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INDEX

1 OBJECTIVE

This operating procedure manual sets out the minimum operational and maintenance requirements for interconnected embedded generators *(Category B and C – 1 MVA and above)*, operated in parallel with the City of Cape Town's (CCT) electrical networks. This serves to filfill the Distributor's obligation in terms of the South African Distribution Code and System Operating Code.

2 SCOPE

This document applies to systems where the generating plant (of 1 MVA capacity and above) may be paralleled with the CCT's network permanently, periodically or temporarily. For generating plant that does not operate in parallel with the Distribution grid (e.g. own use customer generators off-grid or stand-by generators). the Standard for Standby Supply Soft Load Transfer schemes document EEB317 shall apply.

This provides for generic interconnection requirements and shall be applicable to all different types of generators, prime movers, etc. In certain cases, (e.g. wind generating technology) it might be necessary to supplement the requirements of this standard with additional technology-specific requirements.

This also addresses the practical utility interconnection scenarios for EG systems meeting the requirements of NRS 097-2: Grid interconnection of embedded generation: Part 2 Small scale embedded generation, proposed NRS 097-1 and all other applicable standards and Grid Codes.

3 REFERENCE / RELATED DOCUMENTS

The following documents contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the references indicated were valid. Compilers of documents are encouraged to apply the most recent editions of the documents listed below. Information on currently valid national and international standards and specifications can be obtained from the SABS.

Where any discrepancy exists between the NRS standards and these requirements, these requirements take precedence unless amended in writing by the CCT. The technical requirements for all related grid infrastructure shall be as per the CCT specified technical standards that can be provided on application.

Parties using this standard shall apply the most recent edition of the documents listed below:

Identifier	Title
South African Legislation:	Electricity Regulation Act, 2006 (Act No 4 of 2006). Occupational Health and Safety Act, 1993 (Act No 85 of 1993. South African Distribution Code (all parts). South African Grid Code (all parts). Grid Connection Code for Renewable Power Plants (RPPs) connected to the electricity Transmission System (TS) or the Distribution System (DS) in South African Grid Connection Code for Battery Energy Storage Facilities (BESF) connected to the electricity Transmission System (TS) or the Distribution System (DS) in South Africa (once promulgated)
International and National Standards	IEC 62271-100: High-voltage alternating-current circuit-breakers.

	IEEE 1547, IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems. IEEE 1547.1, IEEE Standard Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems. NRS 029, Current transformers for rated AC voltages from 3,6kV up to and including 420kV. NRS 030, Electricity distribution - Inductive voltage transformers for rated AC voltages from 3,6kV up to and including 145kV for indoor and outdoor applications. NRS 031, Alternating Current disconnectors and earthing switches (above 1000V). NRS 037-1, Telecontrol Protocol for stand-alone remote terminal units. NRS 047-1, Electricity Supply, Quality of Service NRS 048-2, Electricity Supply - Quality of Supply Part 2: Voltage characteristics, compatibility levels, limits and assessment methods. NRS 048-3, Electricity Supply - Quality of Supply Part 3: Procedures for measurement and Reporting. NRS 048-4, Electricity Supply - Quality of Supply Part 4: Application guidelines for utilities. NRS 048-6, Electricity Supply - Quality of Supply Part 6: Measurement and reporting of medium-voltage network interruption performance. NRS 048-8, Electricity Supply - Quality of Supply Part 8: Measurement and reporting of extra high voltage (EHV) and high voltage (HV) network interruption performance. NRS 048-9, Electricity Supply - Quality of Supply Part 9: Code of Practice - Load reduction practices, system restoration practices and critical load and essential load requirements under power system emergencies. NRS 054, Rationalized User Specification - Power Transformers. SANS 473 Automated meter reading for large power users SANS 474 Electricity metering - Standard requirements SANS 1019, Standard voltages, currents and insulation levels for electricity supply. NRS 097-2-1: Grid interconnection of embedded generation: Part 2 Small scale embedded generation Section 1: Utility interface NRS 097-1 Code of Practice for the interconnection of embedded generation to electricity distribution networks: Part 1 MV and HV (once published)NRS 097-2-3 Grid interconnection of embedded generation: Part 2 Small scale embedded generation Section 3: Simplified utility connection criteria for low-voltage connected generators IEEE 1815-2012, Standard for Electric Power Systems Communications-Distributed Network Protocol (DNP3). SANS 211 / CISPR 11 Industrial, scientific and medical equipment Radio-frequency disturbance characteristics Limits and methods of measurement SANS 8894: Dead-grid safety lock [under development] SANS 10142-1 The wiring of premises Part 1: Low-voltage installations SANS 10142-1-2 The wiring of premises Part 1-2: Additional special requirements for low

