**ISSUE 1**

**DG lead – Tim Russell**

Voltage control / voltage rise issues including use of generator variable reactive output and other means listed above to control voltages. Exploration of any benchmark voltage levels different to statutory ones that DNOs employ. Insistence on generators operating at fixed power factors: This is an issue that is treated differently by different DNOs (and sometimes differently by different people within the same DNO). It has been suggested by a helpful DNO that it would be useful to discuss this (with non DNO participation) in the context of the revision to the Distributed Generation Connection Guide.

<table>
<thead>
<tr>
<th>ENWL</th>
<th>ENWL does not necessarily require DG to operate at a fixed power factor and have in fact many DG sites that operate within a prescribed range.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPG</td>
<td>We would normally ask generators to operate at a power factor to match the local network – normally for import this would be 0.95 lagging to unity, for export 0.9 leading to 0.95 lagging. In some circumstances and by agreement with the customer, we may ask for these values to be adjusted. As Northern Powergrid contributed to the writing of the DG connections guide produced by ENA, we would be happy to participate in any suggested changes to this guidance.</td>
</tr>
<tr>
<td>SP</td>
<td>The need for a generator to operate at a fixed power factor, or within a limited power factor range, is due to the characteristic of the network the generator will be connected into and the capacity of their connection. We try to work with the customer to ensure as far as possible that their requirements are met within the constraints applicable to our network.</td>
</tr>
<tr>
<td>SSE</td>
<td>SSE adopts a policy that all Power Stations more than 200kW must operate in Voltage Control mode of operation. There are a number of benefits to both the DG applicant and the DNO in adopting this requirement. This is of particular benefit where a weak network may permit a generator to connect with no or little requirement for reinforcement and certainly less than that required if a Power Station is operated at a fixed Power Factor. Certain types and ratings of generation equipment may only be operable at a fixed power factor and not in voltage control mode. Typically, inverter connected micro-generation equipment shall operate at or near Unity.</td>
</tr>
<tr>
<td>UKPN</td>
<td>There are a number of utility wide forums that representatives of UK Power Networks participate in - this issue will be raised at the next meeting of the industry technical code group (ITCG) planned for mid December 2012.</td>
</tr>
<tr>
<td>WPD</td>
<td>At present, WPD request that the generator operates at a specified power factor, generally unity, with a small bandwidth of operation either side. We do offer leading power factor connections where technical studies show this is required. As Low Carbon Network Fund trials and smart grids develop, we will be considering active voltage control/power factor arrangements. We would be happy to participate in any ENA industry review.</td>
</tr>
<tr>
<td>Gen</td>
<td>The key point as SSE appears to have expressed most eloquently is that allowing voltage control mode operation often less reinforcement is required. Operation in this way is not “for the convenience of the generator” but to enable the generator to be accommodated at minimum cost whilst maintaining satisfactory conditions for all other parties connected to the network. Insisting on fixed power factor operation may be necessary in certain circumstances but usually just increases the work needed to connect the generator.</td>
</tr>
</tbody>
</table>

The specific issue brought out is that WPD appears to be an outlier with operation at variable power factor being not usually considered. The desired end point is to ensure that all DNOs are considering the use of all available tools to control voltage as appropriate for each connection i.e. not just the variable reactive capability of many generators but also voltage regulators, shunt reactors etc. etc.
**ISSUE 2 - DG lead – Tim Russell**

G59/2 is absolutely clear that it is not mandatory for generators to have a separate circuit breaker from the DNO breaker at the ownership interface. Why do some Engineers in some DNOs continue to regard it as mandatory?

