**There are two main objectives of the modification:**

1. **Align the NETS SQSS with P2/7/8?? in relation to the use of gross demand**
2. **Ensure that demand side management options and security contribution from embedded generation is taken into account where necessary**
3. **Ensure that there is a consistent approach across DNO and ESO re treatment of import from Electricity Storage (typically being the single most significant demand in a demand group)**

## Objective 1 Align the NETS SQSS with P2 in relation to the use of gross demand

### NETS SQSS

The NETS SQSS V2.5 of the NETS SQSS define the Group Demand as a value submitted by Network Operators and Non-Embedded Customers in accordance with the Grid Code. It does not explicitly state whether this is the Gross Demand or the Net Demand. It then, in Clause 3.5, requires that Transmission Licensees use, for the purpose of assessment of connection capacity requirements, the demand level that would be supplied directly from the National Electricity Transmission System and by Large Power Stations embedded within the Network Operator’s and Non-embedded Customers’ System. It also specifies, in Clause 3.6, that diversity in power flows associated with demand and generation may be taken into account where appropriate when calculating Group Demand.

With Network Operators and Non-embedded Customers being the only party capable of identifying what the gross demand consumed within their system is, it will be necessary for them to provide this data as a part of their annual data submissions as required by the Planning Code. Transmission Licensees will be using the data directly as provided in their assessment without the need to process this data. This would mean that Clause 3.5 is redundant as Transmission Licensees would no longer need to do any calculation.

Transmission Licensees may, however, need to aggregate data related to multiple GSPs when looking at larger Demand Groups. Therefore, it would be necessary to maintain the requirements to take this diversity into account. However, diversity would be applied directly to the gross demand itself rather than to the power flows associated with net demand and embedded generation output as per the current clause 3.6. In order to undertake this aggregation correctly 365x24 data sets of half hourly data would be required. Provision of such data would significantly increase the volume of Grid Code week 24 submissions and the Workgroup proposed a workaround which is described later in this section.

The Workgroup proposes that

* Clause 3.5 is deleted as the Transmission Licensees will no longer need to apply it.
* Clause 3.6 is deleted for simplicity with the definition of the Group Demand updated to convey the message about diversity.
* The definition of Group Demand is updated to become

Group Demand In accordance with the Grid Code, for a single *GSP* or *OSP*: The forecast maximum demand for the *GSP* or *OSP* provided in accordance with the requirements of the Grid Code by the *network operators* or *non-embedded customers* taking demand from the *national electricity transmission system*. For multiple *GSPs* or *OSPs*: The sum of the forecast maximum demands for the *GSPs* or *OSP*s provided by the *network operators* or *non-embedded customers* taking demand from the *national electricity transmission system* after accounting for demand diversity

A diagram of a group of power stations

Description automatically generated



The workgroup noted that the Group Demand definition references both Grid Supply Points and Offshore Supply Points. However, this should not cause any unintended consequences as the Group Demand at an Offshore Supply Point is estimated as the demand at an Offshore Power Station with the generation output being set to zero. i.e. The Group Demand at an Offshore Supply is already equal to the maximum gross demand at the Offshore Power Station.

### The Grid Code

The data relevant for NETS SQSS Section 3 studies are covered under PC.A.4.3 of the Planning Code. This clause specifies the points in time that the Network Operator or the Non-Embedded Customer is required to provide data for in their submissions (PC.A.4.3.1) and the details of the data that is required to be submitted (PC.A.4.3.2).

To ensure that the Network Operator or the Non-Embedded Customer submits the data at the time of the maximum gross demand, PC.A.4.3.1 would need to include this point in time. This could either supersede or be in addition to PC.A.4.3.1 (a) which currently require submission of data relevant to the point of the maximum net transmission demand.

The details of what constitutes demand and the basis of calculating this demand level needs to be included in a revised PC.A.4.3.2.

