CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

REQUIREMENTS FOR SMALL-SCALE EMBEDDED GENERATION

Application and approval process for small-scale embedded generation in the City of Cape Town

September 2021

Making progress possible. Together.

Document Control

Version	Date	Page/Clause	Description
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Foreword

Note: Please ensure that you have the latest version of these Requirements, relevant application forms and associated documents before proceeding with an application. All of the relevant documents are available on the City's website (www.capetown.gov.za/elecserviceforms).

Indemnity

Any entity (e.g. a municipality) using these Requirements either in part or in full for their own small-scale embedded generation program does so on the basis that they indemnify and hold harmless the City of Cape Town and its successors or assigns in respect of any claim, action, liability, loss, damage or lawsuit arising from their use of these Requirements.

Scope

The purpose of these Requirements is to define the City of Cape Town's minimum requirements and application processes for all forms of small-scale embedded generation, such as solar photovoltaic systems, in the City's Licensed area of supply.

The approval process for small-scale embedded generation varies depending on the system architecture, size and customer category. These Requirements apply to systems with a generation capacity less than 1 MVA (1 000 kVA) and all systems up to this limit are required to comply with the conditions and processes described herein.

These Requirements do not apply to those who wish to install a system with a generation capacity of 1 MVA or more. For such systems, please refer to the Standard for Interconnection of Embedded Generation (EEB 705) document, which specifies the minimum technical and statutory requirements.

Abbreviations

ADMD	After Diversity Maximum Demand
AC	Alternating Current
AMI	Advanced Metering Infrastructure
BESF	Battery Energy Storage Facility
CoC	Certificate of Compliance
CCT	City of Cape Town
DC	Direct Current
DMRE	Department of Mineral Resources and Energy
ECSA	Engineering Council of South Africa
EG	Embedded Generation/Generator
EGD	Electricity Generation and Distribution Department of the City of Cape Town
EIR	Electrical Installation Regulations
ERA	Electricity Regulation Act
kVA	kilovolt-ampere (unit of apparent electrical power)
kW	kilowatt (unit of active electrical power)
kWp	kilowatt peak (the rated peak active power output of solar photovoltaic panels)
LV	Low Voltage
MV	Medium Voltage

MVA	Megavolt-ampere (1 000 kVA)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
NRS	National Regulatory Services
OHS	Occupational Health and Safety
PCC	Point of Common Coupling
POC	Point of Connection
PGC	Point of Generator Connection
PUC	Point of Utility Coupling
PV	Photovoltaic
RE	Renewable Energy
RPP	Renewable Power Plant
PPM	Prepayment Meter
SABS	South African Bureau of Standards
SAGC	South African Grid Code
SANS	South African National Standards
SCP	Service Connection Planning (a branch within EGD)
SSEG	Small-scale Embedded Generation/Generator
UPS	Uninterruptible Power Supply
VAT	Value-Added Tax

Glossary

Alternating current (AC)

The flow of electrical energy that follows a sine wave and changes direction at a fixed frequency (i.e. it alternates). Most residential and commercial/industrial uses of electricity require alternating current.

Alternative supply

A combination of supply to an electrical installation or part of an electrical installation which is not connected to the main supply of the distributor or a supply to an electrical installation or part of an electrical installation as an alternative to the main supply of the distributor that is separated by means of an interlocked change-over switching device that shall disconnect the supply before the alternative supply is switched on in such a way that the distributor supply and the alternative supply cannot be connected to the electrical installation or part of the electrical installation at the same time.

Anti-islanding

The ability of a small-scale embedded generation installation to instantly and automatically disconnect the generator from the distribution network whenever there is a power outage, thus preventing the export of electricity to the distribution network from the SSEG. This is done primarily to protect the distributor's workers who may be working on the distribution network and who may be unaware that the network is still being energised by the generator.

Bi-directional meter

A meter that measures the active energy (Wh) flow in both directions (import and export) and either displays the balance of the imported and exported energy in a single register meter (net metering) or displays both imported and exported energy in separate registers.

City

The City refers to the City of Cape Town and will be referred to as such throughout this document.

Cogeneration

The simultaneous production of two or more forms of energy from a single fuel source, also known as combined heat and power (CHP).

Customer/user

A person or legal entity that has entered into an agreement with a distributor for the provision of distribution services. An entity may be an embedded generator, another distributor, an end-use customer (including generators), an international customer, a retailer or a reseller.

Dedicated assets/dedicated network

That portion of the network, which is dedicated to a specific customer. Customer dedicated assets are assets created for the sole use of a customer to meet the customer's technical specifications, and are unlikely to be shared in the distributor's planning horizon by any other end-use customer.

Direct current (DC)

The flow of electrical current in one constant direction. Direct current is typically converted to alternating current for practical purposes, as most modern uses of electricity require alternating current.

Distribution network/grid

The network/grid owned and operated by a Distributor.

Distributor

A legal entity that owns or operates/distributes electricity through a distribution network.

Electrical installation

Any machinery, on or in any premises, used for the distribution of electricity from a point of control to a point of consumption anywhere on the premises, reflecting items included and excluded in the Electrical Installation Regulations.

Embedded generation

A power generation plant using primary
renewable energy sources or fuel driven energy sources that is grid-tied.

Embedded generator

A legal entity that operates one or more electricity generation unit(s) that is connected to the distribution network. Alternatively, a legal entity that desires to connect one or more electricity generation unit(s) to the distribution network.

ECSA registered professional

Person registered with ECSA in the professional category. The professional category includes:

I. Professional Engineer (Pr. Eng.)
II. Professional Engineering Technologist (Pr. Tech. Eng.)
III. Professional Certified Engineer (Pr. Cert. Eng.)
IV. Professional Engineering Technician (Pr. Techni. Eng).

Generation/generating capacity

The maximum output power capacity, measured in kVA (limited either by hardware or software settings), which can flow out of the generation equipment into the customer's alternating current wiring system. This is therefore the maximum alternating current power flow, which can be generated.

Grid-tied SSEG

SSEG that is connected in parallel to the distribution network either directly or through a customer's internal wiring is said to be grid-tied. SSEG that is connected to the grid through a reverse power flow blocking relay is also considered to be grid-tied.

Grid-tied hybrid SSEG

Grid-tied SSEG that islands after interruption of the distributor supply or when the applicable electrical service conditions are outside stated limits or out of required tolerances and then supplies the load from the inverter, operating in the stored-energy mode via a suitably interlocked change-over switch.

