



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

REQUIREMENTS FOR SMALL- SCALE EMBEDDED GENERATION

Application process to become a
small-scale embedded generator in
the City of Cape Town

2017-08-21

Record of Significant Recent Guideline Revisions

Date of Issue	Pages/Clause (in updated Version)	Description (Paragraph numbers refer to this latest update)
21/08/2017	6-8	Changes and additions to "Definitions" regarding Grid-Tied, Off-Grid, Grid-tied Hybrid, Passive Standby UPS and Suitably Interlocked change-over switch.
21/08/2017	11	Revisions to who may professionally sign-off installations
21/08/2017	15/6	Off-grid installations to be Declared. Requirements for grid-tied hybrid systems. COC <u>and</u> test report required for grid-tied hybrid systems
21/08/2017	16/9	Update of metering costs estimates for 2017/2018
21/08/2017	29/2.3 New Para	Prepayment meters required for customers with connections less than 100A
21/08/2017	43	Appendix 3- requirements for inverter requirements after update of NRS097-2-1 (after 8 March 2017)
21/08/2017	45	New Appendix 4 which covers requirements for interlocked change-over switches.
21/08/2017	Throughout	Updated SSEG webpage link to www.capetown.gov.za/electserviceforms

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Foreword

Note: It is important to ensure that you have the latest version of the various application forms and other relevant documents before proceeding with an SSEG application. These are available on the City's website: www.capetown.gov.za/ElecServiceForms

The guideline was part of a British High Commission-funded project run by Sustainable Energy Africa (Not for Profit Company) to facilitate the adoption of small-scale embedded solar PV generation in South Africa.

Indemnity

Anyone (e.g. a municipality) using these Requirements for Embedded Generation in part or in full as a basis 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 this document is to give guidance regarding the City of Cape Town's requirements and application process for connecting all forms of small-scale sustainable embedded generation such as photovoltaic panels to the City's electricity network, including both renewable energy and cogeneration.

The approval process for a small-scale embedded generation (SSEG) installation in the City varies depending on the size of the system and customer category. This guide applies to systems with a generation capacity smaller than 1 MVA (1000 kVA), and all SSEG applicants up to this limit are required to comply with the conditions and process described herein.

This document does not apply to those who wish to install a system with generation capacity of greater than 1 MVA (1000 kVA). For such systems a meeting should be arranged with the City in order to establish the necessary requirements and application process. Anyone wanting to connect more than 1 MVA will not be able to connect under the conditions of these Requirements. In addition, a generating licence or exemption letter from NERSA will be required before connection is considered.

Glossary

Alternating current

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 uses of electricity require alternating current.

Anti-Islanding

The ability of an SSEG installation to instantly and automatically disconnect the generator from the local utility grid whenever there is a power outage in the utility grid, thus preventing the export of electricity to the utility grid from the SSEG. This is done primarily to protect utility workers who may be working on the utility grid and who may be unaware that the grid is still being energized by the SSEG.

Bi-directional meter

A meter that separately measures electricity flow in both directions (import and export)

Cogeneration

The generation of electricity using waste heat.

Customer

In the context of this document, customers are the City's electricity consumers who also generate electricity through small-scale embedded generation.

Dedicated network

Section of the utility grid that exclusively supplies a single customer.

Direct Current

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

Generating capacity

The maximum amount of electricity, measured in kilovoltampere (kVA) (limited either by hardware, or by 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 to the utility's electricity grid 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 utility 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, is said to be a "grid-tied hybrid" SSEG installation.

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 utility grid.

Isolated

A section of an electrical network which is disconnected from all other possible sources of electrical potential is said to be isolated

Load profile

The variation of the customers rate of electricity consumption (or demand) over time.

Low-voltage

Voltage levels up to and including 1kV. (1kV= 1000 volts)

Medium-voltage

Voltage levels greater than 1kV up to and including 33kV.

Net consumer

A net consumer is a customer who purchases (imports) more kWh of electricity than they export (sell) it over any 12 month period.

Off-grid SSEG

SSEG that is physically separated and electrically isolated from and can never be connected to the utility electricity grid – either directly or through a customer's internal wiring – is said to be "off-grid". Consumer loads cannot be simultaneously connected to the utility grid and the SSEG installation, and export of energy onto the utility grid by the generator must not be possible. SSEG that is connected to the grid through a reverse power flow blocking relay is not considered to be off-grid.