	voltage small scale embedded generation installations connected in parallel to the normal electricity supply [under development] SANS 10142-2 The wiring of premises Part 2: Medium-voltage installations above 1 kV AC not exceeding 22 kV AC and up to and including 3 MVA installed capacity SANS 61000-2-2, Electromagnetic compatibility (EMC): Part 2-2: Environment - Compatibility levels for low-frequency conducted disturbances and signalling in public low-voltage power supply systems, SANS 60050-441 International electrotechnical vocabulary Chapter 441: Switchgear, controlgear and fuses SANS 60529, Degrees of protection provided by enclosures (IP Code). SANS 61000-4, Electromagnetic compatibility (EMC): Test and measurement techniques (All sections).
International and National Standards	IEC 60068-2-1, Environmental testing - Part 1 Cold. IEC 60068-2-2, Environmental testing - Part 2 Dry Heat. IEC 60068-2-30, Environmental testing - Part 30 Damp heat, cyclic (12h + 12h cycle). IEC 60255-30, Electrical relays Part 3: Single input energizing quantity measuring relays with dependent and independent time. IEC 60255-6, Electrical relays Part 6: Measuring relays and protection equipment. IEC 60255-21, Electrical relays Part 21 Vibration, shock, bump and seismic tests on measuring relays and protection equipment (All sections). IEC 60255-22, Electrical relays Part 22 Electrical disturbance tests for measuring relays and protection equipment (All sections).
Other Standards	Eskom 240-61268576 Standard for the interconnection of embedded generation Eskom 240-126260252 The dead-grid safety lock specification and minimum requirements for LV connected photovoltaic embedded generators
Other Documents	CCT SSEG requirements document: EBZA33 City of Cape Town Electricity Supply By-law EEB 317 - City of Cape Town Standard for standby supply soft load transfer scheme QoS, Operation Procedure Manual and Connection Equipment (Status: Under development)

4 DEFINITIONS, ABBREVIATIONS AND TERMS

Co-generator: source of electrical power that complies with types I, II or III below:

- Type I: Projects utilizing process energy which would otherwise be underutilized or wasted (e.g. waste heat recovery).
- Type II: Primary fuel based generation projects which produce, as part of their core design, other usable energy in addition to electricity (e.g. Combined Heat and Power projects).
- Type III: Renewable fuel based projects where the renewable fuel source is both the primary source of energy, and is a co-product of an industrial process (e.g. use of bagasse and/or forestry waste from the sugar and paper industries).

Control gear: A general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for the control of electric energy consuming equipment.(SANS 60050-441)

Disconnector: A mechanical switching device which provides, in the open position, an isolating distance in accordance with the specified requirements. Note: A disconnector is capable of opening and closing a circuit when either negligible current is broken or made or when no significant change in the voltage across the terminals of each of the poles of the disconnector occurs. It is also capable of carrying currents under normal circuit conditions and carryingfor the specified time currents under abnormal conditions such as those of short circuit. (SANS 60050-441)

Distributor: A legal entity that owns or operates/distributes electricity through a distribution system. [SAGC]

Distribution System: An electricity network consisting of assets operated at a nominal voltage of 132 kV or less. [SAGC]

Embedded generator's authorised person: person appointed by the embedded generator in terms of the appropriate act to sanction the return to service of plant after major maintenance or repair

Embedded generator's responsible person: person appointed by the embedded generator in terms of the appropriate act to receive communications and take necessary action in accordance with instructions from the system controller

Embedded generation (EG): An embedded generator using renewable power plant primaryrenewable energy sources or fuel driven energy sources.

Embedded generator: A legal entity that operates one or more unit(s) that is connected to the Distribution System. Alternatively a legal entity that desires to connect one or more unit(s) to the Distribution System (SAGC).
NOTE: This definition includes all types of connected generation, including co-generators and renewables. Alternatively, the item of generating plant that is or will be connected to the distribution network.