Group development (Sectional title community)

Site that is supplied by the EGD by means of bulk MV or LV electricity supply and the entity resells the electricity to the private sectional title owners.

Inverter

A power device that converts direct current to alternating current at a voltage and frequency, which enables the generator to be connected to the distribution network.

Isolated

A section of the distribution network that is disconnected from all other possible sources of electrical potential is said to be isolated.

Load Profile

The variation of the customer's rate of electricity consumption (or demand) over time.

Low voltage (LV)

Nominal voltage levels up to and including 1 kV (1 kV = 1 000 V).

Maximum total generation/generating capacity

Total power output capacity of the generator for export to the grid. For PV systems in particular, this refers to the maximum output of the inverter to the distribution network as limited either by hardware or software password protected settings.

Medium voltage (MV)

Nominal voltage levels greater than 1 kV up to and including 33 kV.

Net-consumer

A customer who imports (purchases) more electricity than they export (feed-in to the network) over a rolling 12-month period.

Off-grid SSEG

SSEG that is physically separated, electrically isolated and not interconnected with the electrical installation or the distribution network – either directly or through a customer's internal wiring. Customer loads cannot be simultaneously connected to the distribution network and the SSEG installation, and export of energy onto the distribution network by the generator must not be possible. SSEG that is connected to

the network through a reverse power flow blocking relay is not considered to be off-grid.

Passive standby UPS utilised as standby hybrid SSEG

Applies to any UPS operation functioning according to the following principle:

a. The normal mode of operation consists of supplying the load from the grid as the primary power source.
b. When the grid is outside stated limits, the load is supplied from the UPS inverter, operating in stored energy mode.

Such a system will only be regarded as standby provided that it is equipped with a suitably interlocked change-over switch, selectable as follows:

I. Charger/rectifier mode (normal): Batteries are charged by the SSEG installation or, if required, by the grid. The grid is the primary power source for all loads.
II. Inverter mode: when the grid supply is interrupted or applicable electrical service conditions are outside stated limits or required tolerances or switched by the customer between grid and storage. The grid supply is disconnected and selected loads are supplied from the inverter, within the rating of the energy storage and/or SSEG (also known as grid-assisted SSEG).

Point of common coupling (PCC)

The point in a network where more than one customer is connected.

Point of connection (POC)

The electrical node(s) on the distribution network where the customer's assets are physically connected to the Distributor's assets.

Point of generator connection (PGC)

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

Point of utility coupling (PUC)

The circuit breaker that connects the embedded generator to the distribution network.

Renewable power plant (RPP) categories

Renewable power plants are grouped into the following three categories as per the Grid Connection Code for RPPs in South Africa (Version 3.0):

a. Category A: 0 – 1 MVA

   This category includes RPPs with rated power of less than 1 MVA and connected to the LV network. This category shall further be subdivided into 3 sub-categories:

   I. Category A1: 0 – 13.8 kVA

      This sub-category includes RPPs of Category A with rated power in the range of 0 – 13.8 kVA

   II. Category A2: 13.8 – 100 kVA

      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: 100 kVA – 1 MVA

      This sub-category includes RPPs of Category A with rated power in the range greater than 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.

b. 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 that the Battery Energy Storage Facility (BESF) Grid Connection Code (Draft 5.2) provides further subdivisions for this category.

c. Category C: 20 MVA or higher

   This category includes RPPs with rated power equal to or greater than 20 MVA.

Reverse power flow

The flow of energy from the customer's SSEG onto the distribution grid (i.e. export) as

a result of the instantaneous generation exceeding the instantaneous consumption at the customer's site.

Reverse power flow blocking

A device which prevents the flow of energy from an SSEG onto the distribution grid.

Shared network

A section of the distribution grid that supplies more than one customer.

Small-scale Embedded Generator (SSEG)

For the purposes of these Requirements, a small-scale embedded generator is an embedded generator with a generation capacity less than 1 MVA (1 000 kVA).

Solar PV water heating

Electrical water heating geyser supplied from a PV energy source either:

- directly to a DC geyser heating element or
- to a combination of AC and DC geyser heating element that is interconnected with the distributor grid supply that requires a suitably interlocked change-over switch.

Standby SSEG

SSEG as an alternative supply system that provides a switched alternative supply to the grid supply to supply the electrical installation and is interconnected with the electrical installation by means of a change-over switch for alternative supply and passive standby UPS systems.

Suitably interlocked change-over switch

Switch required for grid-tied hybrid SSEG (essential loads interconnected with the grid), standby SSEG and solar PV water heating to interrupt the grid supply. Switch requirements listed in Appendix 4.

Wheeling

The financial transactions representing the transportation of third-party electrical energy (kWh) over the City's distribution network which allows for the third-party

supplier to sell this electrical energy to a City customer at that customer's point of supply.

Important Notices

Compliance with the Law

Electricity Regulation Act 4 of 2006 (ERA) and associated Regulations, South African Grid Codes and the Occupational Health and Safety Act 85 of 1993 (OHS) are core legislation.

The City's Electricity Supply By-law, 2010 states that no electricity generation equipment provided by a consumer in terms of any Regulations or for his own operational requirements shall be connected to any installation without the prior written consent of the Director of the EGD.

It is explicitly emphasised that any type of SSEG installation which has been issued only with a Certificate of Compliance (CoC), **is not authorised** to connect to the City's distribution network. Failure to obtain this consent constitutes an offence, which could lead to a service fee and/or disconnection of supply to premises and/or imprisonment in terms of the City's Electricity Supply By-law.

Furthermore, the Electricity Installation Regulations (EIR) of the OHS states that it is the property owner who carries the responsibility for the safety of the electrical installation on the property. This includes the SSEG installation on the property. Therefore, the SSEG installation may be in contravention of the OHS, in which case punitive sanctions apply.

Customers who wish to legally install SSEG will be required to follow the application procedure as detailed in these Requirements. No exemptions from these Requirements will be granted for retrospective applications. Retrospective compliance will be required for existing installations whenever the applicable legislation/regulations (e.g. ERA, OHS, South African Grid Codes, etc.), standards (e.g. SANS) and specifications (e.g. NRS) are amended or when quality of supply and/or safety requirements must be improved.

Generation Licenses

SSEG installations are required to comply with Schedule 2 of the ERA which stipulates the requirements for generator licensing and registration or exemption from licensing under certain circumstances. Please refer to the latest Licensing Exemption and Registration Notice published by the Department of Mineral Resources and Energy (DMRE) and if in doubt, seek clarity from the National Energy Regulator of South Africa (NERSA).

