there are only a small number of SSDG installations in relation to the size of the distribution networks, and they have been easily absorbed. When this market increases the number of units clustered on the network could cause nuisance tripping, primarily due to over or under voltage. If the number of installations significantly increases it is possible that a DNO may revoke the right to connection under the G83 recommendation and revert to individual project evaluation, which would considerably increase costs and time.

In summary, this survey suggests there are few technical and operational barriers that cannot be overcome by some small variations to the current recommendations, together with a more standard and consistent approach by the DNOs.

6. Recommendations.

- Encourage regulatory interest to ensure that steps are taken to retain G83 16A provisions as the market develops.
- Carry out an operational review to examine the feasibility of raising the G83 16A limit and setting down a common approach which DNOs should adopt when dealing with developers.
- There is a need to review current documentation and application processes for SSDG connections with a view to standardisation of documentation, guidance and internet availability.
- Accelerate the metering and settlements review already underway addressing the SSDG issues highlighted in this report.
- Develop a national framework metering standard for SSDG that small developers could use.
- Extend the LECs, ROCs and ECA type advantages to all SSDG installations.

7. Glossary of Terms Used

Acronym	Description
The acronyms and short forms used in this report have the following meanings:	
AEAT	AEA Technology
Developers	Manufactures and installers of SSDG
DNO	Distribution Network Operator
DTI	Department of Trade and Industry
End customers	The user of the output from SSDG
Energy Suppliers	A licence holder for the retail of energy
Energy Purchaser	A licence holder who is willing to purchaser export energy
G59 –G83	Engineering recommendations for the connection of SSDG to a network
kWe	The kilo Watt (electrical) content of generation
LECs	Levy exemption certificates
MPAN	Meter point administration number
PV	Photovoltaic
ROCS	Renewable option certificates
SSDG	Small Scale Distributed Generation
ADMD	Average Daily Maximum Demand
Spill	The non recorded export of electricity
ECA	Enhanced capital allowances
Nuisance tripping	Change in network conditions, such as over/under voltage, which would cause the generator to shut down automatically.
GUoS	Generation use of system charge

8. Appendices

Appendix A Questionnaire Template

Introduction prior to asking questions:

Review the following points before commencing questions

- The background & aims of the study is understood
- Who commissioned the study
- Timescales
- What will happen to the information interviewees provide
- Opportunities interviewees will have to review questionnaire information before it is analysed
- Explain that all information gathered will be treated in confidence and use anonymously unless specific permission is granted from interviewees

Company background

Determine company information including

- Core business activities
- Size
- Locations

Questionnaire structure

The questionnaire is divided into 4 basic sections:

- Project preparation
- Construction & commissioning
- Contractual and relationship issues
- General discussion

The questions are a full set of questions and will not be relevant to all the interviewees. Obviously where a question is irrelevant then it should be left blank. The general discussion section at the end is to be used where the discussions lead to areas not covered by the core questions.

It is important to obtain specific illustrations of issues and situations where possible rather than general overall information although some interviewees will be able to provide useful overview data.

A summary sheet is provided to summarise the key issues that came out of the interview and should feed into the main report.

Summary

Company:

Interviewee:

Interviewers:

Date:

Summary of Key Issues From Interview

Question	Response	Question clarification
1. Please provide a brief overview of your business activity.		
2. What for your company is a "typical" project associated with Distributed Generation?		The size of the generating equipment is a key component determining the processes to be followed.
3. Please describe at a high level the processes you use to plan and assess both the technical and financial aspects of a project.		Need to understand how the viability of a proposed project is assessed from the developer's and end customer's perspective
4. How do you identify locations for a project in terms of both the site and connection to the distribution network?		
5. What information do you require about connection equipment, costs, network information and engineering standards?		Discuss DTI guides such as 05/1375 and their usefulness.
6. Is the information on connection equipment, costs, published network information and engineering standards readily available? How is the relevant information accessed?		This appears to be a difficult area for developers and end customers. Are developers aware of the Network Development Statement produced by DNOs?
7. How accurate and useful is this information normally?		