High voltage: nominal voltage levels greater than 44 000V and up to and including 220 000V [SANS 1019]

Indoor switchgear and control gear: Switchgear and controlgear designed solely for the installation within a buildingor other housing, where the switchgear and contolgear is protected against wind, rain, snow, abnormal dirt deposits, abnormal condensation, ice and frost (SANS 60050-441)

islanding: The opening of a circuit breaker or circuit breakers resulting in the severance of the synchronous connection between the Network Service Provider's network and the Embedded Generator, or between the Network Service Provider's network

Loss-of-grid protection: relay protection designed to detect the loss of connection to the utility network and trip the embedded generator to prevent it from energizing an island

Low voltage: nominal voltage levels up to and including 1kV [SANS 1019]

Medium voltage: nominal voltage levels greater than 1 000V and up to and including 44 000V [SANS 1019]

Outdoor switchgear and controlgear: Switchgear and controlgear suitable for installation in the open air, i.e. capable of withstanding wind, rain, snow, dirt deposits, condensation, ice and frost. (SANS 60050-441)

Point of common coupling (PCC): The point in a network where more than one customer is connected or will be connected (NRS 000-1: 2008) The electrical node where more than one customer is connected (SAGC).

Point of connection (POC) The electrical node(s) on the Network Service Provider's network where the Embedded Generator's electrical equipment is physically connected to the Network Service Provider's electrical equipment. (Eskom definition in document 240-61268576)**.** The electrical node on a distribution system where a customer's assets are physically connected to the Distributor's assets (SAGC).

Point of Control : The point at which the electrical installation on or in any premises can be switched off by a user or lessor from the electricity supplied from the point of supply [Regulation R1, OHS Act] NRS 000-1:2008. The point at which an electrical installation on or in any premises can be switched off by a user or lessor from the electricity supplied from the point of supply, or the point at which a particular part of an electrical installation on or in any premises can be switched off where different users occupy different portions of such premises. Shared network charge (EGD SNC) policy.

Point of supply (POS): The physical point on the electrical network, where electricity is supplied to a customer or where the customer's network connects to that of the utility (NRS 000-1:2008). The point determined by the service provider at which the service provider supplies electricity to any premises. This is normally the point on the boundary of the property at which electricity is supplied to the property (EGD SNC policy). Physical point on the electrical network where electricity is supplied to a customer (SAGC).

Point of generator connection (PGC): The circuit-breaker and associated ancillary equipment (instrument transformers, protection, isolators) that connects a generator to any electrical network. Where more than one such circuit-breaker exists, the PGC shall be the circuit-breaker electrically closest to the generator.

Point of utility coupling (PUC):
The circuit-breaker that connects the embedded generator facility to the distribution network.
NOTE: This could include associated ancillary equipment (instrument transformers, protection, isolators). The PUC forms the point of demarcation between the assets of the distributor, and those of the embedded generator. The PUC may be located near the Point of Control or may be some other point(s) within the Embedded Generator's facility between the PGC and Point of Control. The PUC and POS can be the same i.e. the point at which the utility infrastructure is connected to the consumer's network and responsibility is then transferred from one party to the other for ownership and maintenance.

Point of Secure Supply (PSS): That point on the Network Service Provider's network at which a single upstream contingency will not result in the islanding of an Embedded Generator with a portion of the supply network.

Renewable Power Plant (RPP): A unit or a system of generating units producing electricity based on a primary renewable energy source e.g. wind, sun, water, biomass, etc. A RPP can use different kinds of primary energy sources. If a RPP consists of a homogenous type of generating units, it can be named as follows [RSA Grid Code Requirements for Renewable Power Plants]:

- **PV Power Plant (PVPP):** A single photovoltaic panel or a group of several photovoltaic panels with associated equipment operating as a power plant.
- **Concentrated Solar Power Plant (CSPP):** A group of aggregates to concentrate the solar radiation and convert the concentrated power to drive a turbine or a group of several turbines with associated equipment operating as a power plant.
- **Small Hydro Power Plant (SHPP):** A single hydraulic driven turbine or a group of several hydraulic driven turbines with associated equipment operating as a power plant.
- **Landfill Gas Power Plant (LGPP):** A single turbine or a group of several turbines driven by landfill gas with associated equipment operating as a power plant.