Approved Inverters

Until such time as a South African Bureau of Standards (SABS) mark is issued for inverters, the City will require proof of type tests (in the form of test certificates) having been successfully carried out by a third-party test house certifying compliance of the inverters with the City's requirements and the latest NRS 097-2-1 edition. A list of approved inverters which have been shown to comply with the City's requirements can be found on the City's website. Details of the City's requirements regarding the type testing of inverters is provided in Appendix 3.

Professional Sign-off

All grid-tied SSEG installed on the city's distribution network must be certified for compliance with the City's requirements as follows:

- An ECSA registered professional engineer, professional engineering technologist, or certified engineer may certify commercial, industrial and residential SSEG installations.
- An ECSA registered professional technician may only certify residential SSEG installations.

The professional registered person is liable and needs to ensure compliance with design, protection, and all relevant standards.

1. General Requirements

1.1 Introduction

Growing global awareness of climate change coupled with the rapidly falling costs of renewable energy (RE) technologies are two of the major drivers behind the global megatrends of decarbonisation and decentralisation of the energy system. In South Africa, drastic increases in the price of grid electricity and the ever increasing risk of load-shedding due to generation capacity shortfalls in the national energy system have provided further impetus for customers to seek alternative energy generation options. Solar photovoltaics (PV) is the key technology enabling the transition to a more sustainable energy system. Rapid cost reductions of 60-80% since 2010 have increased the economic attractiveness of solar PV, facilitating the adoption of residential and commercial/industrial applications and electricity distributors are increasingly being approached by customers who wish to connect these SSEG systems to the distribution network.

The parallel connection of any generator to the distribution network has numerous implications for the local electricity distributor. The most pressing is the safety of the utility staff, the public and the user of the generator. There is therefore a strong need for such practice to be regulated for the general benefit and protection of citizens as well as the operation and control of the distribution network. Consequently, the City's Electricity Supply By-law requires that no electricity generation equipment shall be connected to any installation without prior written consent from the Director of the EGD. The City has therefore developed this comprehensive Requirements document, which details the application and authorisation process for connecting SSEG to the City's distribution network. It applies to all systems with a generation capacity less than 1 MVA and all SSEG applicants up to this limit are required to comply with the conditions and process specified herein. It is essential that all customers who wish to install SSEG, complete the relevant sections of the application process in full, and that written approval is received from the City before system installation commences.

Currently, SSEG is not adequately regulated at the national level, despite ongoing attempts by the DMRE and NERSA to develop overarching regulatory rules and frameworks. In the absence of a national regulatory framework, the City has developed its own rules for the registration and authorisation of SSEG in its Licensed

area of supply. The Constitution of the Republic of South Africa provides that electricity reticulation is a municipal competency. This means that a municipality is responsible for providing electricity reticulation services to the customers within its jurisdiction. The electricity reticulation function extends to the obligation on municipalities as licensed distributors to provide open and non-discriminatory access to the municipal distribution network. Accordingly, its electricity reticulation function includes, inter alia, administering the connection of generation systems to the municipal distribution network.

1.2 Defining SSEG

As defined in the Glossary and as per the SAGC, an embedded generator refers to a legal entity that operates one or more electricity generation unit(s) that is connected to the distribution network. Alternatively, a legal entity that desires to connect one or more electricity generation unit(s) to the distribution network. For the purposes of these Requirements, an SSEG is an embedded generator with a generation capacity less than 1 MVA (1 000 kVA) which is located on residential, commercial or industrial sites where electricity is also consumed. Such SSEG would be connected to the wiring on the customer's premises which is in turn connected to, and supplied by, the City's electricity network – thus these generators are considered to be 'embedded' in the local electricity network. Most of the electricity generated by an SSEG is consumed directly at the site but times arise when generation exceeds consumption and typically a limited amount of power is allowed to flow in reverse i.e. from the SSEG system onto the electricity grid.

1.3 Applicability

These Requirements are applicable to all customers who wish to install SSEG systems, with a generation capacity less than 1 MVA, in the City's Licensed area of supply. It specifies the minimum requirements to:

- SSEG project developers and installers
- Commercial, industrial and residential property owners
- Engineering consultants commissioned to design SSEG systems
- ECSA registered professionals involved in the commissioning of SSEG systems
- City officials involved in the registration and authorisation process for SSEG systems.

It is essential that all customers who wish to install any type of SSEG, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval is received from the City prior to commencing with the system installation. The City needs to ensure that, amongst other considerations, the SSEG installation can be accommodated on the distribution network, is compliant with the relevant regulations/standards/specifications and that the total SSEG generation capacity of the network has not been exceeded. Therefore, equipment should not be purchased prior to obtaining written approval from the City as approval is not guaranteed and the City will not be held liable for equipment expenses where approval is denied.

Eskom Customers

Customers residing within the metropolitan boundary of the City but are located in Eskom's Licensed area of supply will need to apply to Eskom for approval/authorisation of their SSEG system.

1.4 SSEG Systems

1.4.1 Grid-tied

As defined and with two modes of operation:

a) Grid-tied with export

Customer is allowed to export excess electricity generated by the system onto the grid but needs to remain a Net Consumer.

b) Grid-tied with no export:

Customer needs to install reverse power flow blocking protection in order to ensure that no excess electricity is exported to the grid.

Notes:

i. An SSEG installation connected to the City's grid through a reverse power flow blocking relay is not considered to be an off-grid installation. It is considered grid-tied and must comply with the requirements for grid-tied SSEG.

1.4.2 Grid-tied Hybrid

As defined.

Notes:

i. Compulsory external automatic change-over switch between network supply and the storage supply must comply with requirements detailed in Appendix 4.

1.4.3 Standby (interconnected with electrical installation)

As defined for two types:

a) Passive standby UPS utilised as standby hybrid SSEG
b) Alternative supply

Notes:

i. Compulsory external automatic change over switch must comply with requirements detailed in Appendix 4.
ii. Geyser electrical heating element supplied by both solar PV and the local network with an automatic switching between AC and DC is considered an alternative supply to the geyser heating element.

1.4.4 Off-grid

As defined.

Notes:

i. Geyser electrical heating element supplied from a solar PV generation source directly to a separate geyser heating element is considered off-grid.

1.5 Net Consumer Requirement

Embedded generators can either net consumers i.e. they import (purchase) more electricity than they export (feed-in to the network) over a rolling 12-month period or net generators i.e. they export (feed-in to the network) more electricity than they import (purchase) over a rolling 12-month period.