Question	Response	Question clarification
8. Are the various trade associations helpful in information provision and guidance?		
9. Overall how would you describe your relationships with the Network Operators in developing projects and their willingness to exchange information with you?		
10. How helpful do you find the Network Operators and other parties in discussing design issues and options including the following points: • provision of sample agreements from Network Operators (GDUoS) and the Suppliers (export tariffs); • ease of access to a cost estimate of the connection; • submission of the formal connection application by the developer, if needed, including any experiences regarding the notification arrangements under G83 for single connections, G83 for multiple connections and G59 for over 3.6kW plus the special arrangements for PV under 5kW; • connection offers and their acceptance.		Under G83 Network Operators can challenge multiple connections

Question	Response	Question clarification
11. Limitations under G59 and G83. Are these documents working as envisaged?		G83 issue is voltage limits (nuisance tripping). G59 is stricter than 83 as does not give right to connect and inform.
12. Is there a need for a standard to cover between G83 and G59?		Should there be a different approach (more relaxed) for generators just above the G83 limit?
13. Are the timescales for technical & cost assessments by Network Operators' reasonable?		Generally feasibility studies done by Network Operators to give outline costs and timescales. If acceptable then NOs will proceed with a detailed design study.
14. Have you been charged for feasibility work?		Appears to be varying policies on this between the DNOs.
15. To what extent do you need to engage external expertise to support applications to a Network Operators?		
16. What affect does the overall cost of securing a connection make on the total investment?		Try to determine the proportion of the cost of securing a connection has on the projected costs
17. Is consideration given to using third parties for the contestable activities rather than the network operator?		Concerns that not enough work being won by 3rd parties

Question	Response	Question clarification
18. What issues have arisen with the construction of the connection as defined in the connection offer?		
19. What problems, if any, have there been with adherence to agreed timescales?		
20. What problems, if any, have there been with the contractual arrangements for the contestable aspects of the construction phases where an independent connection provider was also involved?		
21. Do network operators test protection equipment, where necessary? If so what is the general level of charges and the timescale for this process?		
22. In general what is the relationship like with network operators when testing and commissioning connections?		

Question	Response	Question clarification
23. How easy is it making contractual arrangements?		Includes metering and supply businesses.
24. Have any problems arisen with any agreed operating regime of the generator, e.g. constraints that may be imposed on its export e.g. voltage rise at the local substation?		
25. What issues have been experienced with metering?		Important issue
26. Have issues arisen such as nuisance trips of the generator due to low voltage excursions in the network, loss of mains supply, or frequency variations?		
27. Overall relationships with the Network Operators throughout the project i.e. help or hindrance?		
28. In summary what do you consider to be the biggest barriers to connecting small generators to the distribution network?		
29. What practical changes do you think would make it easier for more small generators to be connected to the network?		Please discuss whether a more common approach from the DNOs would help? Currently they appear to work to different processes.

Appendix B Synopsis of Responses

Q1. Please provide a brief overview of your business activity.	The businesses interviewed were selected and considered to be representative of all stakeholders with an interest in the promulgation of distributed generation. The interviewees included in the survey ranged from manufacturers established businesses converting from the more traditional energy sector services and also included newer businesses established specifically to address the SSDG markets. Between them, the manufacturers covered units already being marketed and with installations in the UK, and those being developed for future market launch. The manufacturers were targeting mainly the public sector and those markets where there was potential funding from bodies such as the EST (Community Energy Programme) and utilities (Energy Efficiency Commitment (EEC). The technologies represented included small gas fired CHP, wind turbine and solar photovoltaic panels, as well as control equipment for a range of micro - generation installations. Manufacturers interviewed more generally install commission and maintain their own equipment at present, but do use contractors for installation. Also included amongst interviewees were trade associations for the combined heat and power industries; for energy network operators who are responsible for standards; and consultants to this market sector and suppliers of energy.
Q2. What for your company is a "typical" project associated with Distributed Generation?	From the above representation the "typical" project associated with distributed generation included manufacture and provision of equipment, developing a mass market consumer product for MCHP, and developing hydro based projects typically of 8kW, but with plans to increase up to 20kW units. The domestic and schools market being addressed by wind turbines with typical capacity of 2.5-6kW and 15kW or MCHP installations with a typical electrical power output of 1.1kW. The commercial market sector is seen as an area for increased activity. Some of the interviewees currently have no projects but are developing their products for market. The interviewees generally operated only in the UK but would consider projects abroad.