Passive standby UPS utilised as off-grid 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 primary power source.
- b. When the latter is outside stated limits, the load is supplied from the UPS inverter, operating in stored-energy mode.

Such a system is regarded as off-grid provided 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 the loads, or;
- ii. Inverter mode (when the grid supply is interrupted or applicable electrical service conditions are outside stated limits or required tolerances). The grid supply is disconnected and selected loads are supplied from the inverter, within the rating of the energy storage or SSEG.

Point of Common Coupling

The nearest point on the electrical network where more than one customer is connected.

Point of Connection

An electrical node on a distribution system where the customer's electrical assets are physically connected to the utility's grid (in this case the City of Cape Town's grid)

Pr Eng, Pr Tech Eng, Pr Cert Eng and Pr Techni Eng

This refers to a professional engineer, professional technologist, professional certificated engineer or professional engineering technician who is registered with the Engineering Council of South Africa (ECSA).

Reverse power flow

The flow of energy from the customer electricity installation onto the utility grid (i.e. export) as a result of the instantaneous generation exceeding the instantaneous consumption at the generation site in question.

Reverse power flow blocking

A device which prevents power flowing from an embedded generator back onto the utility grid.

Shared network

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

Small-scale embedded generator

A small-scale embedded generator for the purposes of these Requirements is an embedded generator with a generation capacity of less than 1000kVA (1MVA).

Suitably interlocked change-over switch

Switch required for grid-tied hybrid SSEG and a passive standby UPS utilised as off-grid hybrid SSEG to interrupt the grid supply. Switch requirements listed in Appendix 4.

The City

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

Utility

The electricity distribution service provider responsible for the electricity grid infrastructure to which the customer is connected. (Both the City of Cape Town and Eskom are responsible for portions of the electricity network within the City of Cape Town's metropolitan boundary.)

Utility Network (or Utility Grid)

The interconnected network of wires, transformers and other equipment, covering all voltage ranges, and belonging to the City of Cape Town which supply customers in the City of Cape Town distribution area with electricity.

Wheeling

The deemed transportation of electricity, over a utility's electrical network from an SSEG to a third party electricity customer.

Abbreviations

ADMD:	After Diversity Maximum Demand
AC:	Alternating Current
AMI:	Advanced Metering Infrastructure
DC:	Direct Current
DSD:	Distribution System Development (a section within the EGD Department)
ECSA:	Engineering Council of South Africa
EG:	Embedded Generation
EGD:	Electricity Generation and Distribution Department of the City of Cape Town
kVA:	kilovolt-ampere (unit of electrical power, often similar in magnitude to kW)
kW:	kilowatt (unit of electrical power)
kWp:	kilowatt peak (the rated peak output of solar PV panels)
LV:	Low voltage
MV:	Medium voltage
MVA:	Megavolt-ampere (1000kVA)
NERSA:	National Energy Regulator of South Africa
NMD:	Notified Maximum Demand
PCC:	Point of common coupling
PoC:	Point of Connection
PV:	Photovoltaic
RPP:	Renewable Power Plant
SSEG:	Small-scale Embedded Generation/Generator
VAT:	Value added tax

Important Notices

Compliance with the Law

Paragraph 39 of the City of Cape Town Electricity Supply By-Law 2010 states that no generation equipment may be connected to the grid without the express consent of the Director of the Electricity Services Department.

It is explicitly emphasised that a grid-connected SSEG installation which has been issued only with a Certificate of Compliance (CoC) **has not been authorised** to connect to the City's electricity grid.

Clause 2 of the Electricity Installation Regulations of the Occupational Health and Safety Act states that it is the property owner who carries the responsibility for the safety of the electrical installation on the property. This includes everything related to SSEG installations on the property.

Failure to obtain this consent constitutes an offence which could lead to a fine and/or imprisonment in terms of the City of Cape Town Electricity Supply By-Law 2010.

Furthermore, the installation may be in contravention of the Occupational Health and Safety Act, for which punitive sanctions apply.