Net generators are not permitted by the City.

1.6 On-site Consumption of Electricity

The electricity produced by the SSEG system must be consumed on the property on which the SSEG is located or exported to the City's network for purchase by the City. Transfer of electricity to a different property i.e. wheeling, will only be permitted if both the generator and consumer satisfy the relevant local/national regulatory and technical requirements. The City's requirements for wheeling will be detailed in a separate document.

1.7 Operation of LV Generators as a Back-up Supply

Grid-tied inverters are generally not designed to operate in island mode (where the generator supplies power to a portion of the customer's network during a general power outage). Should the inverter be able to operate in an island state, it must be effectively isolated from the City's grid during operation (as is legally required of any standby generator). SANS 10142-1 Annexure P gives examples of what is required in this regard. If the SSEG is to be configured as a standby supply after islanding from the utility supply, the generator will have to be connected to the existing internal wiring of the property and approval by the Director of the EGD is required if the generator is connected to the customer's network via a break-before-make switch with an appropriate change-over switch interlock. A registered person in terms of the EIR must install the generator and issue a CoC to the owner if the generator is to be connected

to the existing internal wiring of the property. Requirements of SANS 10142-1 – Clause 7.12 (Alternative supplies) and Annexure P, apply.

1.8 SSEG Decommissioning and Illegal Installations

The City requires notice of any SSEG system which has been decommissioned. An SSEG system which has been decommissioned must be disconnected from the distribution network (at the customer's cost) by the removal of wiring which connects the inverter/s to the network and all the PV panels. Customers who intend on decommissioning their SSEG systems have the following options:

a) Customer removes generation source i.e. solar PV panels

I. Customer must provide a CoC which indicates that the system has been disconnected and removed.
II. Compulsory installation of a split prepayment meter (PPM) at the City's cost and the customer to be placed on the appropriate tariff.
III. The customer may opt for the installation of an advanced metering infrastructure (AMI) meter (at the customer's cost) and customer to be placed on the appropriate tariff.

b) Customer keeps generation source i.e. solar PV panels, on the roof

I. Customer must provide a CoC which indicates that the system has been disconnected.
II. Customer relinquishes the option for a PPM by not removing the panels.
III. Customer is charged for a compulsory AMI meter and placed on the appropriate tariff.

The declaration section of the Decommissioning Report (EG/DECOM) must be completed by a registered person and submitted to the relevant Customer Support Services (CSS) office or via email to electricitycustomer.support@capetown.gov.za.

1.9 Change of Property Ownership

When transfer of ownership of a property takes place that has SSEG installed, the new owner will be required to sign a new Supplemental Contract or alternatively the SSEG system must be decommissioned as detailed in section 1.8. The CoC which is required

to be issued as a condition of transfer of ownership of the property must include a statement regarding the state of connection or disconnection. An SSEG compliance test report will be required once NRS 097-2-4 is published. At the time that the customer ceases to be on the SSEG tariff, any remaining credit balance will be refunded to the customer on written request provided that the customer has no other outstanding municipal debt.

1.10 Metering and Meter Accommodation

The latest budgetary estimates for metering changes can be obtained on the City's website (www.capetown.gov.za/elecserviceforms).

Grid-tied SSEG customers must select one of two options for their systems i.e. export or non-export, and this selection will determine the metering solution as described below:

a) Export

Grid-tied SSEG customers who wish to participate in the SSEG Feed-in Tariff must have a bi-directional AMI meter installed. The City will supply and install the requisite meter, at the customer's cost. As mentioned in section 1.5 the SSEG Feed-in Tariff is only available to customers who are net consumers of electricity over a rolling 12-month period.

The City will only add Value-Added Tax (VAT) to the SSEG Feed-in Tariff if the customer is a registered VAT vendor with the South African Revenue Services (SARS). These customers will not be required to submit invoices to the City, as per Interpretation Note No. 56 (31 March 2010) of the Value-Added Tax Act, 1991.

b) Non-Export

Grid-tied SSEG customers who do not wish to partake in the SSEG Feed-in Tariff must install reverse power flow blocking protection to prevent the flow of excess electricity onto the distribution network. Subject to the ruling policies for tariffs and metering, these customers may keep their existing PPMs and remain on the relevant tariff. Any grid-tied SSEG customer with a credit meter that draws less than 100 A will be required to have their credit meter replaced with a PPM, at the City's cost. Grid-tied SSEG customers that draw more than 100 A will be required to reduce their capacity to below 100 A or alternatively, have a bi-directional AMI

meter installed, at the customer's cost. This is done to avoid credit meters and PPMs from running in reverse.

When a customer changes from a PPM to an AMI meter, unused PPM units will be refunded (fully or partially) according to the ruling policy.

Metering Accommodation

Grid-tied SSEG customers who wish to participate in the SSEG Feed-in Tariff will be required to adapt their electrical installation to allow for the AMI meter to be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box/kiosk already exists on the street-front property boundary. If the property is connected to the grid by means of a mid-block reticulation system, the customer will have to install a meter box on the street-front property boundary and take the supply from there. If no kiosk exists or there is no room for the meter in an existing kiosk, a meter kiosk will be installed in the road reserve at the City's cost. In cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, customers will be required to provide metering accommodation at their own cost (according to the City's specifications) on the street-front property boundary. Such a meter kiosk must face outwards and be locked with a standard EGD lock.

1.11 Tariffs

Tariffs are determined annually by the City and subject to approval by both Council and NERSA. The latest tariff book for all customer categories is available on the City's website (www.capetown.gov.za/elecserviceforms).

1.12 Generation Curtailment

The City is following a considered and calculated approach regarding the introduction of embedded generation in the distribution network. In the event of operating conditions resulting in electricity network parameters not meeting the statutory minimum quality of supply standards, peak generation limits may be imposed on embedded generator installations. It is expected that these limitations would be of a temporary nature, applied only during abnormal system conditions.

1.13 Grid Studies

Grid engineering studies will be done by the City for the proposed PV installation should these be required. The latest fees based on capacity sizes can be obtained on the City's website (www.capetown.gov.za/elecserviceforms).

1.14 Amounts Payable

I. The customer will be responsible for all the costs involved in the supply and installation of meters where required.
II. The customer will be responsible for any rearrangement of the electrical installation or meter accommodation, including the moving of the metering point to the property boundary.
III. The customer will be responsible for the cost of any grid studies, should these be required.
IV. The customer will be responsible for any changes required to the distribution network upstream of the Point of Connection (POC) as a result of the SSEG installation.
V. The customer will be responsible for all the costs associated with any specialist tests that need to be carried out e.g. inverter testing, as well as for obtaining the required certification of the design and the installation as detailed below.

