Electricity Distribution

nationalgrid

Company Directive

STANDARD TECHNIQUE: SD1E/6

Technical Requirements for Customer Export or Import Limiting Schemes

Policy Summary

This Standard Technique specifies the requirements for **Customer** owned **Export or Import Limitation Schemes** from LV to 132kV.

Author: **Seth Treasure & Matthew Pope**

Implementation Date **October 2022**

Approved by

Carl Ketley-Lowe
Engineering Policy Manager

Date **3rd October 2022**

Target Staff Group	**Staff involved with the design, specification, installation, witnessing or replacement of generator connections**
Impact of Change	**Amber – This document changes the requirements for Customer Export Limitation Schemes**
Planned Assurance checks	**6 months from the issue of this document the author will interview at least one LV Planner and one HV planner in each License Area to check their understanding**

IMPLEMENTATION PLAN

Introduction

This document specifies the requirements for customer owned **export** and/or **import** limiting schemes.

Main Changes

The document has been updated to align with the changes made to the Energy Network Association (ENA) Engineering Recommendation (EREC) G100 version 2; a summary of changes are as follows;

- Inclusion of import limitation schemes
- Revised calculation process for the determination of the **maximum** installed demand capacity and the **maximum** installed generation unit capacity
- Inclusion of wireless communications
- Four states of operation of a limitation scheme
- Revised definitions
- Increased commissioning requirements for installers
- Inclusion of the G99 simplified connection processes

Impact of Changes

Target Staff Group	**Staff involved with the design, specification, installation, replacement and witnessing of generator connections**
Impact of Change	**Amber – This document changes the requirements for Customer Limitation Schemes (CLS)**

Implementation Actions

The document shall be disseminated to the business via the Policy Dissemination engineers.

Implementation Timetable

A customer / installer may choose to design a scheme compliant with the requirements of ENA EREC G100 version 2 from May 2022, however, the requirements become mandatory from 1st April 2023. A limitation scheme compliant with the requirements of version 1 of ENA EREC G100 is permitted where the installation and commissioning date is before 31st March 2023. Following discussions with manufacturers, it is not envisaged that Version 2 compliant equipment will be publically available until after April 2023.

REVISION HISTORY

Document Revision & Review Table		
Date	**Comments**	**Author**
October 2022	• Document has been revised to comply with ENA EREC G100 Version 2 • Introduction of new terminology • Two additional assessment procedures made available for compliance with G100 V2 and G99 SGI – Section 7 & 8 • New links added for revised application, verification and commissioning forms • Clause 4.7 – Wireless communication availability for CLS compliant installations • Section 12 – Informative section on the operational states of a CLS • Information on use of CTs and VTs by customers • Example assessments added to link within Appendix C	Seth Treasure
March 2020	• Document format has been updated to comply with POL: GE1 • Section 1.6 has been added to provide guidance on interlocking and other control systems that pre-emptively prevent the **Agreed Export Capacity** from being exceeded. • The following definitions have been added: **Micro-generator**, **Power Generating Module**, **Power Park Module**, **Synchronous Power Generating Module**, **Generating Unit** and **Electricity Storage**. • The definition of **Fail Safe** has been modified. • Clause 4.1.7: The requirements for **Power Generating Modules** that are set or designed to self-limit their output have been clarified • Clause 4.1.10: The requirements for reverse power protection at HV connections have been clarified • Clause 4.3.2.1: The protection assessment requirements have been updated and clarified	Andy Hood

Contents

1.0 INTRODUCTION

1.1 This document specifies the requirements for privately owned **Customer Export and/or Import Limitation Schemes** (**CLSs**) that are designed to restrict, as far as is reasonably practicable, the export and/or import at an installation in order to satisfy the **Agreed Export** and/or **Import Capacity** by either controlling the output from the customer's generating units or import of the customers demand. This standard technique is based on ENA EREC G100/2, which shall be read in conjunction with this document.

1.2 This document makes reference to both **Export Limiting Schemes (ELS)** and **Customer Limiting Schemes (CLS)**, where **ELS** is the correct definition for a scheme designed to be compliant with the Engineering Recommendation G100 version 1 and **CLS** is the correct definition for compliance with the revised document (version2).

Some of the requirements as detailed within this policy are common across the two standards, however, version 2 of the document introduces some extended requirements and commissioning confirmation processes as risk management to the extended limits that are applied for the determination process for the maximum aggregate installed capacity (Export and/or Import).

A scheme designed to the requirements of ENA EREC G100 **version 1** is **not required** to comply with the requirements of **version 2** (**CLS**), however, a scheme commissioned from **1st April 2023** or where a customer / installer wishes to take advantage of the extended limits or wireless communication availability, the scheme shall **comply in full** with all of the requirements of ENA EREC G100 **version 2**. For example, if a customer wishes to utilise wireless communication systems and/or the extended voltage tolerances as noted within ENA EREC G100 version 2, the scheme must comply with all of the fail safe functionality, include the three states of operations and lock out functionality as detailed within this document.

1.3 The requirements for NGED owned Connection Control Panels (CCPs) are included in ST: TP18A.

CCPs are used to provide Active Network Management and Soft Intertripping functionality and may not be used instead of Customer Limitation Schemes.

Type B, C and D generating units will require operational monitoring as per the requirements of ENA EREC G99, this functionality may be provided by NGED or the customer, however, NGED is always required to provide telecommunication links and this is typically provided through the CCP. See Standard Technique: SD1G for more detail.

1.4 The requirements for the connection of **Power Generating Modules** to National Grid Electricity Distribution's (NGED's) network are specified in ENA EREC G83, ENA EREC G98, ENA EREC G59 and ENA EREC G99, as applicable.

1.5 **CLS**' are often, but not always, installed with **Energy Storage** that have the ability to charge (i.e. consume **Active Power**) and then discharge (i.e. produce **Active Power**). **Energy Storage** systems are considered as demand when consuming **Active Power** and as **Power Generating Modules** when producing **Active Power**. They must therefore satisfy the requirements of ENA EREC G83, ENA EREC G98, ENA EREC G59 or ENA EREC G99, as applicable. ST: NC1AD provides further guidance on the connection of **Energy Storage** schemes.

1.6 Rather than install a **CLS** the customer may prevent the **Agreed Export or Import Capacity** from being exceeded by installing one of the following;

- **Fail Safe** interlocking system / **Fail Safe** control system that pre-emptively limits the number of **Generating Units** that may operate simultaneously. Where this is the case most of the requirements of this document are waived, including Sections 7-9 associated with the aggregate **Generating Unit** capacity, as long as the system prevents the **Agreed Export or Import Capacity** from being exceeded at all (i.e. even for fraction of a second).

  At HV connections, the **Fail Safe** system shall be backed up by customer owned instantaneous reverse power protection or overload protection that trips the **Generating Units** or the **demand** (part thereof) should the Agreed Export or Import Capacity be exceeded.

  For example, at an HV connected site with photovoltaic **Generating Units** and **Battery Storage** a **Fail Safe** interlocking system is proposed that prevents the **Battery Storage** from producing any **Active Power** until a sufficient number of photovoltaic **Generating Units** have been disconnected in order to eliminate the possibility of the **Agreed Export Capacity** from being exceeded. The interlocking system will also be backed up by instantaneous reverse power protection that trips the **Battery Storage** should the **Agreed Export Capacity** be exceeded. Given this, the requirements of sections 7-9 are waived and so there is no restriction on the aggregate **Generating Unit** capacity.

- **Overload or Reverse Power Protection** that limits the import or export capacity to the **Maximum Export Limit (MEL)** and/or the **Maximum Import Limit (MIL)** at the connection point. This form of protection is only available via relays with directional or definite time settings and therefore it is not envisage to be used in conjunction with low voltage connections.

  The protection will be set at 102% of the MEL or MIL with a time delay of up to 10 seconds.

  At HV connections, the **Fail Safe** system shall be backed up by customer owned instantaneous reverse power protection or overload protection that trips the **Generating Units** or the **demand** (part thereof) should the Agreed Export or Import Capacity be exceeded.

- The aggregate installed capacity of the connection shall also comply with sections 7-9 as appropriate (i.e. the installed capacity must not create an event that would exceed the State 2 Limits – see clause 12.4).

2.0 SCOPE

2.1 This document applies to privately owned **CLS**' that are used to limit the exported or imported power from the customer's installation in order for the customer to satisfy i) their **Agreed Export Capacity** and ii) their **Agreed Import Capacity** and iii) the terms of their Connection Agreement.