Customers found to have illegally connected SSEG to the grid (either before or after their electricity meter) will be instructed to have the installation disconnected from the grid. A Certificate of Compliance issued by an authorised electrical contractor will be required as proof of such disconnection.

Should the customer fail to have the SSEG disconnected from the grid, the Electricity Services Department will disconnect the electricity supply to the property (as provisioned for in the Electricity Supply By-Law)

Customers wishing to connect SSEG legally to the City's grid will be required to follow the normal application procedure as detailed in these Requirements.

Customers drawing less than 100 A with credit meters will be required to have their credit meter replaced with a prepayment meter at the City's cost.

No exemption from any of the City's requirements will be granted for "retrospective applications".

Small-scale Embedded Generation Tariff Structure

On Wednesday 2014-12-05 the National Energy Regulator of South Africa (NERSA) issued a notice that it is in the process of developing a Regulatory Framework on Small-scale Embedded Generation. These Regulations may or may not have a material effect on the City's SSEG scheme as detailed in these Requirements.

Generating licences

Existing legislation requires that anyone generating electricity “not for own use” must obtain a generating licence from the National Energy Regulator of South Africa (NERSA). Clarity is still required whether feeding surplus generation back onto the utility grid and then drawing the same amount of electricity off the grid at a later stage for consumption is regarded as being “generation for own use”. In the absence of this clarity, the City will not require SSEGs smaller than 1 MVA to obtain such a licence provided that, over any consecutive 12-month period, they do not feed more electricity onto the City’s grid than they purchase from the City. The City will register and authorise grid connection of SSEGs up to 1 MVA without evidence of a generation licence. Anyone wanting to connect more than 1 MVA must produce evidence of compliance with Sections 8, 9 and 10 of the Electricity Regulation Act regarding the licensing of generation and the registration of generation with the Regulator failing which the application will not be considered.

Customers authorised by the City may still be required by NERSA to obtain a generating licence. Customers are responsible directly to NERSA for obtaining a generating licence and the City accepts no liability should NERSA refuse a generating licence and the City subsequently withdraws registration and authorisation. The City is obliged to report to NERSA on a regular basis regarding all grid connected generation. Should NERSA refuse a generating licence the generator must be disconnected from the grid unless the customer has received an exemption from NERSA in this regard. Any queries requiring clarity in this area must be discussed with NERSA.

Professional Sign-off

Until such time as

1. SANS 10142-Parts 1, 3 and 4 (The Wiring of Premises) are updated and published, and
2. accredited embedded generation installation and commissioning electricians/technicians exist,

all embedded generation systems installed on the City of Cape Town grid must be certified as complying with the City’s requirements as follows:

- ECSA-registered professional engineers, ECSA-registered professional technologists and certificated engineers may certify industrial, commercial and residential SSEG installations
- ECSA-registered professional technicians may only certify residential SSEG installations

Testing of Inverters

Until such time as an SABS mark is issued for inverters, the City will require proof in the form of test certificates, of type tests having been successfully carried out by a third party test house certifying compliance of the inverters with the requirements of the City and NRS097-2-1. A list of inverters which have been shown to comply with the City’s requirements can be found on the City’s website¹. Details of the City’s requirements regarding the Type Testing of inverters are found in Appendix 3.

¹ www.capetown.gov.za/electricserviceforms

Generation Curtailment

The City is following a considered, calculated approach regarding the introduction of embedded generation onto its electricity grid. Notwithstanding this it may become necessary – in the event of operating conditions resulting in electricity network parameters not meeting statutory minimum quality-of-supply standards – to impose peak generation limits on embedded generator installations. It is expected that these limitations would be of a temporary nature, applied only during abnormal system conditions or low load periods.

1. Introduction

Heightened environmental awareness, dramatic increases in the price of electricity, rapidly decreasing costs of photovoltaic (PV) panels, and the risk of national power blackouts have all resulted in electricity distributors around the country being inundated with requests to allow electricity customers to connect PV and other SSEGs to the electricity grid. Such SSEGs 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 grid. One of the major advantages of such a grid connected system is obviating the need for backup batteries which stand-alone renewable energy generators usually require.

The parallel connection of any generator to the electrical grid, however powered, has numerous implications for the local electricity utility. The most pressing is the safety of the utility staff, the public and the user of the generator. Further implications include the impact of the physical presence of the generation on neighbours (e.g. visual, noise), the impact on the quality of the local electrical supply, and metering and billing issues. There is therefore a strong need for such practice to be regulated for the general benefit and protection of citizens and manageability of the distribution network.