1.15 Applicable Technical Standards

Most of the technical requirements for SSEG installations are covered in the following standards/specifications (see Appendix 1 for complete list of applicable regulations, standards and specifications):

I. NRS 097-2
   Grid Interconnection of Embedded Generation – Part 2: Small-scale Embedded Generation
II. Grid Connection Code for Renewable Power Plants (RPPs) in South Africa (latest version)
III. Standard for Interconnection of Embedded Generation (EEB 705).

The above standards/specifications cover aspects such as voltage range, flicker, DC injection, frequency operating range, harmonics and waveform distortion, power factor, synchronisation, safe disconnection, over- and under-voltage, sudden voltage

dips and peaks, over- and under-frequency, anti-islanding, network faults, response to utility recovery, isolation, earthing, protection and labelling.

The design and installation of SSEG equipment must comply with these requirements. Consult your supplier/installer to ensure that all the required conditions are satisfied.

1.16 Access to Historical Consumption and Excess Generation Graphs

Upon registration on the following City website: http://www.capetown.gov.za/City-Connect/Register/eservices-and-municipal-accounts/Register-for-a-municipal-account, customers with AMI metering will be able to access graphs depicting their property's historical electricity consumption and excess generation.

2. Application Process

The customer must complete and submit the APPLICATION FOR CONNECTION OF EMBEDDED GENERATION (GEN/EMB) Form together with all of the requisite supporting documentation. This is required for all types of SSEG including grid-tied, off-grid and standby systems and includes renewable energy and cogeneration.

Should a metering or tariff change be required as a result of the installation, the customer must also complete the APPLICATION FOR A NEW OR MODIFIED ELECTRICITY SUPPLY SERVICE Form.

The above mentioned forms are available on the City's website (www.capetown.gov.za/elecserviceforms).

The text box below highlights some of the important points to consider prior to making the application.

Purchasing of Equipment SSEG equipment to be connected to the grid must comply with the City's Requirements. It is therefore important for customers to be familiar with these Requirements before purchasing any equipment. This is of particular relevance to the inverter. Specific technical information and certificates are required to be submitted with the application form. It is the responsibility of the customer to ensure that equipment complies with the City's Requirements. A list of approved inverters which have been shown to comply with the City's Requirements is available on the City's website (www.capetown.gov.za/elecserviceforms).
No Existing Electricity Service Connection Should a customer wish to connect an SSEG system at a location where there is no existing electricity service connection, the customer must complete and submit the APPLICATION FOR A NEW OR MODIFIED ELECTRICITY SUPPLY SERVICE Form together with the GEN/EMB Form.
Future Expansion Authorisation to connect the SSEG to the distribution network is only granted for the declared generation capacity. Customers who wish to increase their generation capacity or make any material changes to their installation must obtain authorisation from the City before doing so. The customer must once again complete and submit the GEN/EMB Form. The customer must remain a Net Consumer of electricity over a rolling 12-month period.
Professional Sign Off As detailed above, the SSEG installation must (upon commissioning) be signed off as complying with the City's Requirements. This sign off must be done by an ECSA registered professional. For further information regarding registered professionals, please visit ECSA's website (www.ecsa.co.za/default.aspx).

A summary of the SSEG application and approval process is provided in Figure 1 below.