The Workgroup proposes that a Grid Code workgroup considers

* Either adding a new Clause PC.A.4.3.1 (f) or replacing the existing Clause PC.A.4.3.1 (a) so that it refers to the time at which the maximum demand would be supplied from the Network Operator’s System or utilised within a Non-Embedded Customer’s System.
* Modifying Clause PC.A.4.3.2 to ensure consistency with the demand definition in P2/8 as shown below:

The Workgroup noted that PC.A.4.2 delas with demand profiles across the whole Network Operator’s system. Although this demand profile is not relevant to this modification, there may be a merit in aligning PC.A.4.2 with PC.A.4.3 such that profiles of gross demand are also provided.

The Workgroup proposes that a Grid Code workgroup also considers

* Aligning PC.A.4.2.1 with PC.A.4.3.1 (text not included at the moment)
* Aligning PC.A.4.2.4 with PC.A.4.3.2 (text not included at the moment)

PC.A.4.3.1 Forecast **Demand** (**Active Power**) and **Power Factor** (values of the **Power Factor** at maximum and minimum continuous excitation may be given instead where more than 95% of the total **Demand** at a **Connection Point** is taken by synchronous motors) to be met at each **Connection Point** within each **Access Group** is required for:

1. the time of the maximum **Demand** (**Active Power**) at the **Connection Point** (as determined by the **User**) that in the **User's** opinion could reasonably be supplied from or utilised within the **User System**

PC.A.4.3.2 All forecast **Demand** specified in PC.A.4.3.1 shall:

1. be that supplied from or utilised within the **User System** with appropriate allowance for diversity. This is the Demand that would be imposed on the **National Electricity Transmission System** in the case of:
2. **Embedded Power Stations, Customer Generating Plant,** and imports across **Embedded External Interconnections**, including **Embedded** installations of direct current converters which do not form a **DC Converter Station**, **HVDC System** and **Embedded DC Converter Stations** and **Embedded HVDC Systems** being not available;
3. any means of suppressing **Demand** such as **Demand Response** Services, **Suppliers’** time of use tariffs, and **Network Operator’s** price signals being not in use,;
4. increase in **Demand** following re-energisation of the **User System** compared to the **Demand** level expected if no de-energisation occurred; and
5. any other factors that would in the **User’**s reasonable opinion result in an increase to the **Demand** imposed on the **National Electricity Transmission System.**

~~remaining after any deductions reasonably considerexd appropriate by the~~ **~~User~~** ~~to take account of the output of all~~ **~~Embedded Small Power Stations~~** ~~and~~ **~~Embedded Medium Power Stations~~** ~~and~~ **~~Customer Generating Plant~~** ~~and imports across~~ **~~Embedded External Interconnections~~**~~, including~~ **~~Embedded~~** ~~installations of direct current converters which do not form a~~ **~~DC Converter Station~~**~~,~~ **~~HVDC System~~** ~~and~~ **~~Embedded DC Converter Stations~~** ~~and~~ **~~Embedded HVDC Systems~~** ~~and~~

any such ~~deductions~~ allowances should be separately stated;

1. include any **User's System** series reactive losses but exclude any reactive compensation equipment specified in PC.A.2.4 and exclude any network susceptance specified in PC.A.2.3;
2. be based upon **Annual ACS Conditions** for times that occur during calendar week 44 through to calendar week 12 (inclusive) and based on **Average Conditions** for calendar weeks 13 to calendar week 43 (inclusive), both corrections being made on a best endeavours basis;
3. (d) reflect the **User’s** opinion of what could reasonably be supplied from or utilised within the **User System** ~~imposed on the~~ **~~National Electricity Transmission System~~**~~.~~

### Issues that need addressing

Aggregation of individual GSPs into larger demand groups

The current practice for Connection Points supplying multiple Network Operators and Non-Embedded Customers is that at week 6 the date and time of the maximum net demand at the site, as determined by the Electricity System Operator, is notified to the different parties connected at this site. These parties would then submit the demand data corresponding to the times specified by the Electricity System Operator.