Consequently, the City's Electricity Supply By-law requires that anyone wanting to connect a generator to the City's electricity grid must obtain consent from the Director of the Electricity Generation and Distribution (EGD). This document outlines the City's requirements in this regard and lays out the associated application processes.

Although the electricity distribution industry is highly regulated, SSEGs have not yet been adequately covered in national policy or legislation. In this void, the City has developed policies and practices which it believes are consistent with broader national policy. In particular, the City does not believe it is allowed to purchase electricity at a greater cost than it would have paid Eskom for the generated electricity. The City also does not believe customers are permitted by national legislation to sell electricity to the City in excess of what they purchase from the City over any consecutive 12-month period.

Customers wishing to install an SSEG and feed power back onto the utility grid are required to move onto the SSEG tariff, which includes a daily service charge in order to cover the operating costs of the utility network.

2. Defining small-scale embedded generation

Small-scale embedded generation (SSEG) refers to power generation under 1MVA, such as PV systems or small wind turbines which are located on residential, commercial or industrial sites where electricity is also consumed. SSEG is in contrast to large-scale wind farms and solar parks that generate large amounts of power, typically in the multi-Megawatt range. 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 - from the customer onto the utility grid. An SSEG therefore generates electricity that is "embedded" in the local electricity distribution network in that it is connected to the utility network on the customer's side of the utility's electricity meter.

3. Who the document is for

This Guideline is to assist customers who wish to connect an SSEG, with generation capacity smaller than 1 MVA (1000 kVA), to the City's electricity grid. It is intended to provide guidance in this regard to:

- SSEG project developers
- Commercial and Industrial building owners
- Residential buildings owners
- SSEG installers
- Energy consultants commissioned to design SSEG systems
- City officials involved in SSEG generation
- Professional Engineers or Technologists involved in SSEG commissioning

It is essential that all customers wishing to install a grid-tied SSEG, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval is received from the City before system installation commences. The City needs to ensure that, amongst other considerations, the SSEG installation can be accommodated on the electrical network and that the total SSEG generation capacity of the network has not been exceeded. Equipment should therefore 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. A list of inverters which have been shown to comply with the City's requirements can be found on the City's website²

This document does not apply to those who wish to install a system with generation capacity of greater than 1 MVA (1000 kVA). For such systems a meeting should be arranged with the City in order to establish the necessary requirements and application process. Anyone wanting to connect more than 1 MVA will not be able to connect under the conditions of these Requirements. In addition, a generating licence or exemption letter from NERSA will be required before connection is considered.

Eskom Customers

Customers residing in Cape Town, but located in Eskom's area of supply, need to apply to Eskom for consent to connect SSEG to the electrical grid.

4. SSEG systems not permitted

Net generators are not permitted. SSEGs can either be "net consumers" or "net generators": "Net consumers" on average (over rolling 12-month periods) purchase more electricity from the utility than they feed back onto the utility grid. "Net generators" on average (over rolling 12-month periods) purchase less electricity from the utility than they feed back onto the utility grid.

SSEGs which are net generators are not permitted by the City, and these Requirements therefore apply only to net consumers.

As mentioned in the introduction, the City does not believe it has a legal mandate to purchase electricity, on average taken over any consecutive 12-month period, in excess of what it sells to the customer in question.

² www.capetown.gov.za/electserviceforms

Transfer of power to a different location is not permitted:

The power produced by the SSEG must be utilised on the property on which the generator is located, or fed onto the utility network for purchase by the City. The following are not permissible:

1. Installation on a different property to where the power is used (e.g. installing solar PV panels on a neighbour's house's roof)
2. Supplying power from an SSEG on your premises to another premises (e.g. selling power to neighbours or to another premises elsewhere in the city). This is also known as wheeling.

5. Operation of Generators as a Back-Up Supply

Grid-tied inverters are generally not designed to operate in "islanded 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 islanded state, it must be effectively isolated from the City's grid during operation (as is legally required of any standby generator). SANS 10142-1:2017 Annexure P gives an example of what is required in this regard. Once power to the City's grid is restored, the generator may not be connected or reconnected to the grid until it has been properly synchronised with it. If the embedded generator 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 City's Electricity Services Department 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 Electrical Installation Regulations (2009) must install the generator and issue a Certificate of Compliance 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.