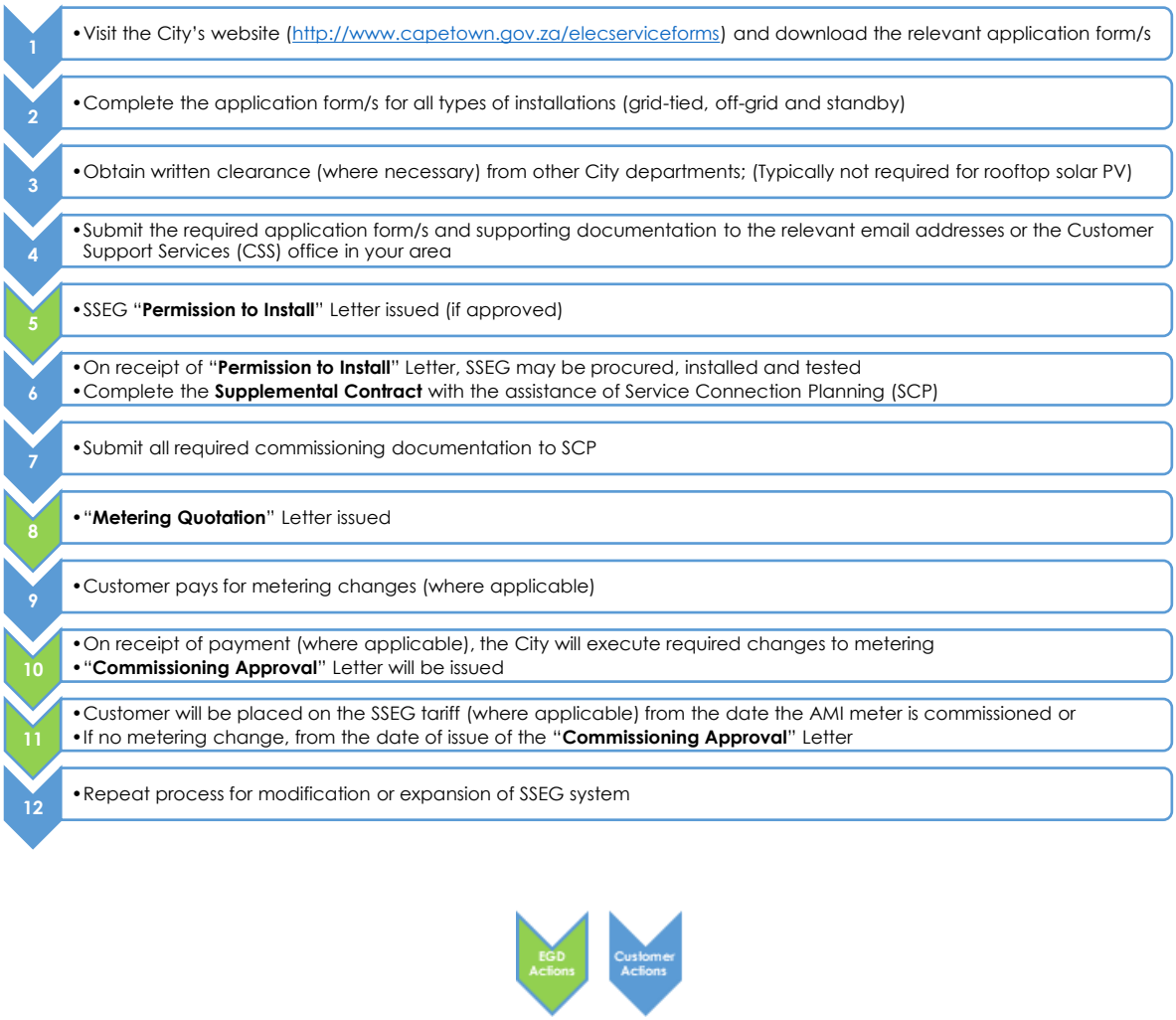

Figure 1: SSEG Application and Approval Process

Step 1: Visit the City's Website

Visit the City's website (www.capetown.gov.za/elecserviceforms) and download the relevant application form/s as noted above. Alternatively, the forms can be obtained from the CSS offices listed below. Both forms require both basic and technical information of the proposed SSEG installation to ensure that all SSEG connections are done in a safe and legal manner and in compliance with all relevant requirements. For grid-tied systems, the information required includes type of energy conversion, total generating capacity, electrical parameters, expected consumption, network connection point, synchronising method, anti-islanding method and generator control method amongst others.

Step 2: Complete GEN/EMB Form and if required, the APPLICATION FOR A NEW OR MODIFIED ELECTRICITY SUPPLY SERVICE Form

The GEN/EMB Form must be completed for all types of SSEG installations including grid-tied, off-grid and standby systems. Should a metering or tariff change be required as a result of the installation, the customer must also complete the APPLICATION FOR A NEW OR MODIFIED ELECTRICITY SUPPLY SERVICE Form. The City requires that the application form/s be signed by the property owner. The property owner will need the support of the proposed installer in order to complete the forms.

Details in the GEN/EMB Form that will need particular consideration are highlighted in the text box below:

Technical Information Type of energy source/system, total capacity, battery storage, export.
Preliminary Design Circuit diagram showing major system components and POC must be provided.
Earthing Arrangement This must be in accordance to SANS 10142-1. Earthing requirements for common earthing systems are described in NRS 097-2-1.
Electrical Parameters of the System Various electrical parameters of the system must be provided. Different sections are applicable for the different system types.
System Protection Detail This includes information about the synchronizing method, anti-islanding, power quality, change-over switch, etc.
Peak Power Generation Output The expected peak power generation output of the system. Note that this must be in line with the limits described in these Requirements.

Step 3: Obtain Permission from other City Departments

Some SSEG installations may require prior approval from other City departments (Planning and Building Development Management, City Health). Please note that for Solar PV SSEG installations, approval from the Planning and Building Development Management department will only be required if the installation falls outside defined parameters. Applications will only be considered when all relevant approvals are obtained and this must be reflected in the relevant sections of the application forms. The requirements of the other City departments are summarised in Appendix 2.

Step 4: Submit Completed Form/s and Supporting Documentation

Once the relevant application form/s have been completed and approval has been obtained from other City departments (if required), the form/s must be submitted to the relevant CCS office for the area in which the project is located. A map showing the area boundaries (Electricity Distribution Licence and Area Boundaries) is available on the City's website (www.capetown.gov.za/elecserviceforms).

The details of the different area offices are provided below:

CUSTOMER SUPPORT SERVICES: AREA NORTH		
Electricity House City Cnr Buitengracht & Hout Streets CBD Cape Town	Electricity House City 51 Buitengracht Street CBD Cape Town 8000	Tel: 021 444 1394 Email: sseg.north@capetown.gov.za

OR

CUSTOMER SUPPORT SERVICES: AREA EAST		
EGD Head Office Bloemhof Complex Bloemhof Street Bellville	Private Bag X44 Bellville 7535	Tel: 021 444 8511/2 Email: sseg.east@capetown.gov.za

OR

CUSTOMER SUPPORT SERVICES: AREA SOUTH		
Wynberg Electricity Depot Rosmead Avenue Wynberg	Wynberg Electricity Depot Rosmead Avenue Wynberg 7800	Tel: 021 400 4750/1/2/3 Email: sseg.south@capetown.gov.za

The Service Connection Planning (SCP) branch within the EGD is responsible for the processing of applications.

Step 5: "Permission to Install" Letter Issued

After due consideration of the application, the applicant will be informed in writing regarding the outcome of the application. Successful applications will be issued with a "Permission to Install" Letter and only thereafter can system installation commence.

Step 6: Installation Commencement Upon Approval

The successful applicant may now commence with installation and commissioning of the SSEG system. Once the installation is complete, the system is ready for testing and commissioning by the installer. Note that the permanent connection of the SSEG system to the distribution network is only permitted on receipt of written permission from the City i.e. "Permission to Install" Letter. However, the SSEG system may temporarily connect to the distribution network only for the purpose of commissioning. Once the commissioning process is completed, the system must be disconnected until the "Commissioning Approval" Letter is issued by the City. The applicant must pay for changes to metering and relocate the metering position, if required. The Supplemental Contract must be completed for grid-tied SSEG with the assistance of SCP. This contract is a legal requirement that governs the relationship between the City and the customer and is valid for as long as the system is in existence.

Step 7: Submission of Commissioning Documentation

As detailed above, commissioning of the SSEG system must be done by an ECSA registered professional who must complete and sign off the GRID-TIED SSEG INSTALLATION COMMISSIONING REPORT (Appendix 1 of the GEN/EMB Form). In addition to the GRID-TIED SSEG INSTALLATION COMMISSIONING REPORT, the following documentation must also be submitted:

I. Copy of final circuit diagram
II. Electrical installation CoC as per SANS 10142-1
III. Signed Supplemental Contract.

The requirements for standby and off-grid systems are detailed in section 1.4. For standby/off-grid systems, the following will also be required:

I. Electrical installation CoC as per SANS 10142-1.

The City reserves the right to inspect the installation if required.

Step 8: "Metering Quotation" Letter Issued (if applicable)

As described above, should a metering change be required as a result of the installation, a "Metering Quotation" Letter will be issued by the City.

Step 9: Customer Pays for Metering Changes (if applicable)

Payment should be made as per the instructions in the "Metering Quotation" Letter. Once the payment is received and the customer has relocated the metering position (if required), the EGD will install and commission the new meter.