- **Biomass Power Plant (BMPP):** A single turbine or a group of several turbines driven by biomass as fuel with associated equipment operating as a power plant.
- **Biogas Power Plant (BGPP):** A single turbine or a group of several turbines driven by biogas as fuel with associated equipment operating as a power plant.
- **Wind Power Plant (WPP):** A single turbine or a group of several turbines driven by wind as fuel with associated equipment operating as a power plant. This is also referred to as a wind energy facility (WEF).

Renewable Power Plant (RPP) Categories: Renewable power plants are grouped into the following three categories [GCRPP]:

- **Category A:** 0 – 1 MVA This category includes RPPs with rated power of less than 1 MVA and connected to the LV voltage (typically called 'small or micro turbines'). This category shall further be divided into 3 sub-categories:
  (i) Category A1: This sub-category includes RPPs of Category A with rated power in the range of 0 to 13.8 kVA.
  (ii) Category A2: This sub-category includes RPPs of Category A with rated power in the range greater than 13.8 kVA but less than 100 kVA.
  (iii) Category A3: This sub-category includes RPPs of Category A with rated power in the range 100 kVA but less than 1 MVA.
  Note: For RPPs connected to multi-phase supplies (two- or three-phase connection at the POC), the difference in installed capacity between phases may not exceed 4.6 kVA per phase.
- **Category B:** 1 MVA – 20 MVA
  This category includes RPPs with rated power in the range equal or greater than 1 MVA but less 20 MVA.
  Note: GCBESF has additional categories, i.e. B1 ≥1 MW to < 5 MW and B2 ≥ 5 MW to < 20 MW)
- **Category C:** 20 MVA or higher This category includes RPPs with rated power equal to or greater than 20 MVA.

Response Time – Acknowledgement time plus intervention time (*Acknowledgement time is receipt of the alarm or noticing a fault; Intervention time is time to reach the plant by a service technician***)**

Resolution Time: (or Repair Time) is the time to resolve the fault starting from the moment of reaching the EG. Resolution Time is generally not guaranteed, because resolution often does not depend totally on the service provider.

Restoration Time: Time between the Interruption start time and the interruption end time (includes Return to service)

Ring main unit: switchgear assembly with an external metal enclosure, usually comprising two ring main switches connected in series and a switch, switch-fuse, or switch with circuit breaking capacity connected to the junction between the ring main switches. (NRS 000-1: 2008 Ed 1)

Soft load transfer (SLT): A system for a stand-by supply that needs momentarysynchronisation/paralleling with the City's distribution network prior to operating the automatic transfer switch (ATS) when the City's supply is restored and visa versa, to allow a seamless transfer of supply to customer loads.

Stand-by generator: legal entity that operates or desires to operate a generating plant so as to provide a stand-by supply in the event of a loss of the grid electricity supply
NOTE: The stand-by generator's plant will only be connected to the CCT's network for maintenance load testing, and only if the requirements of this code of practice have been fulfilled.

Substation (of a power system): part of a power system, concentrated in a given place, including mainly the terminations of transmission or distribution lines, switchgear and housing and which may

also include transformers. It generally includes facilities necessary for system security and control (e.g. the protective devices) [IEC]

Switchgear: A general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for the use in connection with generation, transmission, distribution and conversion of electrical energy. (SANS 60050-441)

Switchgear and controlgear: A general term covering switching devices and their combination with associated control, measuring, protective and regulating equipment, also assemblies of such of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures. (SANS 60050-441)

Switch disconnector: A switch which, in the open position, satisfies the isolating requirements specified for a disconnector. (SANS 60050-441)

Switch [disconnector] [switch-disconnector] fuse: A switch [disconnector] [switch-disconnector] in which one or more poles have a fuse in series in a composite unit. (SANS 60050-441)

Synch-check: (Synchro-check) relay/function that electrically determines if the difference in voltage magnitude, frequency and phase angle falls within allowable limits. Synch check allows the closing conditions of a circuit breaker to be checked by inhibiting the closing circuit until approach of the correct synchronising conditions

Synchronising: The process of manually (synchroscope etc.) or automatically (synchronising unit) controlling generation equipment to attain the conditions where the voltage magnitudes, frequency and phase angle differences, of two independent electrical systems, fall within allowable limits so as to initiate an interconnection between the two electrical systems.