6. SSEG Installations Only for Off-grid Operation.

Generators that are not connected to the electricity grid in any way, and are thus 'off-grid' generators, do not need any written consent from the Director of the Electricity Generation and Distribution Department. Customers with SSEG installations that they deem to be off-grid will however be required to submit the following to substantiate that the SSEG installation is off-grid as defined and that the Electricity Supply By-law therefore does not apply to it:

1. A completed "Declaration for Off-grid Embedded Generation form"³ with details of the customer and the installation, declaring that the SSEG installation is deemed to be off-grid and thus does not have to be approved by EGD;
2. A certificate of compliance (CoC) and test report for electrical installations certifying that the SSEG installation is physically separated from the City's grid and the part of the installation on the property that is being supplied from the City's network. If a suitably interlocked change-over switch is required for a passive standby UPS utilised as off-grid hybrid SSEG, the certificate of compliance and the test report must certify that the change-over switch complies with the requirements as detailed in Appendix 4.
3. A schematic diagram showing details of the SSEG installation in relation to the rest of the installation and the City's grid.

Customers who wish to install off-grid SSEG and draw less than 100 A and who have a credit meter will be required to have their credit meter replaced with a prepayment meter at the City's cost.

³ www.capetown.gov.za/electserviceforms

NOTE that an SSEG installation connected to the City's electricity grid through a reverse power flow blocking relay is not considered to be operating as an off-grid device. It is grid-connected and must comply with all the requirements detailed in these Requirements.

In addition, approvals from other City departments such as the Planning and Building Development Management Department may still be necessary, depending on the type of generator proposed and its characteristics. It is the responsibility of the prospective stand-alone generator owner to obtain the necessary approvals from these departments direct.

7. SSEG system decommissioning

The City of Cape Town requires notice of any SSEG system which has been decommissioned. An SSEG system which has been decommissioned must be disconnected from the grid at the customer's cost by the removal of wiring which connects the inverter/s with the grid.

The Decommissioning Report found in the GEN/EMB application form must be completed and submitted to the relevant DSD office (contact details in 'Step 4' of application process described later on in these Requirements).

8. Change of property ownership

When transfer of ownership of a property takes place which 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 paragraph above. The Certificate of Compliance 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. 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.

9. Budgetary Estimates of costs for metering changes

2017/2018 Budgetary estimates are as follows:

Item	Description	Tariff	Total in R (VAT excl.)
1	AMI LV up to 100 A	Residential SSEG; SPU high	9821.21
2	AMI LV including CTs	SPU High or LPU LV	15308.03
3	AMI MV metering	LPU MV or SPU high	12290.83

Note: the above budgetary estimates exclude metering accommodation requirements.

10. Web access to historical graphs of consumption and excess generation

Electricity customers with AMI meters may, after registering on the following City website <http://www.capetown.gov.za/City-Connect/Register/eservices-and-municipal-accounts/Register-for-a-municipal-account>, access historical graphs of their premises' electricity consumption and excess generation.

SECTION A:

RESIDENTIAL

SMALL-SCALE EMBEDDED
GENERATORS

1. General Requirements: Residential

1.1. Generation size limitations

The generation size limits for residential customers wishing to install an SSEG are detailed below:

Service connection		
No. of Phases*	Service Circuit Breaker Size (A)	Maximum Total Generation Capacity** of SSEG (kVA***)
1	40	2,3
1	60	3,5
1	80	4,6
3	40	6,9
3	60	10,4
3	80	13,9
3	100	17,3

Table 1. Residential SSEG size limitations as derived from NRS 097-2-3

* To determine if you have a single-phase or three-phase connection, check the main circuit-breaker on the distribution board. A single-phase supply will generally have a single main circuit-breaker, and a three-phase a triple main circuit-breaker. If in doubt consult an electrician.

** Generation Capacity refers to the total output capacity of the generator. For PV systems in particular, this refers to the maximum output of the inverter as limited either by hardware, or by software settings. The system designer/installer will provide guidance here.