2.2 This document applies to connections at all voltage levels (i.e. LV to 132kV) and is only applicable where the aggregate generating unit capacity minus the minimum site demand is greater than the agreed export capacity or the aggregate Installed capacity of demand is greater that the Agreed Import capacity of the connection.

2.3 **CLS'** do not, by themselves, control or restrict the fault contribution from a customer's installation and therefore cannot be used as a means to reduce the fault level contribution or bypass any fault level restrictions.

3.0 DEFINITIONS

3.1 **Active Power**: The product of voltage and the in-phase component of alternating current measured in units of Watts (W), kilowatts (kW) or megawatts (MW)

3.2 **Agreed Export Capacity**: The maximum amount of power (expressed in kVA) that is permitted at the **Connection Point** when the **Active Power** flows into the **Distribution System** through the **Connection Point**.

3.3 **Agreed Import Capacity**: The maximum amount of power (expressed in kVA) that is permitted at the **Connection Point** when the **Active Power** flows out of the **Distribution System** through the **Connection Point**.

3.4 **Apparent Power**: The product of voltage and current at fundamental frequency, and the square root of three (in the case of three phase systems) expressed in volt-amperes (VA), kilovolt-amperes (kVA) or megavolt-amperes (MVA).

3.5 **Energy Storage: Energy Storage** in the electricity system is the conversion of electrical energy in to a form of energy that can be stored, the storing of that energy, and the subsequent reconversion of the energy back into electrical energy

3.6 **Connection Point**: A point on the distribution system that provides the customer with a connection allowing power to flow to or from the distribution system. Typically this would be the outgoing terminals of NGEDs fused cut-out or metering circuit breaker

3.7 **Customer Export or Import Limitation Scheme (CLS)**: A system comprising of one or more **Components** providing control signals that interface with the **Customer**'s generation and/or load (i.e. the generation and load that is specifically intended to be controlled by the **CLS**, to control the net flow of electricity into or from the **Distribution Network** at the **Connection Point** so as not to exceed the **MEL** or **MIL**.

A **CLS** may be a single integrated unit (excepting transducer(s) at the **Connection Point**) or composed of a number of distributed discrete **Components**. In all cases the **CLS** is expected to include a **Component** that is a transducer that measures the current and voltage at the **Connection Point**.

Note, that this latter **Component** could form part of another piece of equipment entirely, one that measures the values appropriately, and is not associated originally with the **CLS**, provided it fulfils the same function and is appropriately integrated into the **CLS**'s overall behaviour (including appropriate secure and **Fail Safe** communications).

3.8 **Export limiting Scheme (ELS)**: A system comprising of one or more **Components** providing control signals that interface with the **Customer**'s generation and/or load (i.e. the generation and load that is specifically intended to be controlled by the **ELS**, to control the net flow of electricity into the **Distribution Network** at the **Connection Point.** **The term Export limiting schemes will be replaced by Customer Limiting Schemes when ENA EREC G100 Version 2 becomes mandatory (1st April 2023).**

3.9 **Fail Safe**: A design requirement that enables the **CLS** to limit export or import at the **Connection Point** to the **MEL** or **MIL** respectively, irrespective of the failure of one or more of its **Component**s or the failure of any communications between the **CLS's Components** and **Devices**.

Alternatively, A design requirement that enables the **ELS** to limit export at the **Connection Point** to the **Agreed Export Limit** which is expressed in **Active Power**, irrespective of the failure of one or more of its **Components** or the failure of any communications between the **ELS's Components** and **Devices**.

3.10 **Fully Type Tested**: A **CLS** which has been tested to ensure that the design meets the relevant technical and compliance requirements of EREC G100 (version 2), and for which the **Manufacturer** has declared that all similar **CLSs** supplied will be constructed to the same standards and will have the same performance.

3.11 **Generating Unit**: Any apparatus that produces electricity. This includes **micro-generators** and **Electrical Storage** devices.

3.12 **Installed Capacity:** The capacity of Generation or Demand in KVA that can be installed beyond the connection point following the assessment for the maximum Import or Export Limit.

3.13 **Intrinsic Design Capacity:** The designed maximum **Active Power** capacity of a **Generating Unit** or a **Power Generating Module**. In general this will be identical to the **Registered Capacity**, but can be a higher value where the **Manufacturer** has made specific provision for the maximum **Active Power** output to be limited to a defined value less than the designed maximum **Active Power** capacity. Such a limitation will be semi-permanent and designed in by the **Manufacturer**. It will not be amenable to adjustment by the **customer**; any such adjustment shall be undertaken by personnel specifically empowered and equipped for that task by the **Manufacturer**.

3.14 **Micro-generator**: A source of electrical energy and all the associated interface equipment able to be connected to an electric circuit in a low voltage electrical installation and designed to operate in parallel with a low voltage distribution network with nominal currents up to and including 16A per phase.

3.15 **Maximum Export Limit (MEL):** The maximum current, as agreed between the **Customer** and the **DNO** which may be exported onto the **Distribution Network** via that **Connection Point**.

3.16 **Maximum Import Limit (MIL):** The maximum current, as agreed between the **Customer** and the **DNO** which may be imported from the **Distribution Network** via that **Connection Point**.

3.17 **Minimum Demand:**

Domestic Installations: The minimum demand expected to be seen at a domestic installation taking into account shutdowns and holiday periods. A value of zero demand is typically used unless a customer is able to provide substantive data.

Low Voltage Networks: The minimum demand expected to be seen taking into account diversity and as detailed by the NGED Low Voltage software modelling programme.

Commercial Installations: The minimum demand expected to be seen at a commercial installation taking into account shutdowns and holiday periods. The minimum demand may be ascertained by obtaining two years' worth of customer half hourly average measurements from data logger and determining the minimum demand during the appropriate time frame e.g. day time minimum demand for photovoltaic generation or night time for any other form of generation or where installations include Energy Storage.

High and Extra High Voltage Networks: The minimum demand expected to be seen on HV and EHV networks taking into account shutdowns, holiday periods, the normal and abnormal running arrangements. The minimum demand may be ascertained by obtaining two years' worth of half hourly average measurements from data logger and determining the minimum demand during the appropriate time frame e.g. day time minimum demand for photovoltaic generation or night time for any other form of generation or where installations include Energy Storage.

3.18 **Power Factor**: The ratio of **Active Power** to **Apparent Power**

3.19 **Power Generating Module:** Either a **Synchronous Power Generating Module** or a **Power Park Module**.

3.20 **Power Park Module**: A **Generating Unit** or ensemble of **Generating Units** (including **Electricity Storage** devices) generating electricity, which is either synchronously connected to the network or connected through power electronics, and that may be connected through a transformer and that also has a single **Connection Point** to a distribution network.

3.21 **Reactive Power**: The imaginary component of the **Apparent Power** at fundamental frequency expressed in vars (VARs), kilovars (kVAr) or Megavars (MVAr).

3.22 **Registered Capacity:** The designed maximum **Active Power** capacity of a **Micro-generator**, as declared by the **Manufacturer** which should exclude the **Active Power** consumed by the **Micro-generator** when producing the **Registered Capacity**; ie this will relate to the maximum level of **Active Power** deliverable from the **Micro-generating Plant**. For **Micro-generators** connected to the **DNO's Distribution Network** via an **Inverter**, the **Registered Capacity** of the **Micro-generator** is the lesser of the **Inverter**(s) rating or the rating of the energy source.

3.23 **Synchronous Power Generating Module:** As indivisible set of **Generating Units** (i.e. one or more units which cannot operate independently of each other) which can generate electricity such that the frequency of the generated voltage, the generator speed and the frequency of the network voltage are in a constant ratio and thus in synchronism.

3.24 **Type Tested:** A **CLS**, or a **CLS Component**, or part of a **Component** which has been tested to ensure that the design meets the relevant requirements of EREC G100, and for which the **Manufacturer** has declared that all similar products supplied will be constructed to the same standards and will have the same performance. The **Manufacturer's** declaration will define clearly the extent of the equipment that is subject to the tests and declaration. The ENA provides a database, the Type Test Register, for **Manufacturers** to lodge their statements of compliance and supporting information.