System Operator: The legal entity licensed to be responsible for short-term reliability of the Interconnected Power System, which is in charge of controlling and operating the Transmission System and dispatching generation (or balancing the supply and demand) in real time. (SAGC).

System controller: person on shift at the CCT's or System Operator's Control Centre.

Thermal Generating Unit: A generating unit that uses heat (for instance the burning of fossil fuels) to generate electricity (either through steam or internal combustion processes). This shall include coal, concentrated solar power, nuclear and gas turbine units [SAGC: The Scheduling and Dispatch Rules].

Transmission System (TS): The TS consists of all lines and substation equipment where the nominal voltage is above 132 kV. All other equipment operating at lower voltages are either part of the Distribution System or classified as transmission transformation equipment. (SAGC)

Transmission Network Service Provider (TNSP): A legal entity that is licensed to own and maintain a network on the Transmission System (SAGC).

Utility lockable switch: A 24/7 accessible disconnector to the utility associated with the embedded generator source isolation that has an isolating switch with an utility shackle padlock function.

4.2 Abbreviations

CB: Circuit-Breaker
CCT: City of Cape Town
CoC: Certificate of Compliance
CT: current transformer
DUoS: Distribution Use-of-System
EG: embedded generator

EGD: Electricity Generation and Distribution
ERA: Electricity Regulation Act
HV: high voltage
LV: low voltage
MV: medium voltage
NERSA: National Energy Regulator of South Africa
PCC: point of common coupling
PGC: point of generator connection
POC: Point of Connection
POD: Point of delivery
POS: Point of supply
PUC: point of utility coupling
QOS: quality of supply
SADCNC: South African Distribution Code: Network Code
SADCSOC: South African Distribution Code: System Operating Code
SAGC: South African Grid Code
SATGCNC: South African Transmission Grid Code: Network Code
SCADA: supervisory control and data acquisition
SLT: soft load transfer
SO: System operator
SSP: secure supply point
SSEG: Small Scale Embedded Generation
TNSP: Transmission Network Service Provider
TS: Transmission system
RPP: Renewable Power Plant
RTU: remote terminal unit
VT: voltage transformer

5 BACKGROUND

This Systems Operating procedure manual serves to filfill the Distributor's obligation in terms of the Grid Connection Code for Renewable Power Plants (RPPs) connected to the electricity Transmission System and Distribution System within the City of Cape Town.

This is not intended to be read and applied in isolation; but must reference the relevant statutory standards and specifications as may be developed and updated by the City of Cape Town, setting out the minimum operational and maintenance requirements for interconnected embedded generators *(Category B and C – 1 MVA and above)*, operated in parallel with the City of Cape Town's (CCT) electrical networks.

6 TECHNICAL DETAIL

6.1 Network Connection

The Embedded Generator (EG) to be connected to a CCT substation shall provide a **EG single line diagram** clearly showing the Point of Connection to the Distribution System.

The CCT substation shall in turn be clearly identified by a **substation single line diagram**.

7 RESPONSIBILITIES

7.1 CCT shall be responsible for the operation and maintenance of the CCT Connection Equipment and the CUSTOMER shall be responsible for the operation and maintenance of the EG Connection Equipment. The line of demarcation is to be clearly indicated in diagrams as per 6.1 above.

7.2 CCT's isolation point shall be indicated at the Point Of Connection as per 6.1 above. This isolation point is owned, operated and maintained by CCT. This is to prevent the CUSTOMER from closing its isolation point without communicating with CCT.

7.3 Contact details of the CUSTOMER's and CCT's staff to be contacted by the other Party in the event of network faults which must be isolated shall be provided. In the event of changes of appointments by the CUSTOMER, a letter of notification will be accepted by CCT, before the changes takes effect, providing the contact details of the newly appointed representatives. CUSTOMER's nominated staff must be available 24/7 for the Network Control Centre to contact them in the event of emergencies.

The schedule shall include:

a) Names and contact details of responsible and OHS Act General Machinery
b) Regulations (GMR) 2.1 competent persons and the City's staff names and contact details
c) A description of any operating limitations with regard to the plant and/or the interconnection.