*** kVA and kW ratings for SSEGs are similar in most cases and can be used interchangeably for estimation purposes.

Note: The generation size limits in the table apply to normal residential connections on a shared low-voltage (LV) network. Customers who wish to apply for an installation with a generation capacity exceeding the limits in the above table should consult with EGD before commencing with their formal application.

Note: 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. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases. A qualified electrician, engineer or technologist should be consulted here.

1.2. Group Developments and Blocks of Flats

SSEG installations in group developments or for blocks of flats need to meet unique requirements. Proposals must be discussed with DSD before applications are submitted.

1.3. Electricity Generation Licences

Presently, customers wishing to install an SSEG with a generation capacity of less than 1000 kVA are not required by the City to obtain a generating licence from NERSA before consent is given by the City to connect to the electricity grid. Customers authorised by the City may still be required by NERSA to obtain a generation licence. Such customers are responsible directly to NERSA for obtaining a generation licence and the City accepts no liability should NERSA refuse a generation licence and the City suspends registration and authorisation. The City is obliged to report to NERSA on a regular basis regarding all grid connected generation. Should NERSA refuse a generation licence the generator must be disconnected from the grid unless the customer has received an exemption from NERSA in this regard.

1.4. Metering and Tariffs

Residential customers may adopt one of two approaches to connecting SSEG to the grid:

- i. Customers wanting to connect SSEG to the grid without being compensated for reverse power flow will be required to install reverse power flow blocking protection to prevent reverse power flow onto the electricity grid. Customers with prepayment meters may then, subject to the ruling policies for tariffs and metering, keep their existing meter and remain on the relevant electricity consumption tariff. Customers drawing less than 100 A with credit meters will be required to have their credit meter replaced with a prepayment meter at the City's cost. Customers drawing more than 100 A will be required to either reduce their capacity below 100 A, or alternatively have a bi-directional AMI meter supplied and installed by the City at the customer's cost and be placed on the SPU 1 tariff. In other words, conventional credit and prepayment meters are never allowed to run backwards.
- ii. Residential customers installing SSEG who wish to participate in the SSEG tariff must have a bi-directional AMI credit meter installed. The City will provide and install the requisite meters at the customer's cost. The SSEG tariff is only available to customers who are "net consumers" and it is specifically not available for customers who are "net generators".

Customers (whether with single or three phase supplies) wishing to participate in the SSEG tariff will have to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box or meter room 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 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 to the City's specifications on the street-front property boundary. Such a meter box must face outwards and be locked with a standard EGD lock.

When a customer changes to the SSEG tariff and has an AMI (credit) meter installed to replace a prepayment meter, unused Prepayment meter (PPM) units will be refunded fully or partially according to the ruling policy.

Tariffs are determined annually by the City and are subject to approval by NERSA. The current tariffs are to be found on the City's website.⁴

⁴ www.capetown.gov.za/electricserviceforms

The applicable SSEG tariff is the *Residential small-scale embedded generation tariff* and comprises:

1. A daily service charge
2. Two electricity consumption charges for kWh consumed (for 0kWh-600kWh and >600kWh)
3. A rate per kWh at which the City will purchase residential excess generation

The daily service charge along with charges for consumption and credits for generated electricity fed onto the utility network will be billed monthly (as is done for other City services e.g. water and rates).

Example of payments and refunds for a residential SSEG tariff

SSEG Residential Tariffs 2017/18*			
	Units	Tariff excl VAT	Tariff incl VAT
Service charge	R/day	11,43	13,03
Energy charge – consumption 0 – 600 kWh	c/kWh	111,17	126,73
Energy charge – consumption 600.1 + kWh	c/kWh	205,65	234,44
Energy charge – generation**	c/kWh	68,89	N/A

Typical monthly account if consuming 800kWh and generating 100kWh excess in a particular month						
	Units	Quantity	Applicable tariff (excl)	Applicable tariff (incl)	Rand excl VAT	Rand incl VAT
Service charge	days	30	11,43	13,03	342,90	390,90
Purchase for consumption	kWh	600	111,17	126,73	667,02	760,38
Purchase for consumption	kWh	200	205,65	234,44	411,30	468,88
Credit for generation**	kWh	100	68,89	N/A		-68,89
					Total payment	1551,27