4.0 SCHEME REQUIREMENTS

4.1 **Scheme Design – This document makes reference to both CLS and ELS installations, installations that are designed to comply with the requirements of either set of rules must comply in full with the relevant version of G100 i.e. a system must not be designed to the version 1 rules with the Installed capacity determined following the version 2 process.**

Where a CLS or ELS is installed it is possible that the customer's load (demand or generation) could cause the voltage within Customer installation to breach voltage limits for short periods of time. This could, potentially cause Customer protection such as broken neutral detection equipment associated with electric vehicle charge points (EVCP) to operate. In the event of nuisance tripping it is recommended that the EVCP be protected via a TT earthing system or alternative system that is not measuring the voltage between the phase and neutral.

4.2 **ELS'** measure the **Active Power** at the **Connection Point** and then use this information to either restrict generating unit output or increase demand in order to prevent the agreed export from being exceeded.

CLS' measure the **Current flow** at the **Connection Point** and then use this information to either restrict generating unit output, restrict the import of demand or increase customer generation or demand in order to prevent the agreed export capacity or agreed import capacity from being exceeded.

4.3 **CLS'** shall meet the requirements of ENA EREC G100 as amended.

4.4 The agreed export capacity is expressed as an **Apparent Power** (kVA) value at a given **Power Factor** (or over a power factor range) as measured at the **Connection Point**.

4.5 **ELS'** shall be designed to limit the **Active Power** only. The customer is required to control the **Power Factor** and hence the **Apparent Power** and **Reactive Power** in accordance with the Connection Agreement.

CLS' shall be designed to limit **Current Flow**. The customer is required to control the **Current** taking account of the direction of the active power flow to limit the **Apparent Power** in accordance with the Connection Agreement.

4.6 The **CLS** may be formed of discrete units or integrated into a single packaged scheme, in all cases the CLS is expected to include a component that measures the current and voltage at the **Connection Point**.

A customer may choose to install more than one CLS controlling separate sets of devices, however, the aggregate settings of the CLS must not exceed the aggregate installed capacity of the installation.

4.7 The manufacturer or installer must select an appropriate and secure communication medium for communication between the **Components** forming the **CLS**, and the **Devices** controlled by the **CLS**.*

An **ELS** shall be designed to incorporate hard wired communication links (e.g. RS485 cable / fibre optic cables) or radio links subject to the use of licensed frequencies (i.e. licensed by OFCOM) and have a planned availability of 99.9% or higher. Irrespective of the media used for interconnecting between the discrete units, if the communication path fails the **Generating Unit** output shall be immediately reduced to prevent the **Agreed Export Capacity** from being exceeded.

*A **CLS** may use wireless communication links, however, an **ELS** may not.

4.8 The **Manufacturer** or **Installer** shall consider the cyber security risks posed for the **CLS** both in terms of the communication between the **Components** forming the **CLS**, and the **Devices** controlled by the **CLS** and also in terms of interaction with any other system, including any **Manufacturer's** product management systems. NGED have no specific requirements at the time of writing of this Standard Technique.

4.9 **CLS'** installed at premises with an aggregate **Generating Unit** capacity exceeding 16A per phase and where the **connection point** is at **Low voltage** shall be **Fail Safe** and shall fully restrict excess export if any single component, including the connections communication links between the discrete units, fail or lose their power supply.

4.10 For connections at **high voltage** or above, **Back up** Overload or Reverse Power protection shall always be fitted, it is required in the form of a relay with instantaneous protection only. **The protection shall be set at the state 2 limits** (aggregate installed capacity).

For connections at **low voltage**, overload and/or Reverse Power protection is only required when the CLS cannot be proven or is **not Fail safe**.

The **Back up** Protection shall consist of a separate relay to that of the CLS or any other protective system and the only items that may be shared across the protective systems are Current Transformers (CT's) and Voltage Transformers (VT's) when used are measurement devices connected to the primary system (where the items measure the actual current and voltage of the connection).

All domestic style installation shall include Fail Safe systems due to the unsuitability of the use of protection relays.

4.11 Individual **Power Generating Modules** and **Generating Units** may be designed or set to limit their own **Active Power** output without the need of external controls or sensors, the installer will detail the **Registered Capacity** of the Generating Unit and the **Intrinsic Design capacity** of the Generating Unit. Where the declared Registered Capacity of the power generating module can be accommodated on the distribution network without voltage rise or thermal concerns a CLS is not required to be installed.

Where a power generating module has been noted with a registered capacity lower than the intrinsic capacity, appropriate compliance verification documentation must be provided with the applicable registered capacity. For example, where a 5kW inverter is internally limited to 3.68kW, the compliance verification paperwork shall denote 3.68kW as the registered capacity.

4.12 Once installed and commissioned, the relevant **CLS**, **Power Generating Module** and **Generating Unit** settings should **not** be capable of being altered by the Customer and may only be changed with the written agreement of the DNO. Therefore the settings shall be protected by either password, PIN or physical access capable of being sealed.

4.13 **Exported Current** or **Imported Current** at the **Connection Point** may be controlled by increasing the customer's demand or generation within the installation, however the **CLS** must be designed to reduce the output from generating units or disconnect the generating units or reduce the demand of the premises or disconnect the demand entirely at the premises, as necessary to prevent the **Agreed Export or Import Capacity** from being exceeded, should the demand or generation be unavailable.

Note: An ELS controls Active Power where a CLS controls current

4.14 A **CLS** is **not required** to be installed at connections where the export or import of power will never exceed the export or import capacity of the connection, however, overload and/or reverse power protection is always required at HV connections and above and shall be set just above the MIL and/or MEL value (as applicable) to account for the permitted measurement tolerance which, in G100, is specified as 2% of the MIL or MEL (whichever is higher).

For example, an 11kV connection has an Agreed Import Capacity of 2MVA and no export capacity. A CLS is installed to prevent the export capacity from being exceeded. In this case the MEL is 0A and the MIL is 2000/(√3x11)= 105A. The permitted tolerance for back-up overload protection is 2% of the higher of the MIL and MEL, i.e. 0.02x105 = 2.1A. The directional overload protection is therefore set to operate when the current exceeds 2.1A and active power (kW) is being exported.

This is a form of back up protection, see clause 4.10 for more detail.

4.15 A functional description of the scheme, its settings, and a single line diagram shall be displayed on site.

5.0 AGREED IMPORT OR EXPORT CAPACITIES

5.1 All connections with a site specific connection agreement will have an **Agreed Export and/or Import Capacity**. In some circumstances, one of the capacities may be zero.

5.2 LV connections without a site specific connection agreement are assumed to have an **Agreed Export Capacity** of 16A per phase and **Agreed Import Capacity** of 80A per phase unless otherwise agreed.

6.0 AGGREGATE GENERATING UNIT OR DEMAND CAPACITY (INSTALLED CAPACITY)

6.1 **CLS'** allow the aggregate **Generating Unit** capacity at a site to exceed the **Agreed Export** or **Import** capacity, however, there is still a limit on the maximum aggregate **Generating Unit or Import** capacity that may be installed at the site. This is because a **CLS** is permitted to take up to **60 seconds*** to detect an excursion and then reduce the exported or imported power below the agreed limit. It is envisaged that the majority of schemes will be designed and commissioned to react within **10 seconds**.

*A reciprocating gas engine driven or micro hydro generation unit may be permitted a reaction time of up to 180 seconds subject to the voltage of the distribution network not exceeding the statutory voltage range.

6.2 An **ELS** designed and commissioned in compliance with ENA EREC G100 **Version 1** has a prescribed reaction time of **5 seconds**.

6.3 The aggregate **Generating Unit or Import capacity** is restricted in order to prevent (i) protection from mal-operating and (ii) voltage ratings of equipment from being exceeded and iii) thermal overload of assets during the operating time of the **CLS**. The assessment methodology is detailed within sections 7-9 as appropriate.

Section 7 details the ENA's Small Generation Installation process (SGI) and NGED's simplified connection process.

Section 8 details the connection process for curtailment systems compliant with ENA EREC G100 version 2.

Section 9 details the connection process for curtailment systems compliant with ENA EREC G100 version 1.

An installation is only required to have to comply with one of the assessment procedures (in full), however, the extended voltage ranges as detailed within **section 8** may only be accepted for systems fully compliant with the requirements as detailed within G100 version 2.

Detailed examples of such calculations are included in Appendix D of EREC G100, a hyperlink has been made available within Appendix C of this document.