The EG shall ensure that all operating personnel are competent in that they have adequate knowledge and sound judgment to take the correct action when dealing with an emergency. Failure to take correct action may jeopardize the EG power plant's installation and/or the City's network. EGs shall ensure that:

a) Except in the case of agreed unmanned facilities, the responsible and GMR 2.1 competent persons are available at all times to receive communications from the City's Network Control Centre so that emergencies requiring urgent action by the EG can be dealt with adequately. Where required by the City, it will also be a duty of the EG's staff to advise the City's Control Centre immediately of any abnormalities that occur on the EG plant which have caused, or might cause, disturbance to the Network Service Provider's network;
b) In the case of unmanned facilities, the Network Service Provider will have remote Control facilities to trip and isolate the facility at the EG feeder circuit breaker or if not available, at the PUC. The City shall not control the PGC circuit breaker / isolation devices directly.
c) Where it is necessary for EG employees to operate City's network equipment (where provided), they have been designated in writing by the City as an
d) 'Appointed Authorised Operator' for this purpose. All operations on the City equipment must be carried out to the specific instructions of the City's Network Control Centre. In an emergency, a switch can be opened by anybody, without prior agreement in order to avoid danger. The operation must be reported to the City Network Control Centre immediately afterwards.

The EG shall maintain and operate their plant and equipment in terms of the NERSA License and compliance with the mandatory reporting to NERSA is required as per the Electricity Regulation Act promulgation.

Compliance with the OHS Act is required at all times.

Requirements of NR 040 (ORHVS) apply

For SSEG, requirements of NRS 097- 2 apply.

NRS 097-1 will apply, once published.

8 ACCESS TO SITE

8.1 No unauthorized access will be permitted to restricted areas. Access to restricted areas will be in accordance with NRS 040.

9 SWITCHING AND ISOLATING PROCEDURES

9.1 Switching and isolating operations shall take both the CCT and the CUSTOMER's requirements into account and shall include reasonable notice periods to inform the other Party of switching or isolating operations. All switching or isolating operations will be conducted according to the NRS 040 standards via the CCT Control Centre. The detailed information pertaining to switching, isolating and operations shall be documented in an operational guideline in accordance with the template to be provided.

10 SUPERVISORY STATUS INDICATIONS AND ALARMS

10.1 SCADA communication shall be established between the Facility and CCT's Control Centre as per SAGC for Renewable Power Plants requirements.

10.2 CCT's staff at the Control Centre shall be able to view the status of the Facility Connection Equipment up to the requested CUSTOMER point.

10.3 CCT shall be entitled to send the following control signals to the Facility

10.3.1 Curtailment

10.3.2 Voltage control set points depending on the mode of operation

10.3.3 Opening of the PUC circuit breakers on the CUSTMERS's side, under emergency conditions, (if the PUC breaker is only on the CUSTOMER's side)

10.4 The EEB 705 Standard for the Interconnection of Embeded Generation specifies the full list of alarms and indications that are required from the Facility to the Control Centre.

11 SCHEDULING AND DISPATCH OF ENERGY FROM THE CUSTOMER

11.1 The Facility will either be Non-dispatchable or dispatchable as detailed in the respective contract, under normal operating conditions. Information required to assist with the (CCT) System Operator's generation scheduling must be provided in accordance with the Grid Connection Code for Renewable Power Plants. Under abnormal operating conditions CCT may curtail the Facility's generation output.

12 OUTAGES

12.1 **Scheduled Network Outages**

CCT shall notify the CUSTOMER of all its planned outages that may affect the maximum generation output of the Facility 35 (thirty-five) days prior to the date of the planned outage. CCT shall inform the CUSTOMER about the revised generation output limits, if applicable.

12.2 **Facility, and Facility Connection Equipment planned outages**

The CUSTOMER shall notify CCT 35 (thirty-five) days prior to the date of the planned outage in writing of its planned outages for inclusion in CCT's forecasting schedule. Notification can be sent directly to the Control Centre for Attention: Outage schedulers.

Any planned outages of the EG or the related EG Equipment must be included in the CUSTOMER's short term forecasting schedule.

12.3 **Unscheduled Network Outages**

The Network Control Centre will contact the CUSTOMER's control centre and inform them of any unplanned network outages which have occured on the Distribution System. All attempts to restore supply will be conducted in accordance with section 14, 15 and 16.

12.4 **Facility, and Facility Connection Equipment unplanned outages**

The CUSTOMER's control centre shall notify the CCT of the unplanned outage, the cause of outage and the expected time of return to service.