* - these tariffs are given as an example. Please check the City website for the current tariffs

** - this amount has no VAT added as residential customers are generally not VAT registered

Note: For non-vat registered residential customers, payment for excess generation will exclude VAT

1.5. Load profile management

The SSEG tariff has been structured in such a way that customers will find it most beneficial, from a financial and practical point of view, to ensure that they utilise as much of the generated electricity as they can and avoid or minimise reverse power flow. For example, where a PV system is installed, loads should be shifted to occur during the middle of the day when generation is typically at its highest – when the sun is shining. This means that customers should arrange that loads such as pool pumps, geysers etc. are switched on during this time – from mid-morning to mid-afternoon (roughly from 10:00 until 15:00) when PV generation is at a maximum, and are off after sunset.

1.6. Grid studies

Under normal circumstances grid studies are not required for the connection of a residential SSEG that is within the limits detailed in Table 1 above.

1.7. Who pays for what

- The residential customer is responsible for all the costs involved in the supply and installation of meters
- The customer will be responsible for any rearrangement of the installation or meter accommodation including the moving of the metering point to the property boundary. The cost of providing a meter kiosk in the road reserve will be borne by the City unless the kiosk cannot be accommodated there due to the pavement being too narrow in which case the customer will be required to provide a metering kiosk to the City's specifications inside the property on the road boundary.
- The customer will be responsible for the cost of any specialist grid studies (although such studies are unlikely in the case of residential SSEG installations).
- The customer will be responsible for any changes required to the utility network upstream of the connection point as a result of the SSEG installation (although the need for such changes is unlikely).
- The customer will be responsible for all the costs associated with specialist tests that need to be carried out, e.g. Inverter testing, as well as for obtaining the required certification of the design and installation as detailed below.
- The cost of changing an existing credit meter to a prepayment meter will be borne by the City (Note- prepayment meters cannot be provided for supplies greater than 100A)

1.8. Applicable technical standards

Most of the technical requirements for SSEGs are covered in the following standards (note that these do not necessarily cover all requirements for SSEG systems - see Appendix 1 for the complete list):

1. NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation
2. South African Renewable Power Plant Grid Code

The above standards cover aspects such as voltage range; flicker; DC injection; frequency operating range; harmonics and waveform distortion; power factor; synchronization; safe disconnection from the network; overvoltage and undervoltage; sudden voltage dips and peaks; voltage change; overfrequency and underfrequency; anti-islanding; DC current injection; network faults; response to utility recovery; isolation; earthing; short-circuit protection; labelling.

The design and installation of all SSEG equipment will need to comply with these requirements. Consult with your supplier and/or installer to ensure that these conditions are met.

1.9. How to apply for permission to install Grid- Tied SSEG

The GEN/EMB application form must be completed for all forms of grid-tied embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plant. **Should** a tariff or metering change be required for the SSEG installation, the "Application form for new or modified electricity supply service" must also be completed. (Off-Grid installations must be declared as laid out in Paragraph 6 on page 15).

The forms are available on the City's website.⁵ The text box below highlights some important points to consider prior to applying. Figure 1 that follows outlines the application process:

Purchasing your equipment: SSEG equipment that is to connect to the grid must comply with the City's requirements. It is therefore important for customers to be familiar with these requirements **before purchasing the equipment**. This is of particular relevance to the inverter. Specific technical information and certificates are required for submission with the initial application form. It is the responsibility of the customer to ensure that equipment complies with the required standards. A list of inverters which have been shown to comply with the City's requirements can be found on the City's website:

www.capetown.gov.za/ElecServiceForms

Where there is no existing electricity service connection: Where an SSEG is to be connected at a location where there is currently no connection to the utility network, an "Application form for new or modified electricity supply service" should be submitted simultaneously as a separate document to the SSEG application form. This application form can be found on the City's website⁴.

Where the SSEG installation requires a tariff or metering change: Should a tariff or metering change be required for the SSEG installation, the "Application form for new or modified electricity supply service" must also be completed.