7.0 DETERMINATION OF THE MAXIMUM AGGREGATE INSTALLED CAPACITY OF POWER GENERATING MODULES. SIMPLIFIED METHODOLOGY- ENA EREC G99 SMALL GENERATION INSTALLATION (SGI) PROCESS

7.1 SGI 1 – *Informative only*

All generating units have a rating less than 16A with an export capacity of less than 16A. Devices that are compliant with ENA EREC G98 or G99 (type tested) and where they operate in island mode as well as parallel mode are included and will follow the **notification process.**

7.2 SGI 2 – *Fast Track Application*

All generating units have a registered capacity of 16A or lower with an aggregate installed capacity of 32A or lower and an export capacity of 16A or lower where an ENA EREC G100 compliant device is utilised. Devices that are compliant with ENA EREC G83, G98, G59 or G99 (type tested) and where they operate in island mode as well as parallel mode are included and will follow the **application** process. **No network studies are required.**

7.3 SGI 3 – *New ENA Process*

All generating units have a registered capacity of 32A or lower with an installed capacity of 60A or lower and an export capacity of 32A or lower where an ENA EREC G100 compliant device is utilised. Devices that are compliant with ENA EREC G99 and where they operate in island mode as well as parallel mode are included and will follow the **application** process.

A network study will be conducted to determine the impedance at the point of supply (cut out), no thermal or voltage assessment is initially required;

Where the impedance at the point of supply is **≤ 0.12 ohms** (source loop impedance), the installation can be accepted without further investigation.

Where the impedance at the point of supply is **> 0.12 ohms** or where the requested installation is non-compliant with the requirements of section 7.3, a study compliant with section 8 or 9 will be conducted

7.4 NGED 5 & 5 Process

All generating units that have a registered capacity of 5kW (21.74A at 230V) or lower with an installed capacity of 10kW (43.48A) or lower and an export capacity of 5kW (21.74A at 230V) and an ENA EREC G100 compliant device is utilised. Devices that are compliant with ENA EREC G99 and where equipment operates in island mode as well as parallel mode are included and will follow the simplified **application** process.

A network study will be conducted to determine the impedance at the point of supply (cut out), no thermal or voltage assessment is initially required;

Where an installation is designed to be **compliant with ENA EREC G100 VERSION 1** and where the impedance at the point of supply is **≤ 0.25 ohms** (source loop impedance), the installation can be accepted without further investigation.

Where an installation is designed to be **compliant with ENA EREC G100 VERSION 2** and the impedance at the point of supply is **≤ 0.3 ohms** (source loop impedance), the installation can be accepted without further investigation.

Where the impedance at the point of supply is greater than that detailed above or where the requested installation is non-compliant with the requirements of 7.4. A study compliant with section 8 or 9 will be conducted.

8.0 DETERMINATION OF THE MAXIMUM AGGREGATE INSTALLED CAPACITY OF POWER GENERATING MODULES OR MAXIMUM DEMAND. FOR SYSTEMS COMPLIANT WITH ENA EREC G100 VERSION 2 – MANDATORY FROM 1ST APRIL 2023

To ensure that a premises installation of power generating modules or demand does not have an adverse effect on the connection or wider network, the maximum aggregate installed capacity shall be determined in line with the following criteria. The maximum installed capacity will be the lowest capacity available following either the Protection, Voltage, Thermal, Flicker or ENA EREC G99 compliance assessments.

8.1 Protection Assessment

The maximum current that flows through the **Connection Point**/s must not cause NGED fuses or overcurrent relays to operate.

(a) Where the site is protected by **fuses** (typically low voltage domestic installations) the aggregate generating unit capacity or import capacity shall be no greater than the higher of 1.45 x the fuse rating. Diversity and **minimum** site demand / generation is permitted to be used in the equation.

(b) Where the site is protected by a relay, the maximum installed capacity shall be the 'pick up' value of the relay. For an a connection provided through a Moulded Case Circuit Breaker (MCCB), the pickup / overload current setting (IR) of the metering MCCB can be found via the following link. See Example <here>

Where a connection does not have an Agreed Import Capacity a value of 18.4kVA/80A is assumed for a single phase supply and 41.4kW/60A per phase is assumed for a three phase supply. Where a connection does not have an Agreed Export Capacity a value of 3.68kVA (16.0A) per phase is assumed. In the absence of other information NGED's cut-out fuses should be assumed to be 80A.

When assessing the minimum demand consideration must be given to shut-down / holiday periods etc.

NGED Fuse ratings and overcurrent protection settings are dictated by the protection requirements rather than load requirements. It is not normally acceptable to increase these ratings / settings simply to allow a higher aggregate Generating Unit capacity without also increasing the rating of the associated NGED cables, overhead lines and/or other plant and equipment. Where it is proposed to change fuse ratings or protection settings an assessment shall be carried out by the Planner or by Engineering Design, as applicable, to ensure protection requirements are satisfied.

8.2 Voltage Assessment

Low Voltage assessment (voltage rise) - The aggregate Generating Unit capacity must be limited to prevent the highest network voltage from exceeding the upper statutory voltage limit by no more than **2%** of the nominal voltage, during the operating time of the CLS.

For LV networks, the voltage rise during the operating time of the CLS shall be no higher than 253V + 2% (of 230V) = 257.6V.

Where the aggregate Generating Unit capacity is no more than 32A (7.36kW) / phase, the export is limited to 16A (3.68kW) / phase or less and the Power Generating Modules consist entirely of units that have been type tested to ENA EREC G83, ENA EREC G98, ENA EREC G59 or ENA EREC G99 (as applicable), a voltage assessment is not required (Fast Track determination process).

Where **ConnectLV** is used to carry out the CLS voltage assessment, the LV network is modelled for the maximum generation / minimum demand scenario (of the entire circuit) by using the summer profiles (by selecting the sunshine icon). The installed / aggregate generating unit capacity is determined by increasing the capacity of the generation unit connected at the connection point until a voltage rise of **3.35**% (of 240V) is seen anywhere on the network.

Low Voltage assessment (voltage drop) – The aggregate demand of a connection must be limited to prevent the lowest voltage from exceeding the lower statutory voltage limit by no more than 7% of the nominal voltage, during the operation of the CLS.

For LV networks, the voltage drop during the operating time of the CLS shall be no lower than 216.2V - 7% (of 230V) = 200.1V.

Where **ConnectLV** is used to carry out the CLS voltage assessment, the LV network is modelled for the maximum demand / minimum generation scenario (of the entire circuit) by using the winter profiles (by selecting the snowflake icon). The installed / aggregate demand capacity is determined by increasing the capacity of the demand connected at the connection point until a voltage drop of **12.46**% (of 240V) is seen anywhere on the network.

All connections that include Low carbon Technologies (LCT) shall be capable of the provision of up to **80A** of demand (single phase) whilst maintaining a voltage drop no greater than **8%** of nominal voltage (**7.6**% of 240V) and assets shall be maintained to within their thermal capacity.

High Voltage assessment (voltage rise)

For 11kV and 6.6kV networks, the voltage during the operating time of the CLS shall not exceed the maximum network voltage (derived from POL: SD4) by more than **2%** (of nominal voltage). These limits are summarised in Table 1 and Table 2.

Location	Maximum Voltage from POL:SD4	Maximum Voltage During the CLS Operating Time
Circuits with only HV metered Connections		
All	11.66kV	11.88kV
Circuits with 11kV Distribution Transformers		
+5% Tap	11.59kV	11.81kV
+2.5% Tap	11.31kV	11.53kV
Nominal Tap	11.04kV	11.26kV
-2.5% Tap	10.76kV	10.98kV
-5% Tap	10.49kV	10.71kV

Table 1 CLS Max Voltage Limits – 11kV Networks

Location	Maximum Voltage (from POL:SD4)	Maximum Voltage During the CLS Operating Time
Circuits with only HV metered Connections		
All	7.00kV	7.13kV
Circuits with 6.6kV Distribution Transformers		
+8.4% Tap	7.00kV	7.13kV
+5% Tap	6.95kV	7.08kV
+4.2% Tap	6.90kV	7.03kV
+2.5% Tap	6.79kV	6.92kV
Nominal Tap	6.62kV	6.75kV
-2.5% Tap	6.46kV	6.59kV
-4.2% Tap	6.35kV	6.48kV
-5% Tap	6.29kV	6.42kV
-8.4% Tap	6.07kV	6.20kV

Table 2 CLS Max Voltage Limits – 6.6kV Networks

High Voltage assessment (voltage drop)

For 11kV and 6.6kV networks, the voltage during the operating time of the CLS shall not exceed the minimum network voltage (derived from POL: SD4) by more than **2%** (of nominal voltage). These limits are summarised in Table 3 and Table 4.