12.5 **Communicating Outages**

12.5.1 If CCT is unable to view the status of the Facility on SCADA, then the Network Control Centre will contact the CUSTOMER's control centre as a matter of urgency in an attempt to establish the status of the Facility. A communication outage shall be regarded as a serious risk and the Parties shall take the necessary steps to restore communication without delay.

12.5.2 If CCT has adequate upstream network visibility to ensure secure operation, the NCC may decide not to curtail the generation output of the Facility. Should CCT consider the network to be at risk due to the lack of visibility, the NCC may decide to isolate the Facility or may telephonically instruct the CUSTOMER to reduce the generation output of the Facility.

12.5.3 The recommended response time by the CUSTOMER to a communication outage event is 1 hour with a recommended repair time as per NRS 047 following the response time. Should the repair be of such a nature that it exceeds the recommended time frame, then the CUSTOMER shall inform the Network Control Centre accordingly. The Parties shall co-operate to decide on the mitigation and contingency plan to reduce the risk to the network.

12.5.4 The communication of outages shall be dealt with as follows:

a) [If the Control Centre notices communication is out of service, the Control Centre shall contact CCT SCADA Field Services.
b) If CCT's substation is visible then the Control Centre shall assume that the problem is on the CUSTOMER's equipment and shall contact SCADA Field Services who shall then contact the CUSTOMER's staff on standby.
c) If CCT's Substation is not visible then the Control Centre shall assume that the problem is on CCT's equipment and shall follow CCT normal process]

13 REACTIVE POWER AND VOLTAGE CONTROL FUNCTIONS

13.1 To ensure proper voltage control during contingencies in the surrounding network, the CUSTOMER is required to operate the Facility normally in the appropriate mode (Voltage Control mode/ Reactive Power mode or Power Factor Control mode) as default, provided that CCT in its discretion reserves the right to change the control mode and CCT may instruct the CUSTOMER's control centre to change to different set points. The CUSTOMER's response to CCT's instruction to change to different set points within a specified control mode must be completed within 30 (thirty) seconds, as is required in accordance with the Grid Connection Code for Renewable Power Plants. At any time that the CUSTOMER has to change the mode or set point for any reason, the CUSTOMER must inform the Control Centre and provide the reason for the change.

13.2 The set point for the default control mode is to be provided in table similar to this:

Table 3: Reactive Power and voltage control functions

Modes	Set point
Voltage Control (V Control)	
VAr Control (Q Control)	
Power Factor Control (PF Control)	

14 RECONNECTION OF THE FACILITY TO THE DISTRIBUTION SYSTEM

14.1 The Facility is connected via a CCT substation to the Distribution System. Different plants may have 1 or 2 connections to CCT, providing for firm or unfirm connections. This must correlate

with the substation single line diagram as provided in section 6. Should this main CB trip, the EG will be islanded (isolated from the Distribution System) and the switching procedures as set out in sections 15, 16 and 17 must be followed.

15 FOLLOWING LOSS OF THE DISTRIBUTION SYSTEM

15.1 The Party who detects the islanding condition first, shall:

15.1.1 Inform the other Party's control centre accordingly;

15.1.2 Disconnect the Facility from the Distribution System

15.2 If the islanding condition is first detected by CCT, CCT shall:

15.2.1 Disconnect the Facility by opening the breaker on CCT's side of the PUC or the appropriate disconnecting circuit breakers if plant has 2 connections to CCT;

15.2.2 Restore supply to the Distribution System; and

Only close the circuit breaker on the CCT's side of the PUC when the breaker of the Facility at the PUC is confirmed to be open.

16 FOLLOWING DISCONNECTION OF THE FACILITY ON THE CUSTOMER SIDE

16.1 After requested disconnection of the Facility on the CUSTOMER's side of the PUC, the Facility may not be automatically connected to the Distribution System without first consulting CCT Control Centre. Thereafter it can be reconnected provided that the voltage and frequency are within limits as specified in the Grid Connection Code for Renewable Power Plants.

17 MAINTENANCE

17.1 For a total shutdown of the EG, all circuits of the POC will be opened, isolated and earthed by CCT for plant on CCT side.

17.2 Before maintenance is done on the EG point of isolation at the PUC, the related CCT point of isolation at the POC needs to be opened, isolated, earthed and locked into the open position in accordance with the NRS 040 standard.