Q3. Please describe at a high level the processes you use to plan and assess both the technical and financial aspects of a project.	The response to this question was, to an extent, technology dependent. Generally a site assessment and a detailed risk assessment are likely to be carried out. For wind, this includes taking account of wind patterns and topography. In some cases the sales process forms a feasibility study which also involves site liaison and survey. For MCHP heat and electrical load studies can be delivered, to analyse the demand and project viability. Key data includes historic gas and electricity consumption. A typical pay-back period is 10-15 years, but reports are that economics and pay-back periods are not always the driver for a project; customers often have other reasons such as environmental considerations. In some cases carbon dioxide savings are included in the information provided. Some developers rely completely on the installer to identify locations and suitable projects.
Q4. How do you identify locations for a project in terms of both the site and connection to the distribution network?	There is a common theme of being reactive to customer enquiries to identify locations, following which the site and distribution network connections are evaluated. Sometimes the customer contact is through planned developments. Where proactive targeting takes place it is generally driven by targeting particular house types (large) where the scheme may be viable. One company reported that it was able to identify locations within its preferred market through company employees and known volunteers. For wind power, identifying suitable locations using the wind profile data is possible. With potential locations identified, the network connection costs become a key factor in confirming the viability of the location. All installations then made in accordance with the existing Engineering Recommendation G83.
Q5. What information do you require about connection equipment, costs, network information and engineering standards?	Where the information is not all available in house, the information is provided by the completion of an application form. The equipment to be installed is fairly standard and installed in accordance with G83 and causes no major problems. There are believed to be no general information sheets available from the DNOs, and site visit and connection charges vary between DNOs. There is a view amongst developers that they have no choice regarding connection charges and have to pay whatever the DNO

	quotes. There is a perceived need for competition / regulation in this area to help reduce charges. Developers mention the concept of "power zones" introduced by Ofgem seems not to have progressed.
Q6. Is the information on connection equipment, costs, published network information and engineering standards readily available? How is the relevant information accessed?	Some developers reported that this was all available in house, whilst others thought it difficult to access, to the point where they have used unofficial copies. Information on connection equipment is considered to be readily available, and is discussed with the DNO for a G59 installation. There were no issues reported with G83 notifications, but there is general concern amongst developers that the DNO response might change if they receive a significant increase in requests. There is a view that the technical documentation is working as envisaged and nothing within the documents is seen to limit connections. The view of the G83 upper limit is again raised, but there is also a view that the current document allows sufficient flexibility on the upper limit, subject to the DNO's approval. Some DNOs are considered to take the engineering recommendations as a starting point only and apply their own additional standards, especially ROCOF protection.
Q7. How accurate and useful is this information normally?	Both G83 and G59 are considered good and clear documents, but considered not readily available to small generator developers or private individuals. All installations are reported as able to be made in compliance with existing Engineering Recommendation G83/1, and there are mixed responses on whether a document for generator capacities between G59 and G83 is required. Again it is reported that the standards are for guidance as each DNO has its own standards because of the need for flexibility. DNOs are considered not to provide sufficient information in support of an approval or rejection.
Q8. Are the various trade associations helpful in information provision and guidance?	The trade associations are considered by members as useful for lobbying and providing forums and working groups, but not very effective on the interpretation of technical issues. Some are considered to be of no assistance as they run on extremely limited budgets and can't afford the expertise to provide detailed advice. The trade associations rely on members for information and report that it is not always forthcoming.

Q9. Overall how would you describe your relationships with the Network Operators in developing projects and their willingness to exchange information with you?	The response from developers to their experience with DNOs was mixed, ranging from excellent to obstructive. In the main, but with a few reported exceptions the network operators are considered to be helpful and supportive. The key issues where the DNOs are considered to have been less helpful are in their charges for studies, treatment of borderline G83 installations and a lack of consistency in approach, not only between companies but also between different regions of the same company. Particular mention has been made that G59 installations are becoming more difficult. It is believed by developers that published statements of policy, charges etc. would improve relationships. Finding the appropriate person within the DNO is seen as a problem and individual relationships are seen as important.
Q10. How helpful do you find the Network Operators and other parties in discussing design issues and options including the following points:	In the main the DNOs are reasonably responsive, but it does vary between DNOs. There have been incidents whereby there is a suspicion that costs have been set artificially high so as to encourage the developer to not go ahead with the project.
• provision of sample agreements from Network Operators (GDUoS) and the Suppliers (export tariffs);	This is considered a straight-forward process and they use their own standard forms which the DNOs normally accept.
• ease of access to a cost estimate of the connection;	Reported as good in a few cases, but overall considered to be poor. Developers worry about future relationships and a risk to the business development of small scale generation.