Location	Maximum Voltage from POL:SD4	Minimum Voltage During the CLS Operating Time
Circuits with only HV metered Connections		
All	10.34kV	10.12kV
Circuits with 11kV Distribution Transformers		
+5% Tap	10.68kV	10.46kV
+2.5% Tap	10.42kV	10.20kV
Nominal Tap	10.17kV	9.95kV
-2.5% Tap	9.92kV	9.70kV
-5% Tap	9.66kV	9.44kV

Table 3 CLS Min Voltage Limits – 11kV Networks

Location	Maximum Voltage (from POL:SD4)	Minimum Voltage During the CLS Operating Time
Circuits with only HV metered Connections		
All	6.2kV	6.07kV
Circuits with 6.6kV Distribution Transformers		
+8.4% Tap	6.61kV	6.48kV
+5% Tap	6.41kV	6.28kV
+4.2% Tap	6.36kV	6.23kV
+2.5% Tap	6.25kV	6.12kV
Nominal Tap	6.10kV	5.97kV
-2.5% Tap	5.95kV	5.82kV
-4.2% Tap	5.85kV	5.72kV
-5% Tap	5.80kV	5.67kV
-8.4% Tap	5.59kV	5.46kV

Table 4 CLS Min Voltage Limits – 6.6kV Networks

8.3 **Thermal Assessment**

A CLS is typically expected to operate within 10 seconds, however, ENA EREC G100 requires that the thermal rating of the capacity be assessed for a reaction time of up to 5 minutes. The risk of multiple high current flows being seen at the connection is mitigated by the requirement of the CLS to 'lock out' to a failsafe capacity in the event of two excursions within any 10 minute period.

This document shall be read in on conjunction with Standard Technique: SD11Z regarding Category Z Load Management Schemes.

Cable assessment - Cables shall be maintained to within the appropriate **seasonal Distribution** current rating as detailed within ST: SD8B.

Overhead Lines – Wires shall be maintained to within **110%** of the appropriate seasonal rating as detailed within **ST: SD11Z.**

Overhead Plant – Overhead plant shall be maintained to within **125%** of the appropriate seasonal rating as detailed within **ST: SD11Z**.

Switchgear – Switchgear thermal capacity is limited by the protection assessment as detailed above.

8.4 **Flicker / Step Voltage change Assessment –** A CLS may control the export of power on site by either curtailing the capacity of the generation unit, turning the generation unit off entirely or by switching on a load. For a limitation system designed to control the maximum demand of a site, the CLS may curtail the demand, turn the demand off entirely or turn on a generator.

Therefore, it can be seen that the operation of a CLS will have an impact of the voltage at the connection point. For compliance with ENA EREC P28 the change in voltage at the point of common coupling must be maintained to a level **≤ 3%.**

It is envisaged that the ENA EREC P28 assessment process will be the determining factor for the calculation for the maximum aggregate installed capacity.

Note: The below assessments are in addition to any assessments required to confirm compliance with ENA EREC P28 for the site as a whole.

Flicker at Low Voltage (Generation Curtailment) – For the assessment of the voltage change an assessment similar to that of a purely resistive load (e.g. Kiln) shall be undertaken with the capacity of the resistive load being **the capacity of the curtailed generation** (e.g. a site with a 4kW export capacity and 9kW aggregate installed capacity where a 5kW battery storage system and a 4kW PV array make up the installation, the connection will be assessed for a change in voltage associated with a 5kW demand being connected or disconnected). Example <here>

Flicker at Low Voltage (Load Curtailment) – For the assessment of the voltage change an assessment similar to that of a purely resistive load (e.g. Kiln) shall be undertaken with the capacity of the resistive load being the rating of the switchable load (this shall be deemed to be 100% of the capacity of the load unless otherwise stated by the installer).

Flicker at High Voltage – For the assessment of the voltage change an assessment similar to a step change in voltage assessment shall be undertaken. The assessment shall detail the maximum possible change in voltage due to the curtailed Import or Export power being disconnected or connected. Example <here>

Voltage Swing - Where a battery is being installed and where the battery can change from an import of energy to export of energy within less than 120 seconds. A voltage swing assessment shall be undertaken unless controls are installed to ramp the change in power (increase and/or decrease). Example <here>

8.5 **ENA EREC G99 Compliance –** The Engineering Recommendation G99 stipulates a maximum aggregate capacity of Power Generating Modules that can be connected to a single phase supply of 17kW and 34kW for a split phase supply (ENA EREC G99 clause 7.6.1).

8.6 **Other Restrictions**

It is possible that other factors may restrict the maximum aggregate **Generating Unit** capacity at a connection, for example fault level contribution, or possible transmission system related restrictions. Where this is the case the Planner shall notify the customer of the reason for the restriction.

9.0 DETERMINATION OF THE MAXIMUM AGGREGATE INSTALLED CAPACITY OF POWER GENERATING MODULES OR MAXIMUM DEMAND. FOR SYSTEMS COMPLIANT WITH ENA EREC G100 VERSION 1 – PERMITTED UNTIL 31ST MARCH 2023

9.1 **Protection Assessment**

The maximum current that flows through the **Connection Point**/s must not cause NGED fuses or overcurrent relays to operate.

(a) The simplest way to guarantee this is to ensure the aggregate **Generating Unit** capacity is no greater than the higher of 1.25 x **Agreed Import Capacity** or 1.25 x **Agreed Export Capacity** + the minimum site demand, whichever value is higher.

(b) If the simple assessment (a) fails an additional, more complex assessment shall be carried out to check that the aggregate **Generating Unit** capacity is no greater than 1.2x the equivalent kVA value derived from the pickup value of NGEDs overcurrent protection settings / cut-out fuse ratings plus the minimum site demand. *See the example within section 8.*

The nominal voltage (i.e. 230V phase to neutral or 6.6kV, 11kV, 33kV, 66kV or 132kV phase to phase) is assumed when calculating the equivalent kVA values.

Where a connection does not have an **Agreed Import Capacity** a value of 18.4kVA (i.e. 80A) per phase is assumed and where a connection does not have an **Agreed Export Capacity** a value of 3.68kVA (16.0A) per phase is assumed. In the absence of other information NGED's cut-out fuses should be assumed to be 80A.

When assessing the minimum demand consideration must be given to shut-down / holiday periods etc.

If both of the above assessments fail the proposal is not acceptable, however, it may be possible to increase the **Agreed Export Capacity** to accommodate the proposed **Power Generating Module**/s without the need to reinforce the network.

NGED Fuse ratings and overcurrent protection settings are dictated by the protection requirements rather than load requirements. It is not normally acceptable to increase these ratings / settings simply to allow a higher aggregate **Generating Unit** capacity without also increasing the rating of the associated NGED cables, overhead lines and/or other plant and equipment. Where it is proposed to change fuse ratings or protection settings an assessment shall be carried out by the Planner or by Engineering Design, as applicable, to ensure protection requirements are satisfied.

9.2 Voltage Assessment

The aggregate **Generating Unit** capacity must also be limited to prevent the highest network voltage from exceeding the upper statutory voltage limit by more than 1% of the nominal voltage, during the operating time of the **ELS**.

For LV networks, the voltage during the operating time of the **ELS** shall be no higher than 253V + (1% of 230V) = 255.3V.

Where the aggregate **Generating Unit** capacity is no more than 32A (7.36kW) / phase, the export is limited to 16A (3.68kW) / phase or less and the **Power Generating Modules** consist entirely of units that have been type tested to ENA EREC G83 or ENA EREC G98 (as applicable), a voltage assessment is not required.

Where WinDebut is used to carry out **ELS** voltage assessment, the LV network is modelled normally (including any existing demand and **Power Generating Modules**) and the aggregate **Generating Unit** capacity at the connection being considered is increased until a voltage rise of **2.4%** (of 240V) is reached. At this point, the aggregate **Generating Unit** capacity modelled at the connection is deeded to be the maximum acceptable value.

For 11kV and 6.6kV networks, the voltage during the operating time of the **ELS** shall not exceed the maximum network voltage (derived from POL: SD4) by more than 1% (of nominal voltage). These limits are summarised in Table 5 and Table 6.