However, as it is proposed to change the group demand definition from net demand to gross demand, the ESO wouldn’t have the information to estimate the time of the maximum gross demand for the combined site. Hence there will be a need to require Network Operators and Non-Embedded Customers to provide detailed gross demand profiles to facilitate this aggregation.

In the first instance, Transmission Licensees could ignore diversity and assess compliance against a Group Demand for the aggregate Demand Group that is equal to the sum of the Group Demands for individual Demand Groups. This would constitute a worst-case scenario.

If non-compliance is identified and if there is a potential need for reinforcement, Transmission Licensees would request load profiles from the Network Operator and or Non- Embedded Customer for the individual Demand Groups to perform the aggregation.

To facilitate this, the Workgroup proposes the following additions to require the provision for gross demand profiles at one or more Grid Supply Points for one or more days.

The workgroup noted that that there could be situations where the submission of the demand profile for 365 days would be necessary to do the aggregation. In such case, the notification under PC.A.4.3.6 would need to refer to the whole year.

PC.A.4.3.1 :

:

In addition, forecast daily **Demand** (**Active Power**) profiles in respect of a **Connection Point** notified in accordance with PC.A.4.3.6 is required for days notified in accordance with PC.A.4.3.6:

PC.A.4.3.2 :

:

1. in the case of forecast daily **Demand** profiles for **Connection Points** and dates notified in accordance with PC.A.4.3.6, be such that the profiles comprise average **Active Power** levels in 'MW' for each time marked half hour throughout the day.

PC.A.4.3.6 No later than calendar week 17 each year, **The Company** shall notify each **Network Operator** and **Non-Embedded Customer** in writing of the following, for the current **Financial Year** and for each of the following seven **Financial Years**, which will, until replaced by the following year’s notification, be regarded as the relevant specified days and times under PC.A.4.2.1:

1. any **Connection Point** that **The Company** requires the **User** to submit forecast daily **Demand** (**Active Power)** profiles for specified dates; and
2. the dates for which **The Company** requires that **User** submits a forecast daily **Demand** (Active Power) profile for the specified **Connection Points**

Storage

Although embedded Large Power Stations affect the net demand, its effect is counteracted by the addition of their output to the net demand in accordance with Clause 3.5.2 of the NETS SQSS. This means that the connection of an embedded Large Power Station has no impact on the Group Demand. Applying the same logic to storage, the connection of an embedded Large storage plant will have no impact on Group Demand.

The proposal to delete Clause 3.5 does not alter this position in relation to Large Power Stations. The drafting of the Grid Code extends that position to embedded Small/Medium Power Stations. Hence, an outcome of this proposal would be that the demand security level required for a specific Demand Group would not be reduced due to the demand being masked by the presence of a significant capacity of embedded Small/Medium Power Stations within the Demand Group.

So, similar applying the same logic on storage, and treating charging as negative output, storage would have a neutral contribution to the Group Demand. This would mean that storage would not affect the size of the Demand Group and would not warrant an increased level of security of supply. However, it does not negate the need to reinforce the Grid Supply Point to ensure that storage can operate as required.



One limitation is that, unlike an embedded Small/Medium Power Station that contains generation only, the operation of storage following an outage could affect the Network Operator’s ability to restore demand. Therefore, measures would need to be put in place to ensure that storage does not take demand in situations where that could affect the ability of the Network Operator to meet the operational demand security requirements.

PC.A.4.3.2 (a) :

It should not include any export over **Embedded External Interconnections** or **Active Power** supplied to **Embedded Electricity Storage Units** unless the **Network Operator** or the **Non-Embedded Customer** has no means to reduce this export over **Embedded External Interconnections** or **Active Power** supplied to **Embedded Electricity Storage Units** to zero;

The workgroup notes that there is a requirement on all Generators with Type A, B, C, and D Power Stations to be able to accept an instruction issued by the Network Operator to disconnect from the system. Hence, provided that the Network Operator have the communications infrastructure to allow sending this instruction, most of new storage plant would have no contribution to the Group Demand.