• submission of the formal connection application by the developer, if needed, including any experiences regarding the notification arrangements under G83 for single connections, G83 for multiple connections and G59 for over 3.6kW plus the special arrangements for PV under 5kW;	Experience to date has been restricted to small scale field trials requiring the interaction with a single DNO. All contact has been satisfactory and in strict compliance with the notification process as defined in Engineering Recommendation G83/1. Information is generally available and provided openly if requested. One developer reported that suppliers are very keen to buy excess power and good prices are currently available. Companies are very keen to get into the renewable market because they want to sell green electricity. ROCs have been very helpful in this respect, but the paperwork and administration is cumbersome for small companies. Shallow charging is now the accepted policy enshrined in the distribution price review and there will be some possibility to spread this over time in a "GUoS" regime to come into force in 2010? Still a grey area?
• connection offers and their acceptance.	Supplier agreements not known at this stage. Cost estimates from DNOs for visits to site for whatever purpose vary widely and could be several hundred pounds for a very small scheme. Other issues include an accessible point of contact and adherence to time deadlines: It can be difficult to get a cost estimate. DNOs vary in the amount of information that they require (one particular DNO requires much more detailed technical information). Estimates cover three areas: cost of the physical connection; cost of the network analysis; and charges for the witness testing (largest quote for this has been circa £600, but is typically circa £400) although generally the Company or the end users haven't been charged for this as the Company does as much preparation as possible to make the test as simple as possible for the DNO witness.

Q11. Limitations under G59 and G83. Are these documents working as envisaged?	Developers report that the documents are cumbersome and should be rewritten and simplified. Need more standardisation e.g. metering. Approved protection list would help. Generally the notification process is achieving its purpose. However, developers observations are as follows; • They suggested that submission of the G83/1 notification on the day of commissioning is not practical in a volume installation business. • They also observed that the "fit and inform" process defined under Engineering Recommendation G83/1 conflicts with the customer's contractual obligations with their electricity supplier. • It is their experience that a gap exists between issuing the SSDG notification to the DNO and the resulting awareness of the Meter Operator in identifying whether the fiscal metering provision is suitable for the export of electricity. • G83 is seen as a good specification, but it is very tight. It would be preferred not to have to carry out tests under G59. Small developers would be keen to push up the threshold, perhaps even to 100kW (but recognise the need for DNOs to have to carry out some checks). • The 'Part P Building Regulations' new wiring regulations introduced this year are a problem. This may be prohibitive for a small business and means that they can only use registered electricians who may be more expensive, and potentially less familiar with the type of work. • As far as control and connection equipment is concerned the DNO is not obliged to witness every connection above G83 and up to 50kW. Some installers use standard equipment, with which the DNOs are familiar. There is a view that standard equipment needs to be recognised and written into the Engineering Recommendations and standards. • One Trade Association reported that the standards are too general. There is a need to define more closely areas such as loss of volts and frequency. In addition manufacturers interpret the standards differently creating differing performances. • Interpretation of standards by DNOs is not consistent.

Q12. Is there a need for a standard to cover between G83 and G59?	Of those interviewees who had the experience to respond, the reaction to this issue was varied. The prevalent view was that there was no need for an additional standard to cover the area between G59 and G83, but some flexibility with installations that fall just over the G83 limit Others believed that a standard between G59 and G83 would be useful to try to remove the complication of DNOs interpreting the rules differently. A less onerous system for compliance up to 50 kW would help the development of SSDG.
Q13. Are the timescales for technical & cost assessments by Network Operators' reasonable?	Varies between DNOs. The developers try to impose its own timescale. However depending on the DNO and its workload there have been reported incidents where projects have been jeopardised by delays. No charges imposed so far but the future regime must be established now to remove uncertainty for the developer of small generators. For the larger schemes above G83 the timescales should be reduced as delay and associated costs could kill the project. The preparation of the connection agreements takes the longest and is often subject to delay, even taking up to two months. This can cause problems with the client since it delays commissioning; the unit cannot be used until the connection agreement has been issued and the unit commissioned.
Q14. Have you been charged for feasibility work?	There are few reported instances of charging to date. Amongst those interviewed there was no experience of charging, but there was an awareness of charge being quoted, if not ultimately levied. There is evidence of a general view that the regime for charging should be established now to remove uncertainty for the developer. Of those quoted instances where costs have been incurred there was a general view that this was based on the need for G59 analysis and was expected to be in the region of £400-£500, but with individual instances cited of £2,000 - £2,500 and with a wide variation between DNOs. The belief amongst developers is that circa £250 would be more reasonable. To date customers are believed to have been charged direct, but developers have not experienced this.