17.3 Before maintenance is done on the CCT feeder disconnector at the POC, the EG point of isolation at the PUC needs to be the opened, isolated, earthed and locked into the open position in accordance with the NRS 040 standard.

17.4 CCT shall only close the Circuit Breaker on CCT's side of the POC when the main Circuit Breaker of the EG at the PUC is confirmed to be open by the responsible person and all permits have been cleared.

17.5 All equipment at the PUC *(primary and secondary – CB's, disconnectors, protection systems and SCADA)*, related to the connection of the EG to the Distribution system, shall be maintained in accordance with the OEM specifications (NRS 089 Standard). The results of such tests shall be made available to either Parties.

17.6 CCT shall be responsible for the maintenance of the equipment on the CCT's side of the POC in accordance with the respective maintenance cycle of the equipment.

17.7 The EG shall be responsible for the maintenance of the equipment on the CUSTOMER side of the PUC in accordance with the respective equipment recommended

maintenance cycle. Maintenance records shall be made available to CCT when requested.

18 POWER OUTPUT CURTAILMENT

18.1 CCT will require curtailment for two reasons:

18.1.1 Generation capacity surplus (provided all other generators have reduced output as far as possible). This instruction will be given by the CCT Control Centre, who will send a curtailment signal/notification to the CUSTOMER.

18.1.2 Network constraints – local or upstream which will prevent the CUSTOMER from exporting up to the Maximum Export Capacity. This is referred to as constrained generation. The CCT Control Centre will send a curtailment signal/notification to the CUSTOMER

18.2 The CCT Control Centre will issue a curtailment notice (including via a curtailment signal/notification) requesting the CUSTOMER to reduce its generation output to a set value. If no response from the CUSTOMER is received within 30 (thirty) seconds (as required in terms of Section 11 of the Grid Connection Code for Renewable Power Plants) after the curtailment notice was issued, the Network Control Centre will open the PUC Circuit Breakers and disconnect the EG from the Distribution System. When the network or the balancing of the supply and demand on the System has returned to normal, the Control Centre will contact the CUSTOMER to reconnect to the Distribution System.

19 FREQUENCY RESPONSE

There are no operational requirements for frequency set points in the droop curve. If there is any change to this requirement, the CCT will notify the CUSTOMER in writing.

20 COMMISSIONING AND COMPLIANCE

20.1 The Commissioning and compliance testing of the EG Connection Equipment and the EG shall be conducted in accordance with the Grid Connection Code for Renewable Power Plants and the (Distribution Connection and Use-of-System Agreement), before the commencement of commercial operation of the Facility.

20.2 CCT shall notify the CUSTOMER of the required test and commissioning requirements as set out in the Grid Connection Code for Renewable Power Plants and EEB 705.

20.3 All plant on the CCT side of the POC will be tested and commissioned with the applicable equipment standards and specifications.

21 HANDOVER OF DOCUMENTS

21.1 The CUSTOMER shall handover the following information relating to the Facility and Facility Connection Equipment to CCT's representative as indicated in EEB 705.

21.2 The CUSTOMER shall meet the following requirements before the PUC Breaker can be closed:

21.2.1 The protection settings of the Facility shall be coordinated with CCT's protection settings.

21.2.2 SCADA data shall be available and visible to CCT.

21.2.3 A safety declaration, certified by a professional engineer, shall be submitted to CCT stating that the Facility has been tested in accordance with the standards, is electrically safe to

operate and complies with the provisions of EEB 705 and any applicable Law including the Occupational Health and Safety Act (Act 85 of 1993).

21.3 The Standard for the Interconnection of Embedded Generation (EEB 705) contains the list of all documents required for commissioning, before first energization and synchronization.

22 REPORTING, LOAD FORECASTING & POST EVENT ANALYSIS

22.1 The CUSTOMER shall provide generation historical performance data and forecast data as follows:

22.1.1 One week ahead forecast data, half hourly MW data, adjusted every 24-hours to account for weather variations where applicable,

22.1.2 12-month generation forecast/ projection in half hourly MW data, provided initially in March/ April for CCT bulk power purchases budget planning and plant scheduling for the following financial year (July- June), updated data to be provided once again during the mid-year adjustment period in November/December,

22.1.3 Access to metering data to CCT for actual generation performance related data in half hourly MW format,

22.2 The Parties shall provide each other with relevant information to assist with post event analysis following disturbances or other events for which further investigation is required.