Demand connected at storage sites:

Some storage sites would be taking demand from the Network Operator’s system for purposes other than charging their energy storage. This demand would need to be treated separately as any other consumer’s demand. If both elements are not metered separately, Network Operators may need additional data submissions from Storage sites.

A Workgroup member raised the concern regarding the energy not supplied incentive and how we ensure TOs are not penalised during loss of supply events. This needs further investigation.

## Objective 2 Ensure that demand side management options and security contribution from embedded generation is taken into account where necessary

### The NETS SQSS

Version 2.5 of the NETS SQSS allows the use of security contribution from embedded Large Power Stations to meet the demand security criteria. It factors contribution from embedded Small/Medium Power Stations implicitly because they reduce the gross Group Demand. It does not allow any security contribution from any flexible demand.

With the implicit security contribution of embedded Small/Medium Power Stations removed as a part of achieving Objective 1, their security contribution will need to be explicitly allowed and calculated in a manner that is similar or equivalent to the security contribution from embedded Larger Power Stations. To achieve this, the references to “Large Power Station” in Section 3 will need to be updated to refer generically to “Power Station”

For flexible demand, as this is currently allowed to be used by Network Operators, the NETS SQSS needs to be updated to define what Flexible Demand is and to ensure where security contribution from a Power Station is referenced, the clause also refers to Flexible Demand

Flexible Demand A subset of demand in a *demand group* associated with customers who agree to change their demand at a given point in time in response to an instruction in accordance with an agreement with a Network Operator. This excludes any changes to demand following an *emergency instruction*.

The workgroup also proposes to modify clauses 3.13 and 3.14 so that the calculation of demand security contributions refer to embedded Power Stations and flexible demand rather than embedded Large Power Stations only.

3.13 Where network assets are insufficient to meet the security requirements, it is necessary to assess the contribution to security from *~~large~~ power stations* connected at either the transmission connection interface or embedded within the *Networks Operator’s* system and any *flexible demand* connected at either the transmission connection interface or within the *Networks Operator’s* system. This will identify whether the contribution to security ~~of the~~ *~~large~~* from *power stations* connected to and/or *flexible demand supplied from* the network has the potential to meet any deficit in system security from network assets.

3.14 The combined contribution to security from *~~large~~ power stations* and *flexible demand* shall never have a greater impact on system security than the loss of the largest circuit infeed to the group. The contributions from embedded *~~small~~* ~~and~~ *~~medium~~ power stations* and *flexible demand* provide additional capacity to enable the supply of demand which may not otherwise be met following a *secured event*, but shall not replace the requirement for system connection. The assessment of contribution of generation to group security will therefore consider;

3.14.1 the generation *annual load factor;*

3.14.2 the availability of generation under outage conditions;

3.14.3 the fuel source availability, i.e. whether energy is continuous, stored, storable or predictable;

3.14.4 common-mode failure mechanisms such as common fuel source, connections or plant stability / ride-through capability;

3.14.5 capping of generation contribution in the event that the generation contribution is dominant with respect to circuit infeed capability

The assessment of the contributions from different power stations and from flexible demand would need to be shared between Transmission Licensees and Network Operators. The main two options would be that

* Transmission Licensees keep the responsibility of estimating the contribution from embedded Large Power Stations and from Power Stations at the interface point as per the current arrangement, or
* Transmission Licensees keep the responsibility of estimating the contribution from Power Stations at the interface point and transfer the requirement to assess the contribution from embedded Large Power Stations to Network Operators

In both cases, Network Operators will be responsible for the provision of any security contributions from embedded Small/Medium Power Stations and flexible demand.