<table>
<thead>
<tr>
<th>Organization</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENWL</td>
<td>Electricity North West does not insist on the generation customer providing a circuit breaker at the interface. However we would routinely design the interface for such a circuit breaker as it is the easiest way for the generator to discharge their own ESQCR duties. We will always connect a generator’s installation without the generator protecting his network with his own circuit breaker, but in those circumstances we would expect the generator to demonstrate that his installation is safe and ESQCR compliant when protected from the Electricity North West metering circuit breaker.</td>
</tr>
<tr>
<td>NPG</td>
<td>It is not mandatory and should only very rarely be needed. However, a customer’s protection may need to trip a DNO metering breaker in order to protect the customer’s assets.</td>
</tr>
<tr>
<td>SP</td>
<td>The need for the customer circuit breaker does not come from G59/2 but from the Electricity, Safety, Quality and Continuity Regulations 2002. These specify in Part II, Item 6 “A generator or distributor shall be responsible for the application of such protective devices to his network as will, so far as is reasonably practicable, prevent any current, including any leakage to earth, from flowing in any part of his network for such a period that that part of his network can no longer carry that current without danger.” In other words, each party has a responsibility to protect their own network. Therefore the generator is required to install protective devices to cover the generator’s network.</td>
</tr>
<tr>
<td>SSE</td>
<td>We do not have a policy of requiring serial protection where a short HV or EHV customer sub-circuit is proposed (typically 200m). If the customer installation extends to a distance greater than this then a separate customer CB protecting their installation is appropriate. In terms of operations and isolation of the customer’s network, we do require that the developer provides a method of isolation (as minimum) between our CB and customer’s network. This is typically achieved by installation of an off-load isolator.</td>
</tr>
<tr>
<td>UKPN</td>
<td>It is important to comply with G59/2 and if as part of the discussion two circuit breakers are installed in close proximity then we agree that the protection zones are adequately identified.</td>
</tr>
<tr>
<td>WPD</td>
<td>We allow a single circuit breaker to be used where the extent and complexity of the Customer’s network which protected and controlled by WPD’s circuit breaker is limited. Where the Customer’s network is complex and/or extensive then we insist on them having their own circuit breaker and protection. This approach is consistent with the requirements for “a means of cutting off the supply and for isolation” defined in the Electricity at Work Regulations and the associated HSE guidance on these regulations. The question of overlap protection will depend on site specific issues.</td>
</tr>
<tr>
<td>Gen</td>
<td>If SP are interpreting the ESQCR correctly and to comply each party has to have a protection system for his network that acts to protect it by tripping its own circuit breakers then all DNOs, NGC and all transmission connected generators are in breach of those regulations. Take as a simple example a SGT owned by NGC feeding a 132kv busbar owned by a DNO. The DNO busbar protection will protect the busbar by tripping all circuit breakers connected to the faulty section including those on the 132kv side of the SGT (s) which are not owned by the DNO. Does SP maintain that two 132kv circuit breakers on the 132kv side of a SGT are required, one owned by NGC and one owned by the DNO? [The voltage references / owners are chosen for England and Wales transmission / distribution boundaries]. Obviously we agree that generator’s must install protective devices to cover their network but as stated by NPG this can trip a DNO circuit breaker as well as circuit breakers owned by the generator. With regard to a distance limitation as suggested by SSE we are not sure why it is appropriate to install another circuit breaker for distances of above 200m. What is the objection to the use of intertripping over longer distances? DNOs use it themselves for circuits many km long, particularly for transformer feeders. We of course agree with SSE that an off load isolator between the metering circuit breaker and the generator network is needed.</td>
</tr>
</tbody>
</table>
ISSUE 3

DG lead – Lee Mason TBC

SSE has stated to us that if they fail to comply with the recommendations of G59 they would be in breach of their licence conditions. Is this true?

Ofgem: If a DNO fails to comply with the recommendations of G59, they are in breach of their licence conditions. G59 is referenced in the Distribution Code, which Electricity Distributors are required to comply with by their licenses. Further details to be found in Guidance note 2/4.
I’m concerned about risk to viability of small projects from new (G83-2) requirements for systems to switch off at only 253V (even momentarily). Reason: DNO won’t reduce voltage unless 253V exceeded at their connection point (and for more than momentarily).