Location	Maximum Voltage from POL:SD4	Maximum Voltage During the ELS Operating Time
Circuits with only HV metered Connections		
All	11.66kV	11.77kV
Circuits with 11kV Distribution Transformers		
+7.5% Tap	11.66kV	11.77kV
+5% Tap	11.59kV	11.70kV
+2.5% Tap	11.31kV	11.42kV
Nominal Tap	11.04kV	11.15kV
-2.5% Tap	10.76kV	10.87kV
-5% Tap	10.49kV	10.60kV

Table 5 ELS Voltage Limits – 11kV Networks

Location	Maximum Voltage (from POL:SD4)	Maximum Voltage During the ELS Operating Time
Circuits with only HV metered Connections		
All	7.00kV	7.07kV
Circuits with 11kV Distribution Transformers		
+8.4% Tap	7.00kV	7.07kV
+5% Tap	6.95kV	7.02kV
+4.2% Tap	6.90kV	6.97kV
+2.5% Tap	6.79kV	6.86kV
Nominal Tap	6.62kV	6.69kV
-2.5% Tap	6.46kV	6.53kV
-4.2% Tap	6.35kV	6.42kV
-5% Tap	6.29kV	6.36kV
-8.4% Tap	6.07kV	6.14kV

Table 6 ELS Voltage Limits – 6.6kV Networks

9.3 **Flicker / Step Voltage change Assessment**

See clause 8.4 above.

9.4 **Other Restrictions**

It is possible that other factors may restrict the maximum aggregate **Generating Unit** capacity at a connection, for example fault level contribution, or possible transmission system related restrictions. Where this is the case the Planner shall notify the customer of the reason for the restriction.

10.0 POWER QUALITY

10.1 The installation shall comply with all relevant power quality requirements including but not limited to:

- ENA EREC P28 (voltage disturbances)
- ENA EREC G5 (voltage distortion / harmonics)
- ENA EREC P29 (voltage unbalance)
- BS EN 61000-3-2 (voltage distortion limits for ≤ 16A/phase equipment)
- BS EN 61000-3-3 (voltage disturbance limits for ≤ 16A/phase equipment)
- BS EN 61000-3-11 (voltage disturbance limits for ≤75A/phase equipment)
- BS EN 61000-3-12 (voltage distortion limits for ≤ 75A/phase equipment)

10.2 A curtailment scheme can only be considered to reduce / improve the connection requirements in association with Power Quality concerns when the system is used to disconnect items opposed to curtailing the flow of current. For example a curtailment scheme is used to energise up to 50 EVCP at any point in time when a total of 70 chargers are installed.

10.3 Compliance of individual components does not guarantee the installation as a whole will satisfy the power quality requirements.

10.4 Customers shall provide suitable information at the time of application to allow the planner to assess for power quality before connection. Further guidance can be found in ST: SD6J, which covers equipment rated ≤ 75A per phase and ST: SD6F, which applies to equipment rated greater than 75A per phase.

10.5 If single-phase **Generating Units** are installed within a 3 phase or split phase installation they shall, as far as possible, be balanced across the phases. The difference in **Generating Unit** output between the highest and lowest phases should not exceed 16A, in accordance with EREC G59 or EREC G99, as applicable.

11.0 ACCURANCY, THRESHOLDS AND RESPONSE RATES

11.1 The overall accuracy of **CLS** / **ELS** with regard to measurement and control of **Active Power** and, where applicable, voltage, shall be determined by the manufacturer of the system and published within its operating manual. These tolerances should, as far as possible, take account of sensing / measurement errors, processing errors, communication errors and control errors. Consideration should also be given to environmental factors (e.g. the expected ambient temperature range).

11.2 The maximum permissible tolerance for the **CLS** measurement and control of current is ± 2% of the MEL or MIL and ± 1% of the nominal voltage at the connection point.

11.3 The maximum permissible tolerance for the **ELS** measurement and control of current is ± 5%.

11.3 The settings applied to the **CLS / ELS** shall take account of the published tolerances to ensure the required export limits and voltage limits are maintained.

For example, if an **ELS** is required to limit the export of **Active Power** to 100kW and it has an overall tolerance of ± 5% at this value, it should be set to limit the **Active Power** to 95kW (i.e. 95% of the required value).

11.4 Only for ELS: Where backup reverse power protection is installed it shall measure the **Active Power** at the intake position/s and trip the **Generating Units** if the **Agreed Export Capacity** is exceeded for more than 5s. This backup system should have an **Active Power** accuracy of +/-3% or better.

11.5 Only for CLS: Where backup reverse power protection is installed it shall measure the **Current Flow** at the intake position/s and trip the **Generating Units or Load** if the **Agreed Export or Import Capacity** is exceeded for more than 10s. This backup system should have an **Active Power** accuracy of +/-2% or better.

12.0 OPERATING STATES (*INFORMATIVE*) – FOR CLS ONLY

12.1 CLS installations complaint with ENA EREC G100 version 2 have four operating states, these states of operation are a form of control to limit the frequency of operation of the curtailment installation and form part of the fail safe functionality. If a curtailment scheme were to operate excessively, this would indicate that the maximum and minimum export or import capacities differ from that of the assessment and could result in voltage fluctuation issues (flicker complaint).

12.2 State 1 – Normal operation

This is the normal operating state of the **CLS**. In this state the **CLS** will be modulating the consumption and generation of the **Devices** it controls such that current flowing at the **Connection Point** remains within that required by the **MEL** or **MIL** as appropriate and that the voltage at the **Connection Point** remains within statutory limits.

12.3 State 2 – Occasional excursion

From time to time conditions within the **Customer's Installation** could be such that the current flow exceeds the **MEL** or **MIL**. This could be caused by normal operation (e.g. switching) of the **Customer's Devices** or other loads in the **Customer's Installation** (e.g. a kettle in a **Domestic Installation**), or it could be caused by the sudden failure or tripping of part of the **Customer's** load or generation equipment. Very short excursions into state 2 as part of normal operation are not problematic provided they are short, i.e. less than 10s. However longer excursions, such as might accompany failure or tripping of a **Device** should be rare by definition, and therefore not considered as normal operation. In both cases the **CLS** will recognize the condition and shall have the capability to control the **Devices** and bring the current flowing at the **Connection Point** back within the **MEL** or **MIL** and within a maximum response time.

The default maximum response time for a **CLS** to bring the current flow back within **MEL** or **MIL** is 1 minute.

12.4 State 2 Limits

This is the calculation of the maximum permissible current flow that can exist prior to either a Thermal, Protection or Voltage **extended limit** being exceeded. If the State 2 Limit is exceeded the CLS must progress to State 3.

12.5 State 3 – Failed state

This state is designed to cater for a failure of the **CLS** in some way. In this state the **Devices** shall be set to operate at levels that cannot, whatever happens next to equipment in the **Customers Installation**, breach the **MEL** or **MIL**. In many cases this will simply mean that the **Devices** are tripped or switched off. An alternative could be that some **Devices** are set to a clearly defined low power state such that their operation can never result in the current flowing at the **Connection Point** approach the **MEL** or **MIL**.

If state 3 operation is caused by:

- excessive import or low volts, then the generation **Devices** shall not be constrained or tripped by the **CLS**;
- excessive export or high volts, then load **Devices** shall not be constrained or tripped by the **CLS**.

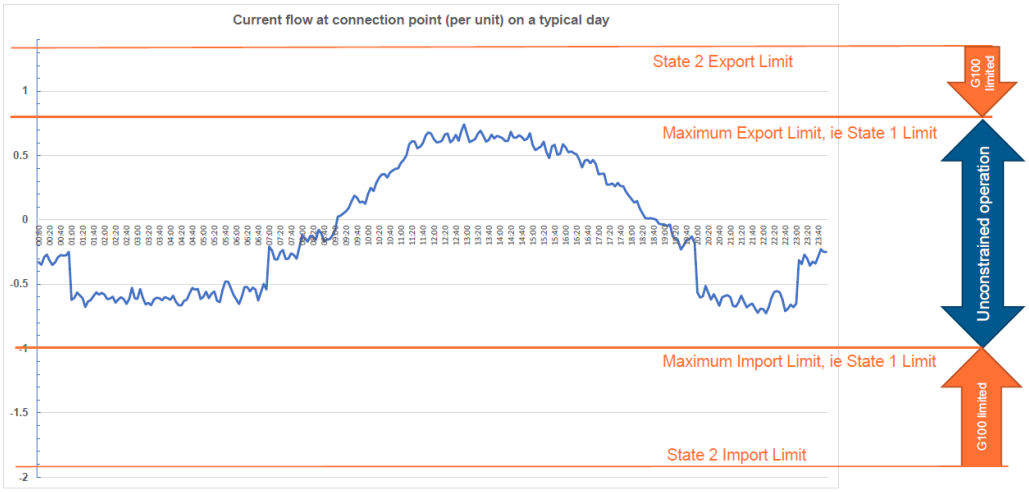
When a failure is detected by the **CLS**, it shall set all the **Devices** into their state 3 operational state within 10s.