The text proposed for the 1st option is:

3.15 ~~The effective contribution of~~ *~~large power stations to demand group~~* ~~importing capacity shall not exceed the levels indicated in Table 3.2 while~~ While taking due account of the considerations detailed in paragraph 3.14, the effective contribution to security of *demand group* shall be:

3.15.1 in the case of *small power stations* and *medium power stations* embedded within the *network operator’s* systemand in the case of *flexible demand*, as declared by the *network operators* in accordance with the requirements of the *grid code*;

3.15.2 in the case of *large power stations* embedded within the *network operator’s* system or *power stations* connected at the transmission interface point, as estimated by *onshore transmission licensees*. Guidance on the estimation of such contribution is available in Annex D of Engineering Report 130 Issue 3 2019.

The text proposed for the 2nd option is:

3.15 ~~The effective contribution of~~ *~~large power stations to demand group~~* ~~importing capacity shall not exceed the levels indicated in Table 3.2 while~~ While taking due account of the considerations detailed in paragraph 3.14, the effective contribution to security of *demand group* shall be:

3.15.1 in the case of *power stations* embedded within the *network operator’s* systemand in the case of *flexible demand*, as declared by the *network operators* in accordance with the requirements of the *grid code*;

3.15.2 in the case of *power stations* connected at the interface point, as estimated by *onshore transmission licensees*. Guidance on the estimation of such contribution is available in Annex D of Engineering Report 130 Issue 3 2019.

In either case, the Grid Code would need to be modified to ensure that all parties have the data they require to do the assessment.

### Issues to be addressed

Estimating the security contribution from embedded generation and flexible demand

1. Flexible demand and power stations that are subject to a demand security contract:

The value of this security contribution will be equal to the contracted level.

1. Embedded small and medium power stations not subject to a demand security contract:

EREP 130 provides several options for the estimation of the security contribution from embedded small and medium power stations.

1. Embedded large power stations and power stations connected at the interface point:

The same options in EREP 130 available for small and medium power stations could be used to estimate the contribution from embedded large power stations. However, as the number of these power stations is reasonably limited the use of the spreadsheet (EREP131) is probably the most appropriate methodology for these power stations.

1. Storage

There is currently not enough information related to how storage, other than pumped storage, provide energy arbitrage. This is due to the fact that

* + - battery storage systems are relatively new to the energy market, and
    - the majority of battery storage systems seem to focus more on the ancillary services rather than on energy trading.

Due to this, security contribution from battery storage systems should only be considered where the provision of such service is guaranteed by a contract with a view to review this position in the future as more data becomes available.