<table>
<thead>
<tr>
<th>ENWL</th>
<th>All parties are bound by the ESQCR voltage limits and hence these drive the voltage criteria applied by DNOs to ensure statutory compliance. Note the limit in G83.2 is actually 262V and not clear where the 253V figure comes from.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPG</td>
<td>This is more a statement not a question. However we are considering our voltage policy, including our response to NGET voltage reduction schemes, protection, losses, voltages at high demand and voltages at high generation, as our customer base evolves.</td>
</tr>
<tr>
<td>SP</td>
<td>The DNO has the right (and obligation) to operate their network within the statutory voltage bandwidth. However, it is extremely unlikely that a connection will be operated at a steady state voltage of 253V because this value is at the upper end of the voltage bandwidth. The circumstance may be caused by a connection close to output terminals of a transformer, where the associated network has a number of other dispersed customer connections.</td>
</tr>
<tr>
<td>SSE</td>
<td>There is an option which only applies at or above the second stage over-voltage setting for a manufacturer to switch off to preserve the electronics and if the overvoltage lasts less than 0.5 seconds they can restart straight away. If the over-voltage lasts longer than 0.5 seconds they must trip and then when the voltage returns to within stage one settings they start a reconnection timer, which under G83/2 is set for 20 seconds. (G59/2 calls for 60 seconds and G83/1-1 called for 180 seconds). If the Installer stated that they purchase equipment designed for installation in Europe and not the UK, but install it in the UK and find that it keeps tripping on the European over voltage setting of 253V, this would be understandable. We aware that this happened frequently in the pre-December 2011 rush, but we have not been made aware of this issue since. This issue was discussed extensively in the G83 revision group and we are satisfied that we have a robust over voltage setting system which will not cause problems if implemented properly by the manufacturers.</td>
</tr>
<tr>
<td>UKPN</td>
<td>The current statutory voltage limits are at LV 230 plus 10 % and minus 6% which as a result gives a top voltage of 253 volts, currently looking at the impact of DG on the network and as a result voltage settings are being reviewed. Some trial solutions are being considered such as GEN AVC (Automatic voltage control on distribution transformers) We are learning too!</td>
</tr>
<tr>
<td>WPD</td>
<td>G83/2 will require a stage 1 over-voltage protection setting of 262.2V not 253V. This about 9V of voltage rise within the customer’s installation before the protection will operate (depending on the protection tolerances).</td>
</tr>
</tbody>
</table>
1st Technical Meeting

ISSUES 4

Upper Voltage Limit in G83-2

Pre-amble

The issue below has been raised as there is a concern about risk to viability of small projects from new (G83-2) requirements for systems to switch off at only 253v (even momentarily), as the DNO won’t reduce voltage unless 253v exceeded at their connection point (and for more than momentarily).

Background

ESQCR Requirements

All parties are bound to comply with the ESQCR (Electricity Safety, Quality and Continuity Regulations) for voltage limits, and for a nominal 230V system the maximum permitted supply voltage is 253V. This is historically due to fact that in 1994, to remove a perceived barrier to trade between European countries, the European Commission (EC) decided to ‘harmonise’ the standard UK mains voltage of 240 V and the European standard of 220 V at 230 V. (In 2010 this was modified to 230V +/-10%. This means the supply voltage (single phase must be between 207 and 253 V)

G83-2 Overvoltage Requirements

If the voltage at the inverter exceeds 262.2V for 1 second or greater (230V +14%) or a transient voltage of 273.7V for 0.5 second or greater (230V + 19%), then the relay(s) controlling the inverter must disconnect the generating system.

Reason for variance between ESQCR 253V and G83-1 trip voltage of 262.2V

As DG raises voltage locally, an allowance for local voltage rise on the customers side of 9.2V between inverter and DNO connection point has been made, in context that the majority of the UK network is still supplied to customers at 240V nominal and not 230V (1ph)

The issues

- There seems to be some confusion between ESQCR voltage requirements and G83-2 settings, and why they are not the same.
- Some PV inverters with European grid code settings rather than G83 have entered the UK market via grey importing with lower voltage trip settings than G83. This has caused some systems to trip.
- The max voltage drop (rise) between inverter and point of DNO connection should not be more than 3%. The PV installation cable sizing impedance should be designed to meet this %. If the supply is 253V and 3% is adhered to, there should not be an issue.
- DNO’s are not always informed about PV system commissioning (as they should be), so the strategic network voltage profile modelling can become inaccurate.
- Electricity export will also raise the DNO voltage, and significant PV installations in one area can raise supply voltage out of ESQCR limits, especially in summer when demand may be low and lack of demand means distribution grid voltage is higher. If the exports are not balanced over 3 phases, voltage imbalances at the overarching 3 phase supply will also occur.
The 33/11 kV transformers on DNO system generally have automatic voltage control (tap changers), but the 11/.433 (.400) that G83 type installations are connected to generally do not.

Lowering the tap settings on transformers can help alleviate the problem but is often dependant on ensuring the “end of line” customers voltage does not drop below the lower limits of ESQCR requirements.