12.6 State 4 – Operation without a CLS

State 4 need not be implemented by default. It is a state that allows operation of some of the Customer's Devices without the control of a **CLS**. Such a state might be required if the **CLS** is out of service for a considerable time for some reason.

The operational arrangements for state 4 in many cases will be the same as those for state 3, i.e. with the **Devices** switched off or set to a permanently clearly defined low power state. However, particularly for larger industrial or commercial installations, NGED might specifically agree how the installation can be operated in the absence of a functioning **CLS**. State 4 operation will only be allowed by pre-agreement with NGED.

12.7 Operational state concept



A customers installation shall be designed to operate within the state 1 bounds and a customer installation should only enter into the state 2 bounds for a typical duration of up to 10 seconds (max 60* seconds) to mitigate thermal, voltage or flicker limits. A connection may enter the state 2 bounds due to a sudden change in demand (e.g. a power shower being turned on or off) and the time taken for the limiting scheme to modulate the current flow.

The upper bounds of state 2 are known as the State 2 limits and if these thresholds are passed, the scheme shall enter the 'failed state' (State 3) where the customers demand or generation is tripped or switched off to ensure that the normal ASC is not exceeded.

** Reciprocating gas engine driven generation and micro hydro are permitted a reaction time of up to 180 seconds subject to the voltage being maintained within the statutory voltage range.*

12.8 Excessive operation

A CLS installation is designed to curtail current flow with a typical reaction time of up to 10 seconds, this will mitigate temperature rise on assets and therefore thermal overload concerns are mitigated.

Statutory voltage must be maintained for 95% of the time when assessed over a 7 day period (see ST: SD6J for further detail) and therefore excessive excursion into the state 2 voltage bounds (i.e. a voltage rise **>1.44% <3.35**% within **ConnectLV**) could cause a statutory voltage complaint. To mitigate this risk a CLS will enter into a state 3 operation (typically the demand or generation unit will be switched off) when in breach of any of the follow criteria;

- A single excursion into state 2 operation that persists for more than 1 minute
- There are more than three excursions (each of more than 10s and less than 1 minute) into state 2 operation in any 24 hour period
- The time between any two consecutive excursions into state 2 operation of greater than 10s is 10 minutes or less (measured from the time of re-entry into state 1 operation from state 2 operation following the first excursion)

Other criteria applies to reciprocating gas engines.

The **CLS** should be capable of interrogation by the **Customer** to determine the nature of the failure. The **Manufacturer** or **Installer** shall ensure that the **CLS** remains in state 3, including through the power supply to the **CLS** being cycled on/off, until it is reset.

For **CLSs** installed in **Domestic Installations**, 3 resets shall be allowed in any 30 day period. If this criterion is breached the **CLS** will remain locked in state 3 pending further investigation and resolution of the issues causing the **CLS** to be locked-out in state 3.

For **CLSs** installed in non-domestic installations any excursion into state 3 operation shall not be capable of being reset within 4 hours of the start of state 3 operation.

13.0 APPLICATION AND ACCEPTANCE

13.1 Customers / installers shall provide NGED with information on the proposed **CLS** or **ELS** to enable the impact on the network to be assessed. The appropriate application forms are provided via the following links;

- Application form for an ELS installation (must be commissioned before 1st April 2023)
- Application form for a CLS installation (mandatory from 1st April 2023)

The following information shall be provided by the installer:

- Single line diagram of **CLS / ELS** that shows the position and function of each component of the **CLS / ELS**.
- An explanation of the **CLS / ELS** operation
- Description of any **Failsafe** functionality (i.e. interruption of sensor signals, load, loss of power, internal fault detection etc.)

13.2 An ENA Type Test Register for Fully Type Tested systems will be created and where a reference number to the database is provided, this shall supersede the requirement for the customer/installer to provide product information.

Where a product is not included on the ENA Type Test Register the customer / installer shall provide the manufacturers **CLS** product information via the following product form.

13.3 NGED will assess the **CLS** / **ELS** using the process described in Appendix B and where a **CLS** / **ELS** is acceptable, the engineer will determine the maximum aggregate **Generating Unit** capacity.

14.0 COMMISSIONING, TESTING AND WITNESSING

14.1 Commissioning requirements and recommended test sequences are specified in ENA EREC G100. The generator commissioning, test and witnessing requirements (defined in ENA EREC G83, G98, G59 and G99) must also be satisfied. Where a **Fail Safe** interlocking system or **Fail Safe** control system is installed that pre-emptively prevents the Agreed Export Capacity from being exceeded this shall also be commissioned, tested and where required by NGED, witnessed to ensure it meets the requirement of this document.

14.2 **Aggregate Generating Unit Capacity above 3.68kW / phase and up to 7.36kW / phase**

ENA EREC G100 version 1 commissioning tests shall be carried out, with the exception of the fail-safe tests. The installer shall submit the **ELS** and generator installation / commissioning confirmation forms to NGED within 28 days, in accordance with ENA EREC G100 and G59 or G99 (as applicable).

Commissioning confirmation form for a ENA EREC G100 version 1 installation

ENA EREC G100 Version 2 details a reduced set of test to be undertaken for Fully Type Tested systems, however, onsite communication and power supply fail safe tests are still required. Where a system is not fully type Tested, the full range of commissioning checks shall be undertaken

In all cases an Installation and Commissioning confirmation form shall be submitted.

Commissioning confirmation form for an ENA EREC G100 Version 2 installation

NGED do not normally witness these tests if the Power Generating Modules (including the any **Electricity Storage**) have been type tested to G83, G98, G59 or G99.

14.3 **Aggregate Generating Unit Capacity above 7.36kW / phase**

In this case the ENA EREC G100 and G59 or G99 (as applicable) shall be carried out, including the G100 fail-safe tests. Installation and commissioning confirmation forms shall be completed by the installer and submitted to NGED within 28 days.

NGED do not normally witness these tests where the aggregate **Generating Unit** capacity is less than 50kW (3 phase) and 17kW (single phase) and all the **Power Generating Modules** have been type tested to G83, G98, G59 or G99.

Where the aggregate **Generating Unit** capacity is above 17kW per phase (50kW 3 phase) NGED normally witness the **CLS** / **ELS** commissioning tests carried out by the installer, however, this requirement may be waived at NGED's discretion.

The commissioning forms are the same as above.

15.0 CUSTOMER USE OF NGED INSTRUMENT TRANSFORMERS

15.1 In general customers will not have access to NGED's instrument transformers. NGED may permit access to the secondary connections of their instrument transformers or signals derived from them where the following preconditions and requirements are met. Where reasonably practicable, signals derived by an NGED-owned transducer should be provided instead of direct access to secondary connections.

15.2 **Preconditions**

The customer has demonstrated that it is not reasonably practicable for them to provide their own instrument transformer. *NGED will not normally provide access to an instrument transformer at a new build site, except where there is a clear safety benefit to accommodating the instrument transformer within NGED's compound or equipment. A typical example is where the required protection solution is for the customer to install unit protection (e.g. high-impedance or biased current differential protection) utilising current transformers located within NGED's metering circuit breaker that overlap with NGED's protective zones.*

NGED have determined that it is reasonably practicable for NGED to provide access to their instrument transformer. *NGED will not normally provide standalone instrument transformers for use by customers, but may consider accommodating a VT winding or CT core within plant/apparatus at the time it is being ordered. NGED will not retrospectively add instrument transformers to existing plant for use by customers.*

15.3 **General Requirements**

- The customer shall not take any metallic connections outside of the curtilage of the earthing system to which they are connected.
- The instrument transformer shall remain NGED's property.
- The use of NGED instrument transformers and the wiring interfaces to them shall be clearly recorded in the Site Responsibility Schedule.
- The customer shall state their connected burden in writing, and NGED shall confirm that it is within the rated capability of the instrument transformer.
- The customer shall discuss and agree any proposed change of burden with NGED in advance.
- The requirements of the applicable Metering Code of Practice shall be complied with.
- The customer shall not connect any provided terminal to earth unless expressly permitted by NGED.