|  |  |  |  |
| --- | --- | --- | --- |
| Topics | ICL comments | Comments | Status |
| Impact of BM or other services | Approach 3 is still applicable if the right input to the spreadsheet can be produced.  Tolerance level can be adjusted to reflect the confidence in the assessment. | AMC concerns / conclusions  1. Approaches 1 and 2 are unsuitable  2. Approach 3 is probably OK to use but there is a need to carry out some assessment to see of the expected output from a large power station which is a BM unit is materially different compared to a large power station operating without BM instructions. NGESO can instruct a BM Unit to operate below or above its preferred output  3. Guidance is required on the choice of Tm. This will need to come from the TO via the ESO.  4. Guidance is provided on the selection of the time of year eg winter or mtce period peak. This will need to come from the TO via the ESO  5. Guidance is required on the p(security contribution can be delivered). This can be adjusted by tweaking some of the parameters. Guidance on this will need to come from the TO. How material is this factor. |  |
| **Approach 3 for energy storage** | It is suitable for non-contracted energy storage  Similarly, it still can produce valid results with a particular generation profile representing the behaviour of storage for a particular period of time. | AMC concerns / conclusions  1. In EREP 130 ‘contracted’ is defined as being contracted by the DNO provide a security service. Clearly this definition is not appropriate n a SQSS context  2. There needs to be more thought as to what ‘contracted’ and ‘non contracted‘ means in the context of applying EREP 130 to generation and also to BESS.  3. Need to consider the approach in relation to all the ‘ancillary’ services that NGESO contract for and whether they may influence the natural behaviour of the BESS |  |
| Aggregation of generators | Could be grouped by types and aggregated together.  Potential alternative to update the spreadsheet to accommodate more generators. | AMC concerns / conclusions  1. Guidance is required on the grouping of generators if there are >10 that need to be assessed  2. Guidance is required on the treatment of the net/gross demand associated with the generation which is not included in the security assessment. ICL have provided some thoughts but this needs to be clarified  3. What should the deminimis value be for a security assessment. EREP 130 is 5%. Is this reasonable. For a GSP where there is a security concern the demand will be at least 100MW, so the deminimis size will be 5MW.  4. Would increasing the numbers of generators that can be accommodated in the spreadsheet help? |  |
| How to consider BESS import and export demand security contribution | It could be considered separately, and that accuracy would be within data and asset tolerances. If it is considered together, within EREP 131, a carefully crafted profile for contracted DSR might be potentially a way forward. | AMC concerns / conclusions  1. I note that slide says ‘could’ – guidance is required as to how the security contribution from BESS Import and BESS export should be considered  2. This may be complicated where there are multiple parties involved.  3. In both cases the security contribution is very likely to be based on the terms of the ‘contract’. If this is a contact between the ESO and the BESS, then there will need to be an obligation for the ESO to provide details of this (as part of the week 24 process?) to the DNO so that they can do the assessment |  |
| Tm consideration for BESS | Contribution could be 100% until Tm is equal to the rated storage duration (Tr). Increasing Tm contribution drops to Tr/Tm, e.g., for Tm=2\*Tr contribution would be 50% | AMC concerns / conclusions  1. I note that slide says ‘could’ – guidance is required as to how the security contribution from BESS export should be considered |  |
| EREP 130 in general |  | • I think that there is a need to walk through EREO 130 to think about how it would / could be applied to SQSS |  |

Data exchange required to ensure that the assessment of contribution towards demand security takes place correctly and in a timely manner.

There are different data issues depending on whether the security contribution from large generators is assessed by Transmission Owners or Network Operators.

Assessment by Transmission Owners:

These are likely to include assessment of security contributions by power stations connected at the interface point. The data required for this assessment is

1. Date and Time
2. Location
3. Shortage of demand security
4. Persistence time (Tm)
5. Generation output
6. Demand profile

All this data is available for Transmission Owners except for:

1. Generation output: This are available on request from the ESO
2. Demand profile: This will need to be requested in accordance with the proposed new PC.A.4.3.6 and provided by Network Operators in accordance with the proposed modified PC.A.4.3.1.

Assessment by Network Operators:

These are likely to include assessment of security contributions from power stations other than power stations connected at the interface point. The data required for this assessment is exactly the same as that required by Transmission Owners.

However, Network Operators will need to be notified of the following by NGESO:

1. That they need to do a generation security assessment at a specific GSP
2. All the data required for the assessment except for demand and generation profiles as these are likely to be already available to them
3. The level of security contribution required
4. The level of the maximum security contribution that will be considered.

Following the assessment, Network Operators will need to submit the output of the assessment

The proposal is to cover this assessment under a new Clause PC.A.4.8 in the Grid Code Planning Code

PC.A.4.8 Connection Point Demand Security Resources Available (Active Power)