Q15. To what extent do you need to engage external expertise to support applications to a Network Operator?	Amongst those interviewed there were no reports of the requirements to engage any external expertise to support applications to a network operator.
Q16. What affect does the overall cost of securing a connection make on the total investment?	As most projects so far have tended to be development projects sponsored by the developer and or supplier the connection charges have been absorbed. When the market opens up the developers see connection costs as being significant in relation to the savings. High charges could cause a project not to go ahead particularly where there is a need for the network to be upgraded. One developer believes that competition for the DNOs in the provision of services could reduce cost by half. The connection should be like that of a refrigerator with type approval secured for the generator.
Q17. Is consideration given to using third parties for the contestable activities rather than the network operator?	There is not a widespread use of third parties for contestable work. Where third parties are used it is in the traditional sub contract areas such as cable laying. There is a view amongst developers that up to 50% cost reduction could be achieved on cable, meters etc. DNOs insist on providing the cables, meters etc. Potential economies of bulk purchasing by DNOs are believed not to be passed through.
Q18. What issues have arisen with the construction of the connection as defined in the connection offer?	This area was not a major cause of concern, with the exception from one provider of equipment, that DNOs insist on full commissioning of tried and tested equipment.

Q19. What problems, if any, have there been with adherence to agreed timescales?	Several interviewees were concerned about project progression being in the hands of other parties. Once approval is given work usually progresses to timescale. As a result of low volume field trial installations no issues have been experienced to date. However, it would be our suggestion that submission of the G83/1 notification on the day of commissioning is not practical in a volume installation business. Others considered that timescale adherence had been excellent, whilst others thought that the timescales had been rather long. Some companies confirmed that the DNOs have always stuck to the dates they promised so there haven't been any problems due to adherence to promises. Several companies said that this has never been an issue.
Q20. Were there any issues with the contractual arrangements for the contestable aspects of the construction phases where an independent connection provider was also involved?	The biggest reported issue is the passage of information between the various parties involved particularly if the installation is above the G83 limit. The introduction of a data exchange proforma seems to deal with the major issues. However, there were reports of forms that have been over complicated and requiring information which was either not readily available or was simply not relevant. There were mixed views on the requirement for an additional Engineering Recommendation or an extension of the G83 limits to cater for the range between G59 andG83. Unexpected costs have caused problems and late information on costs jeopardised the viability of projects.

Q21. Do network operators test protection equipment, where necessary? If so what are the general level of charges and the timescale for this process?	Some companies confirmed that charges had been allowed for and were built into design costs. Others indicated that sometimes testing was required, but that they were not aware of any charges. The interface is now pretty standard. Other companies used a Proforma based approach to testing. One participant indicated that they had completed two G59s so far. They set up their own testing equipment although the test results were not complete. Even so, the DNO tester who attended accepted that the equipment was working properly and accepted the results. On other occasions, they have had to rent the DNO test equipment (c£400) to do the tests and submit the results to the DNO, who did not send anyone to witness or carry out the tests. The specifications are tight so it would be very easy to be just outside the requirements and then have to incur the retest fee (c£250). Another participant indicated that testing was undertaken for all G59 installations. The charges are generally included in the overall connection charge. However, the main costs are incurred by the equipment manufacturer in providing complicated on site testing equipment and the time taken to test. In addition, all the equipment is fully tested before leaving the factory. Very variable between zero and £950 per site. G59 relays cost around £500 and an external expert may have to deal with the DNO and the settings at a cost. Some but not all DNOs insist on witness testing of protection equipment. Another company commented that on occasions those installations that have been witness tested appeared to lack understanding of the equipment and test methods.
Q22. In general what is the relationship like with network operators when testing and commissioning connections?	Some interviewees had never experienced a problem, whilst others reported that relationships were generally good. However, there were a limited number of comments that “they would not engage” and “can be difficult with their demands”. The response was varied as with most relationship issues.