15.4 Specific Requirements for Voltage Transformers

- NGED's voltage transformer shall not be used to provide a voltage reference for synchronisation or interface protection.

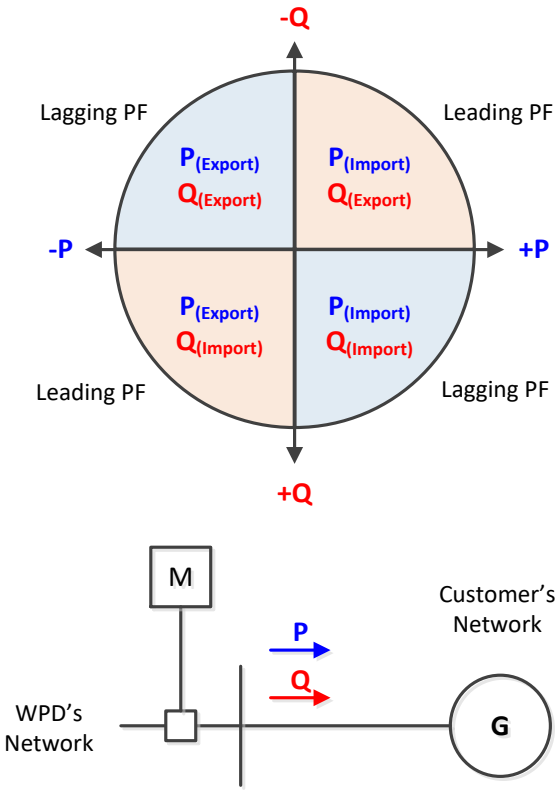
- The connections provided to the customer shall be suitably sub-fused such that a fault on the customer's installation does not compromise other uses of the voltage transformer.

15.5 Specific Requirements for Current Transformers

- The current transformer shall be dedicated to the customer's use. It shall not have any NGED or metering burdens connected to it.

- The customer shall provide suitable shorting facilities within their installation to facilitate safe work.

POWER FLOW CONVENTION

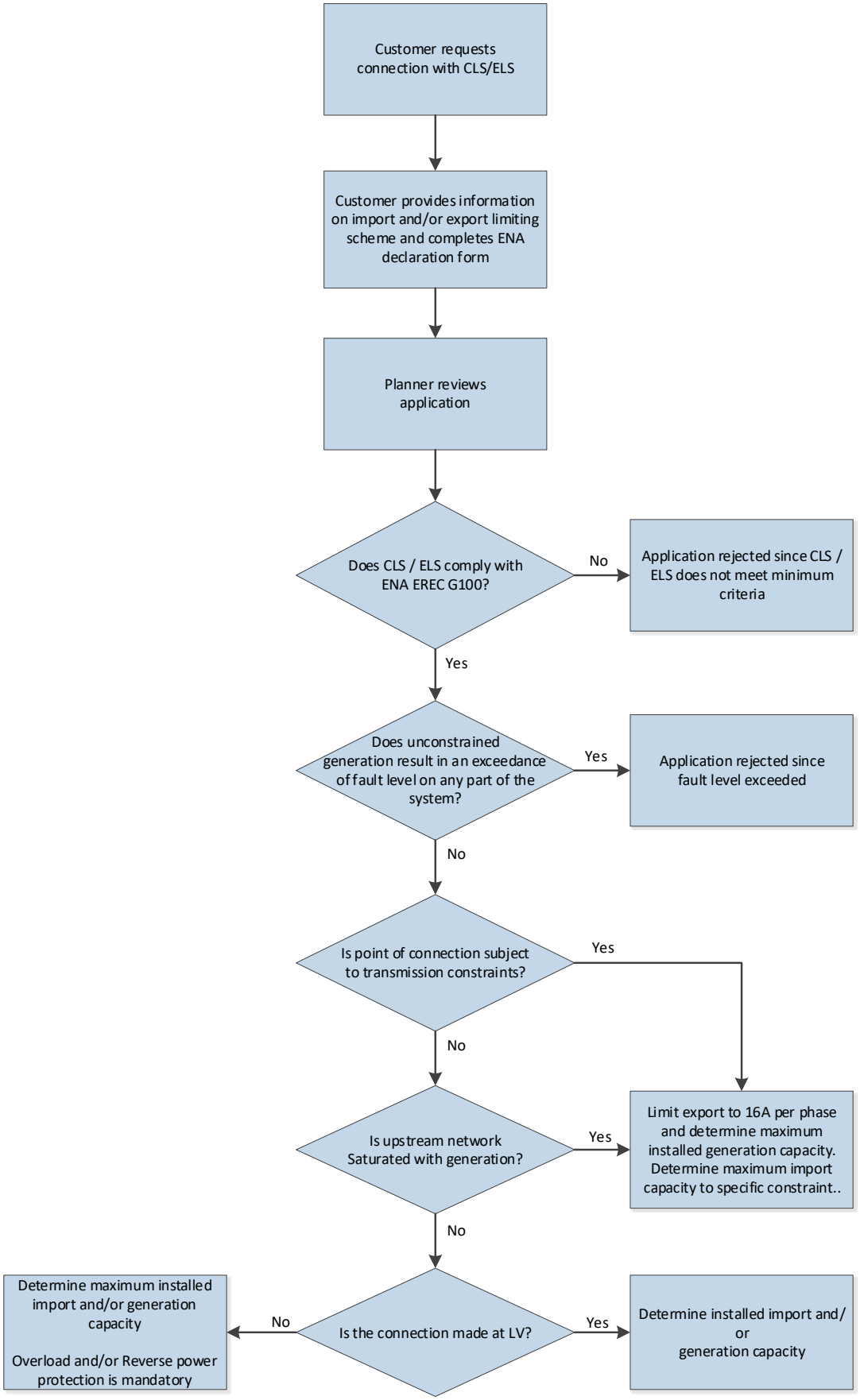


P = Active Power (kW)
Q = Reactive Power (kVAr)

Active Power (P) is deemed to be positive (+ve) when it flows into the customer's installation from the distribution system.

Reactive Power (Q) is deemed to be positive (+ve) when lagging VARs flow into the customer's installation from the distribution system.

Customer owned import or export limitation scheme acceptability criteria



APPENDIX C

Example assessments for the determination of the Maximum Export/Import capacities and the Maximum installed Aggregate capacities.

Link to examples from ENA EREC G100 Version 2.

APPENDIX D

SUPERSEDED DOCUMENTATION

This document supersedes ST: SD1E/5 dated March 2020 which has now been withdrawn.

APPENDIX E

RECORD OF COMMENT DURING CONSULTATION

Comment form

APPENDIX F

ASSOCIATED DOCUMENTATION

POL: SD4	11kV and 6.6kV System Design
ST: SD6F	Dealing with Potentially Disturbing Electrical Loads/Equipment
ST: SD6J	Connection design – potentially disturbing electrical equipment rated ≤75A/phase subject to conditional connection
ST: NC1AD	Process for the connection of energy storage schemes
ST: NC1R	Relating to Applications for the Connection of Embedded Generators rated up to 75A (17kW) per phase to NGED's Distribution System
EREC G5	Planning levels for harmonic voltage distortion and connection of non-linear equipment to transmission systems and distribution networks in the United Kingdom
EREC G59	Recommendations for the connection of generation plant to the distribution systems of licensed distribution network operators
EREC G83	Recommendations for the Connection of Type Tested Small-scale Embedded Generators (Up to 16A per Phase) in Parallel with Low-Voltage Distribution Systems
EREC G98	Requirements for the connection of Fully Type Tested micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019
EREC G99	Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019
EREC G100	Technical Requirements for Customer Export Limiting Schemes
EREC P28	Planning Limits for Voltage Fluctuations Caused By Industrial, Commercial and Domestic Equipment in the UK
EREC P29	Planning Limits for Voltage Unbalance in the United Kingdom
BS EN 61000-3-2	Limits for harmonic current emissions (equipment input current ≤16 A per phase)

BS EN 61000-3-3	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection
BS EN 61000-3-11	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems – Equipment with rated current ≤ 75A and subject to conditional connection
BS EN 61000-3-12	Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current >16 A and ≤ 75 A per phase.

APPENDIX G

KEY WORDS

Connection, Generator, SSEG, Export Limiting Scheme, ELS, Customer Limiting Scheme, CLS, Reverse Power, G100.