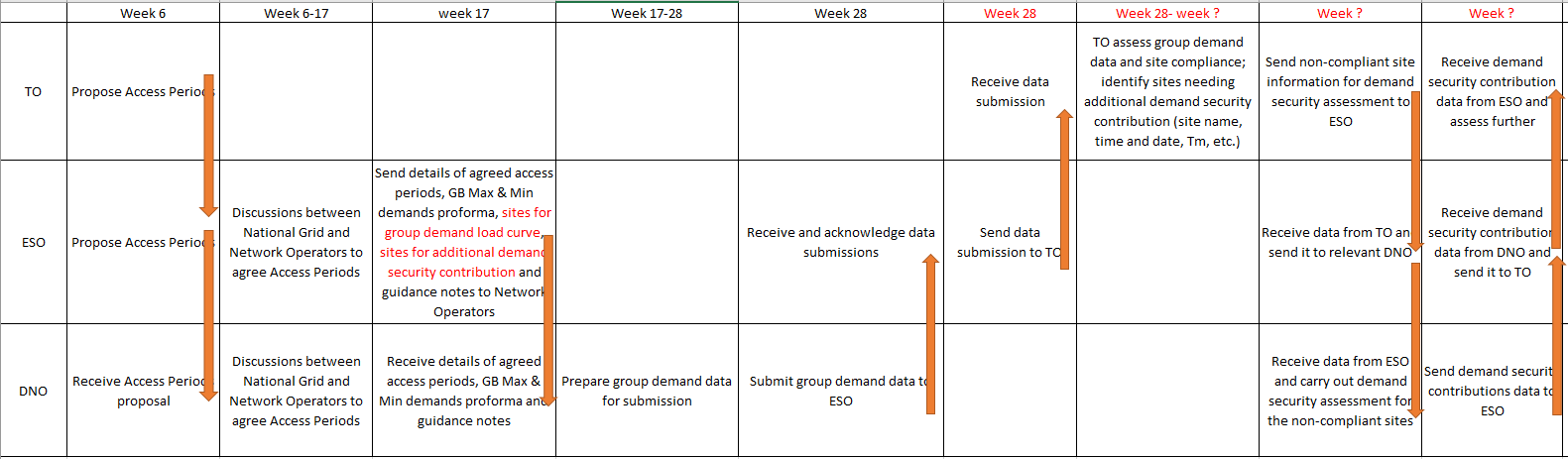
PC.A.4.8.1 Any resources available within the **Network Operator**`s **User System** that could be considered when assessing compliance with the demand connection capacity requirement criteria for the **Connection Point** as defined in the **NETS SQSS** including:

for all **Connection Points**,

1. the **Demand** (**Active Power**)capacity that could be supplied from a different **Access Group** immediately, within 60 seconds, within 15 minutes, and within 3 hours following an instruction from **The Company** to the **Network Operator** and
2. the **Demand** (**Active Power**) that could be either reduced or supplied by P**ower Stations** embedded within the **User System** at the **Connection Point** immediately, within 60 seconds, within 15 minutes, and within 3 hours following an instruction from **The Company** to the **Network Operator**; and
3. For all **Connection Points** notified by **The Company** in accordance with PC.A.4.8.2, these resources shall also include the **Demand** (**Active Power**) that is likely to be supplied from **Power** **Stations** embedded within the **User System** at the **Connection Site** excluding any **Power Station** that is considered under PC.A.4.8.1 (b) as assessed by the **Network Operator** in the case of embedded **Small Power Stations** and embedded **Medium Power Stations**,in accordance with **EREP 130** of the **Distribution Code** and, in the case of embedded **Large Power Stations**, in accordance with **EREP 131** of the **Distribution Code.**

PC.A.4.8.2 No later than calendar week 17 each year **The Company** shall notify each **Network Operator** of the requirement to provide additional information about the resources available within the **Network Operator**`s **User System** that could be considered when assessing compliance with the demand connection capacity requirement criteria for the **Connection Point** as defined in the **NETS SQSS**. For each **Connection Point** notified, **The Company** shall specify the level of resources that it estimates to be required for compliance, the maximum level of resources that would be considered, and any other information that **Network Operator** reasonably requires in order to assess the security contribution from such resources.

**The proposed data exchange process is illustrated in the diagram below:**

****

A Workgroup member advised that GC0139 is looking to split the Weeks 24 and 28 process and add extra data exchange in week 2. The Proposer advised that they are aware of it and will clarify with the modification Proposers.

A workgroup member advised that the currently non-compliant sites would be discussed with relevant DNOs for the best solutions and these discussions would continue to happen in the next cycle of data submission. Therefore the proposed new data exchanges could be integrated to the next cycle of data submission as shown in the diagram below.