Q23. How easy is it making contractual arrangements?	Some developers and DNO have introduced standard documentation to assist with communications and contractual arrangements, which appear to be working well. Other still relying on individual arrangements. The relationship between developer, supplier, DNO and meter operator can be difficult to understand. There is a view from the developers that the arrangements need to be made easier and use standardised documentation. Metering is the most difficult. There was one instance where the metering staff were unaware of the type of metering that was required or of how to acquire it. Distribution Companies vary but supply companies are quoted as being particularly difficult.
Q24. Have any problems arisen with any agreed operating regime of the generator, e.g. constraints that may be imposed on its export e.g. voltage rise at the local substation?	Some developers reported that they were not aware of any problems and that arrangements were working fine. However uncertainty as to future arrangements was a concern. Some DNOs insist on zero export as a condition of the connection agreement, but they do not insist on export metering. Therefore, if any export does take place it can not be measured!
Q25. What issues have been experienced with metering?	The high cost of metering and settlements charges in relation to overall project costs and savings remains a major hurdle to the connection of SSDG especially if export is being considered. There are no clear alternatives to the current import/export metering arrangements of 2 meters and associated MPANs. Developers reported that gaps exists between issuing the SSDG notification to the DNO and the resulting awareness of the Meter Operator in identifying whether the fiscal metering provision is suitable for the export of electricity.

Q26. Have issues arisen such as nuisance trips of the generator due to low voltage excursions in the network, loss of mains supply, or frequency variations?	Nuisance tripping has been identified as a significant issue and requires attention in setting up protection schemes, one developer reported over voltage to be an issue. One respondent reported that there were multiple nuisance trips, but machines were self starting and it had not become a major problem.
Q27. Overall relationships with the Network Operators throughout the project i.e. help or hindrance?	A very mixed response from developers to this question ranging from "most try to be helpful" to "generally poor". On a personal level the staff are generally considered helpful and interested, but the corporate attitudes and procedures are reported as more of a hindrance. Some DNOs were named as being particularly difficult to deal with.
Q28. In summary what do you consider to be the biggest barriers to connecting small generators to the distribution network?	The main barriers quoted are • Lack of consistency in the process across the UK • Metering including the cost / benefit of export. • Multiple units on the network • Connection into domestic house wiring complexity • Supplier contractual terms. • Communication of SSDG installation between DNO, Supplier and Meter Operator. • Fit and inform timeline as defined by Engineering Recommendation G83. • The requirement for on site testing of all G59 installations even though equipment is fairly standard. • G59 compliance is the main barrier – no reported type approval possible. • Technical issues in network design of installations above G83.

Q29. What practical changes do you think would make it easier for more small generators to be connected to the network?	Again the issue of the band of connections falling between the scope of G59 and G83 was raised. Some developers described this as an urgent need, others did not see a problem. The need for standardisation between DNOs was again flagged [the concept of a single owner electricity supply industry still seems to prevail] Developers consider that uniform and consistent contractual terms for connection of micro generation are necessary with an obligation upon the DNO to notify the supplier once they have received the SSDG installation certificate notification. The introduction of a regulatory method for dealing with payments for infrastructure up-grades by DNOs to address the betterment element of networks charge to developers is considered necessary. Further, the introduction of approved installers who would manage the whole process including the complex contractual arrangements was identified as a potential benefit.

Appendix C List of companies interviewed

Groups	Companies	Date Interviewed
Trade Associations	Energy Networks Association CHPA Association Micropower Council	6 October, 2005 6 October, 2005. 23 November 2006
Distribution Network Operators	United Utilities Scottish and Southern Energy	2 November, 2005. 4 November, 2005
Developers	Powergen British Gas/Microgen EC Power Hydro-generation Ltd. Scottish and Southern Energy Solar Century Windsave Wind and Sun SiGen	8 November, 2005. 7 November, 2005. 17 November, 2005. 20 October, 2005. 10 November, 2005. 11 November, 2005. 23 November 2005 3 Jan 2006 3 Jan 2006
Meter Operator	Siemens metering Services	28 November,2005
Manufacturers	Baxi GP Electronics Provenenergy Solutions	24 October, 2005. 11 November, 2005. 4 November, 2005.
Consultants and Research Organisations	EA Technology	2 November, 2005.
End Customer	Suffolk County Council Woking Borough Council	11 November, 2005. 6 January 2006