DNO’s will only lower the tap settings if it can be proven 253V is consistently exceeded at DNO supply side, and this is often an arduous task, involving periods of voltage data logging etc.

Irrespective of DG issues, given nominal supply voltage is 230V, the UK voltage is generally between 240V and 250V and sometimes above 253V statutory limit.

**Final objective**

The final objectives are

- To get broader industry understanding of ESQCR requirements and G83 interrelationship
- To overcome and allay any fears about small scale embedded generation suitability
- For multiple G83 projects, where there is most likely a risk of viability risk or limitation, the objective is to ensure that when there is a potential issue the DNO can cooperate with pragmatic voltage reduction and reasonable network reconfiguration measures that avoid the costly reinforcement measures.
- More cooperation and very strict technical and documentation compliance from Installer fraternity to help DNO’s, and cooperation from DNO’s with supply voltage reduction measures.
**ISSUES 5**

**Differences in anti islanding requirements between DNOs**

**DG lead – Bob Weaver**

**Pre-amble**
The issue below has been raised essentially as requests for information from each of the DNO’s in order to ascertain the requirements currently required and the protection employed in order to ensure that the DNO considers that it is sufficiently secure from any DG project being able to operate in an ‘island mode’.

Ultimately it is considered that it will be a requirement on the DNO’s to agree and provide a set of standard criteria, network requirements/configurations and protocols that will satisfy the requirements of all DNO’s.

This will apply to:
- HV connections
- EHV connections

and for all DG type projects.

**Background**
Whilst the existing technical documents cover ‘anti islanding’ as a subject matter - there would still appear to be a wide variance (even within single DNO’s) relating to their policies and applications for dealing with anti islanding.

To some extent it has become apparent that the DNO’s do not know what they want, are unable to provide suitable information in a consistent and timely manner and as such there are no industry based generic standards.

Where customers are working across DNO boundaries there is seen to be little consistency (and little will to provide any consistency) in network design, protection requirement and application type, manufacturer or supplier.

This issue has been raised in order to attempt to quantify the extent of any perceived problem and still satisfy the individual requirements of each of the DNO’s - but in a more transparent and consistent manner.

**Final objective**
The final objective is to arrive at a situation whereby any customer or developer is in a position to immediately define the requirements for anti islanding protection and also the criteria and policies likely to be used and adopted – and on an industry wide basis.

We are seeking to establish where there is a requirement for ‘additional protective equipment’, or when there may be considered to be a requirement for a particular network configuration.

Noting the requirements of various DNO’s it should be possible to arrive at a situation whereby all of the DNO’s are capable of agreeing and providing a common structure and template.

It is not the intention for the DG community to dictate to the DNO’s any of the above parameters.

However is not unreasonable to expect a reasonable level of technical support, drawings, as appropriate, and with a consistent approach across all DNO’s.
ISSUE 6

Substation Housing Requirements

DG lead – Bob Weaver

Pre-amble
The issue below has been raised essentially as requests for information from each of the DNO’s in order to ascertain the types/makes and full specifications of ground mounted substations for DG type projects. Ultimately it is considered that it will be a requirement on the DNO’s to agree and provide a set of standardised drawings, types and manufacturers and that will satisfy the requirements of all DNO’s. This will apply to:

- HV connections
- EHV connections
and for all DG type projects.

Where there is an option for ICP’s, IDNO’s and developers to provide suitable enclosures there will be an expectation to type test and certify such enclosures such that they are considered suitable for installation in all DNO areas. This is in order to attempt to satisfy the individual requirements of each of the DNO’s but in a more transparent and consistent manner.

Background
What has become noticeable during the past few years is that it is becoming particularly difficult to gain information from the DNO’s on their preferred and standard GM substation enclosures for DG applications. To some extent it has become acutely apparent that the DNO’s do not know what they want, are unable to provide suitable information in a consistent and timely manner and as such there are no industry based generic standards. Where customers are working across DNO boundaries there is seen to be little consistency (and little will to provide any consistency) in type, manufacturer or supplier.