Step 10: "Commissioning Approval" Letter Issued

If all of the above steps are concluded to the City's satisfaction and all of the relevant supporting documents are received, a "Commissioning Approval" Letter will be issued.

Step 11: Customer Placed on Appropriate Tariff and Generation Commences

The customer will be placed on the appropriate tariff which will be applied from the date the AMI meter was commissioned or, if no metering change was required, from the date of issue of the "Commissioning Approval" Letter.

Step 12: Repeat the Process for Modification or Expansion of the SSEG System

Should the customer wish to modify or expand the SSEG system, a new application must be submitted.

3. Residential SSEG

3.1 Generation Size Limitations

The generation size limitations for SSEG are provided in the Table 1 below.

Service Connection				
No. of Phases*	**Service Circuit Breaker Size (A)**	**Maximum Total Generation Capacity** of SSEG (kVA***) to the grid**	**Maximum Inverter Capacity (kVA)**	**Maximum Battery Charging Current Limit (A) per Phase from the Grid****
1	40	2.3	9.2	10
1	60	3.5	13.8	15
1	80	4.6	18.4	20
3	40	6.9	27.7	10
3	60	10.4	41.6	15
3	80	13.9	55.4	20
3	100	17.3	69.3	25

Table 1:Shared LV feeder generation size limits as derived from NRS 097-2-3

* Check the main circuit breaker on your distribution board to determine whether you have a single- or three-phase connection. A single-phase connection will generally have a single main circuit breaker and a three-phase connection a triple main circuit breaker. If in doubt, consult an electrician.

** Maximum Total Generation Capacity refers to the total output capacity of the generator for export to the grid at the POC. For solar PV systems in particular, this refers to the maximum output of the inverter to the grid as limited either by hardware or software (password protected) settings.

*** kVA and kW ratings for Solar PV SSEG are similar and can be used interchangeably for estimation purposes.

**** Maximum battery storage capacity is not defined but maximum battery charging current limits are according to these values.

Notes:

i. The generation size limits in Table 1 apply to standard connections on a shared LV network.

ii. If SSEG generation capacity is 4.6 kVA or less, a single-phase inverter can be installed even if the customer has a three-phase connection at the PoC. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases and the difference in installed capacity between phases may not exceed 4.6 kVA per phase. A qualified electrician, engineer or technologist should be consulted in this regard.

iii. The maximum individual generation limit in a shared LV feeder is 25 % of the customer's NMD, up to a maximum of 17.3 kVA (generators greater than 17.3 kVA should be connected through a dedicated LV feeder).

3.2 Generation Capacity Categories

The residential generation capacity categories are detailed below:

I. Grid-tied SSEG

a) Inverter Maximum Total Generation Capacity for export to the grid is in accordance with Table 1.

b) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.

II. Grid-tied Hybrid SSEG

a) Inverter Maximum Total Generation Capacity for export to the grid is in accordance with Table 1.

b) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.

c) Battery capacity is unlimited.

d) Maximum Battery Charging Current Limit is 25% of the circuit breaker size of the customer's service connection, as per Table 1. This limit must be specified on the inverter's serial-plate or if software adjustable, the setting must be password protected.

e) If essential loads are interconnected with the grid, the compulsory external automatic change-over switch must comply with requirements detailed in Appendix 4.

III. Standby SSEG (interconnected with electrical installation)

Type 1: Passive standby UPS utilised as standby hybrid SSEG

a) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.

b) Battery capacity is unlimited.

c) Maximum Battery Charging Current Limit is 25% of the circuit breaker size of the customer's service connection, as per Table 1. This limit must be specified on the inverter's nameplate or if software adjustable, the setting must be password protected.

d) No export allowed.

e) Compulsory external automatic change-over switch must comply with requirements detailed in Appendix 4.

Type 2: Alternative supply

a) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.
b) Battery capacity is unlimited.
c) No charging from the distribution network allowed.
d) No export allowed.
e) Compulsory external automatic change-over switch must comply with requirements detailed in Appendix 4.

IV. Off-grid (physically separated and not interconnected with the electrical installation)

a) No limits on the inverter or battery capacity.

3.3 Residential SSEG Tariffs

As of 01 July 2021, all residential SSEG customers will be placed on the Home User Tariff with an additional AMI meter reading fee. For SSEG customers, the Home User Tariff works as follows:

I. A monthly network access and administration charge
II. A monthly AMI meter reading fee
III. Block 1 (0 – 600 kWh) and Block 2 (600.1+ kWh) electricity consumption charges for kWh consumed
IV. A rate per kWh at which the City will purchase exported excess generation i.e. SSEG Feed-in Tariff.

The monthly network access and administration charge, AMI meter reading fee along with the charges for consumption and credits for exported excess generation; will be billed monthly (as is the case for other City services).

3.4 Group Developments and Blocks of Flats

SSEG installations in group developments or for blocks of flats need to meet unique requirements and will be assessed on a case by case basis. The proposed installations must be discussed with the EGD before applications are submitted. Please refer to

suite of technical drawings: SK 5276. Technical requirements are detailed in the Standard for Interconnection of Embedded Generation (EEB 705) document.

4. Commercial and Industrial SSEG

4.1 Generation Size Limitations

All LV commercial and industrial (C&I) customers who wish to install SSEG systems with a generation capacity less than 1 MVA, must comply with the size limitations specified in NRS 097-2-3. For LV C&I shared feeder customers, limits as per Table 1 is applicable up to 100 A three phase only.

For LV and MV customers it is likely that specialist engineering studies will be required for C&I SSEG installations, especially if the generation capacity is above 350 kVA. The purpose of the study is to determine the impact of the proposed SSEG system on the distribution grid.

Note the difference in the definitions of Generation Capacity and Maximum Total Generation Capacity. The system designer/installer should provide further guidance in this regard.

4.2 C&I SSEG Tariffs

C&I SSEG customers will remain on the relevant tariff with the addition of the following components:

I. A monthly AMI meter reading fee
II. A rate per kWh at which the City will purchase exported excess generation. There are two feed-in tariffs available to C&I SSEG customers viz. SSEG Feed-in Tariff 1 and SSEG Feed-in Tariff 2. The applicable tariff depends on whether or not the customer elects to retain the "green attributes" of the exported excess generation or sell them to the City.