Final objective
The final objective is to arrive at a situation whereby any customer or developer is in a position to define the type, manufacturer and specification of a suitable substation enclosure that will suit all DNO’s and without undue frustration. Noting the requirements of various Local Authority requirements it should be possible to arrive at a situation whereby all of the DNO’s are capable of agreeing substations types and specifications that are suitable (at the customers discretion) for environments, situations and locations acceptable for the following substation types:

- Brick built
- GRP
- High Security

It is not the intention for the DG community to dictate to the DNO’s any of the above parameters. However is not unreasonable to expect a reasonable level of technical support, a consistent approach and with some form of limited choice across all DNO’s.
ISSUE 7

SCADA, Telemetry and Secure Power Back-Up Requirements

DG lead – Bob Weaver

Pre-amble
The issue below has been raised essentially as requests for information from each of the DNO’s in order to ascertain the requirements for SCADA, telemetry and secure power back-up requirements for DG type projects.
Ultimately it is considered that it it will be a requirement on the DNO’s to agree and provide a set of applications, standardised requirements and drawings that will satisfy the requirements of all DNO’s. This will apply, where applicable, to :-
- HV connections
- EHV connections
and for all DG type projects.

This is in order to attempt to satisfy the individual requirements of each of the DNO’s - but in a more transparent and consistent manner.

Background
What has become particularly noticeable during the past few years is that it is becoming particularly difficult to gain information from the DNO’s on their preferred applications and requirement relating to the above issues and for DG applications.
To some extent it has become acutely apparent that the DNO’s do not know what they want, are unable to provide suitable information in a consistent and timely manner and as such there are no industry based generic standards.
Where customers are working across DNO boundaries there is seen to be little consistency (and little will to provide any consistency) in type, manufacturer or supplier.

Final objective
The final objective is to arrive at a situation whereby any customer or developer is in a position to immediately define the requirements for this ‘additional equipment’, when it will be required and applicable to which particular set of circumstances or technologies.
Noting the requirements of various DNO’s it should be possible to arrive at a situation whereby all of the DNO’s are capable of agreeing and providing a common structure and template.

It is not the intention for the DG community to dictate to the DNO’s any of the above parameters. However is not unreasonable to expect a reasonable level of technical support, drawings, as appropriate, and with a consistent approach across all DNO’s.
ISSUE 8

SCADA, Telemetry and Secure Power Back-Up Requirements

DG lead – Graham Parnell

Entitlement to non-firm connections: This is something that could usefully be clarified in the DG connection guide. Currently most DNOs are quite happy for ‘managed’ connections but some are less willing to consider a non firm connection if requested. The idea of a generator reducing its output or being tripped following a fault or for a particular planned outage is one of the most basic forms of active network management and fundamental to the notion of smart networks.

| ENWL | Electricity North West fully endorse this view and believe such techniques have very significant potential to unlock network capacity from existing assets. This is the core of our Tier 2 LCNF project “Capacity to Customers”. |
| NPG | Northern Powergrid agrees that an important aspect of ‘optioneerering’ on new connection arrangements is the ability, in liaison with the applicant, to produce connection offers and agreements specifying technical restrictions (non-firm arrangements) in order to enable the connection of new loads to our network at locations that would otherwise be unavailable due to unacceptable impacts on existing customers. In many cases this allows customers to obtain connections at a much reduced cost in line with their financial constraints. |
| SP | The concept of a managed connection, and the technology and commercial arrangements to support such an approach are still developing. We are actively engaged in rolling out such approaches in a measured way so that we fully understand the impact. We do not recognise that there is an ‘entitlement’ to a non-firm connection. Where a generator is connected to a circuit which faults, their connection will always be de-energised. This is not active network management in the sense being proposed. |
| SSE | In SSEPD we are actively working on the conversion of our Orkney ANM to business as usual. This will be deployed in zones, with a programme of "ANM enabled zones" being rolled out. In terms of expectations in many locations, ANM on its own will not provide enough availability to make generation schemes "bankable", however, in many cases it will work well. We have started the studies to establish viable ANM enabled zones in our SHEPD network. |
| UKPN | The ENA held a meeting at their offices on 8 November on the DG Connection Guides and it is likely that they will be re-written. The issues of non-firm connections may be included as part of the re-write. UK Power Networks will support this activity. Our future Plug and play initiative is looking at the option of non-firm connections. |
| WPD | Within WPD we do allow, and often suggest “managed” connections. |
| Gen | With respect to the SP comment clearly there is no “entitlement to a non firm connection” if providing one would cause unacceptable consequences for others. Equally we do not think that DNOs have an entitlement to refuse a non form connection unless there is a good reason for the specific connection under consideration. |