Appendix 1: Relevant Regulations, Standards and Specifications

The City requires that all SSEG installations are fully compliant with the relevant regulations, standards and specifications in order for the installation to be approved. Below is a (non-exhaustive) list of the most relevant regulations, standards and specifications:

- Electricity Regulation Act 4 of 2006 and Electricity Regulation Amendment Act 28 of 2007
- South African Grid Codes (Distribution, Transmission and Renewable Power Plants)
- Occupational Health and Safety Act 85 of 1993
- City of Cape Town Electricity Supply By-law, 2010
- SANS 10142: All Parts
- SANS 474/NRS 057: Code of practice for electricity metering
- NRS 097 Series
- City of Cape Town Standard for Interconnection of Embedded Generation (EEB 705).

Appendix 2: Approvals from other City Departments

Planning and Building Development Management Department

- Rooftop Solar PV Installations: No building plans will be required provided that the solar PV panels (in their installed position) do not project more than 1.5 meters (measured perpendicularly) above the roof and/or not more than 600 mm above the highest point of the roof.

  If the solar PV panels (in their installed position) exceed the above limits, building plans (incl. an engineer's endorsement) will be required. A relaxation in terms of the Zoning Scheme Regulations will also be required.
- Ground-mounted Solar PV Installations: No building plans will be required provided that the solar PV panels (in their installed position) do not project more than 2.1 meters (measured perpendicularly) above the natural/finished ground level.
- Clearance will be required for other SSEG technologies such as wind turbine generators.

City Health Department

- Air quality and mechanical engineering (noise) units are not required for SSEG installations that do not include generators powered by fossil-fuels i.e. diesel.
- Should a generator which burns fossil-fuels or generates noise be incorporated in the installation, approval by the City Health Department will be required.

Appendix 3: Inverter Type Testing

The City's requirements for grid-tied inverters (GTIs) and ancillary equipment (e.g. network and system grid protection voltage and frequency relay) type test certification are as follows:

I. An accredited (3rd party) body must perform the inverter type test certification in terms of NRS 097-2-1. The accredited body must according to the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006, be SANAS accredited or by a member of the recognition arrangements of the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.

II. The accredited body must:

a) Issue a Certificate of Conformity for all GTIs and ancillary equipment (e.g. network and system grid protection voltage and frequency relays for the centralised disconnect switch) in terms of the requirements of latest NRS 097-2-1 edition, currently Edition 2.1.

b) Provide summary Test Report [excluding sensitive information test results] comprising of:

- Report reference number, test laboratory name, client/applicant's name and reference, test specification and report form, test item description/name/model/types, ratings, lab and testing location, name and signature of test person and approval authority, manufacturer name and address, test report documentation version control;
- Test item particulars, test case verdicts [N/A, pass and fail], test and issue dates, general remarks;
- Copy of GTIs and ancillary equipment name plate data;
- General product information, preferably with the inclusion of the GTIs and ancillary equipment electrical block diagram;
- Summary of NRS 097-2-1 indicating all clauses, clause description/requirement/test, result/remark and verdict [N/A, pass or fail];
- Test overview summary.

III. An accredited body Certificate of Conformity is required for any brand and model. Manufacturer declaration is not accepted.

IV. Inverters certified and already installed in terms of NRS 097-2-1: 2010 edition do not require modifications until retrospective requirement must be implemented as described in Compliance with the Law above.

V. City of Cape Town type tested inverters/equipment listed in terms of NRS 097-2-1:

a) NRS 097-2-1: 2017 Edition 2 (published 2017-03-08) already listed inverters: Complying with the specification and with the electromagnetic compatibility (EMC) requirements, inclusive of Clause 4.1.13.3 frequency band that was relaxed to '30 kHz to 148,5 kHz'. Type testing in terms of IEC 61000-2-2 Ed.2 Amd.2 (30 to 150 kHz), published on 2018-05-09, was considered as alternative to SANS 50065-1. List includes inverters that may only be used in plants according to Category A3: 100 kVA - 1MVA and connection to the grid via an external customer MV/LV AC transformer.

b) NRS 097-2-1: 2017 Edition 2.1 (published 2020-07-20) for current listings: Complying with the specification.

c) Until a new NRS 097-2-1 Edition 20XX is published, all the current NRS 097-2-1: 2017 Edition 2 and 2.1 type tested inverters and equipment remain on the City of Cape Town type tested inverters/equipment list and must be re-type tested within two years after the publishing of a new NRS 097-2-1: Edition 20XX.

VI. Type tested network and system grid protection voltage and frequency relays shall be programmed in terms of NRS 097-2-1 or the applicable South African Grid Codes and may only be used in conjunction with approved NRS 097-2-1 type tested inverters on the City's list of approved inverters.

Note: Listed network and system grid protection voltage and frequency relays are used for switching two in series disconnect switches appropriately sized for the SSEG for:

a) Grid-tied inverters [compliant with NRS 097-2-1 and on the City's Approved Inverter list] without a disconnect switch integrated into the inverter whilst meeting all the other requirements, e.g. quality of supply, short circuit levels, DC injection, flicker, voltage unbalance, power factor, electromagnetic compatibility, synchronisation. This typically applicable to micro inverters.

b) Grid-tied SSEG central disconnect switch for > 30 kVA.

Type test certification and associated documentation can be submitted (via email) to the relevant CSS office in your area:

sseg.north@capetown.gov.za

sseg.south@capetown.gov.za

sseg.east@capetown.gov.za

Appendix 4: Compulsory External Automatic Change-over Switch for Grid-tied Hybrid and Standby SSEG

I. This includes interrupters, transfer switches, bypass switches, isolation switches and tie switches.
II. The interlock requirements of SANS 10142-1 Section 7.12.2.5 are applicable.
III. The change-over switch shall be SANS/IEC 60947-6-1: Low-voltage switchgear and control gear – Part 6-1: Multiple function equipment – Transfer switching equipment, compliant and preferably automatic to meet customer needs.
IV. The change-over switch shall be installed external to the inverter for grid-tied hybrid and standby SSEG (essential loads interconnected with the grid).
V. Solar PV water heating and other appliances with alternative supplies interlocked with the utility grid supply must also comply with the requirements of this appendix.

Notes:

i. The EIR CoC with the accompanying test report must provide detail of the suitably interlocked change-over switch as above in the alternative power supply installed sections.
ii. For solar PV water heating and other PV appliances with alternative supplies, a Letter of Authority (LoA) from the National Regulator for Compulsory Specifications is required for the change-over switch.

Appendix 5: South African Grid Code Signal and Control Requirements

All SSEG with a capacity of more than 100 kVA, require signal and control with the City's distribution network in terms of the Grid Connection Code for Renewable Power Plants and the proposed Battery Energy Storage Facility Grid Connection Code.

Consult the EGD for technical requirements.