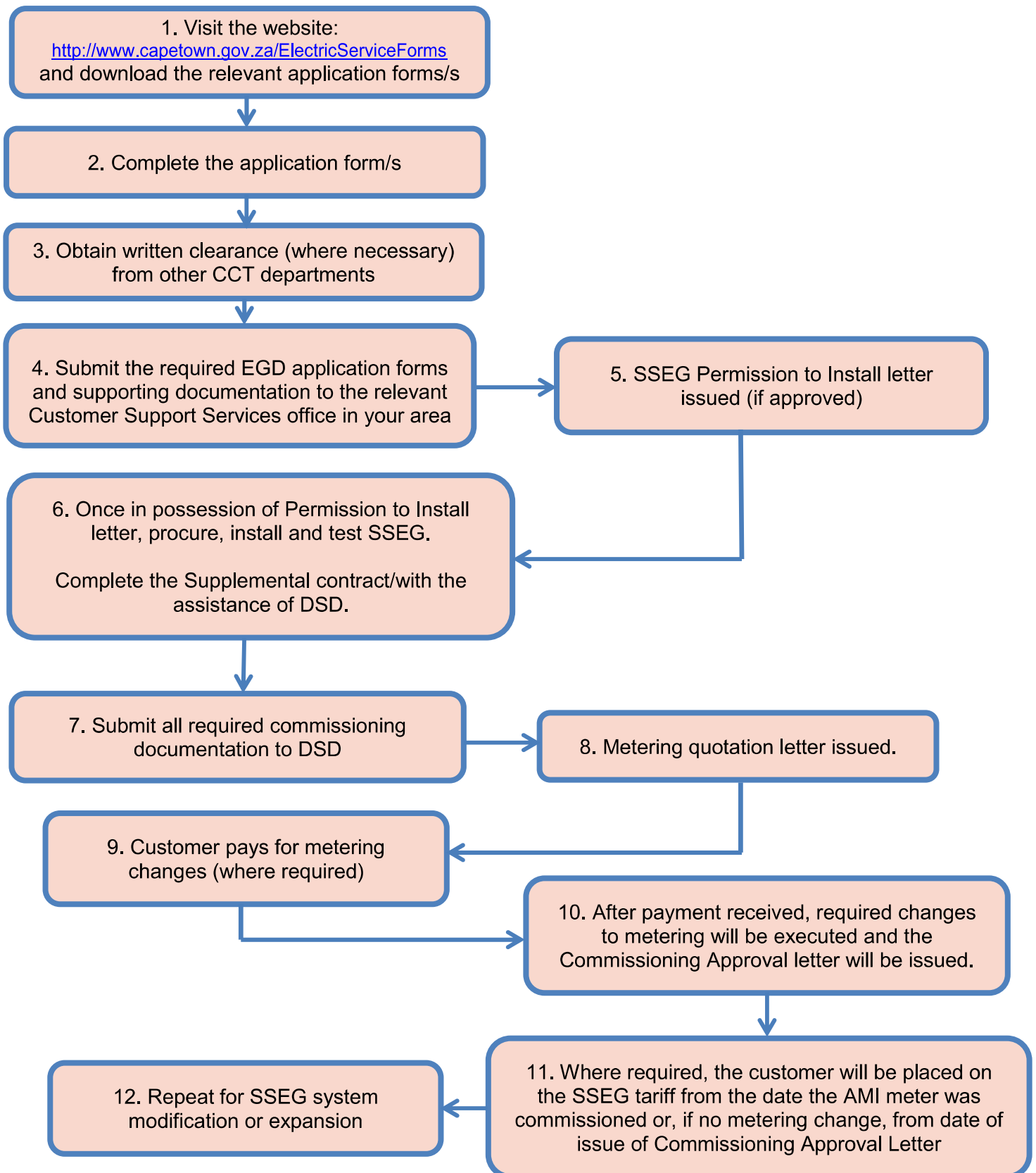
Future expansion: Consent to connect the SSEG to the electricity grid is only granted for the declared generation capacity. Customers wishing to increase the capacity of their generation or make changes to their current installation must obtain approval for the expansion or change. Application must again be made through the submission of a completed GEN/EMB application form. It is important that the customer remains a 'net customer'.

Professional sign off: As detailed on page 11, the final installed SSEG system must be signed off on commissioning as complying with the City's requirements by a professional engineer or technologist registered with ECSA. For more information regarding professional personnel, visit: <https://www.ecsa.co.za/default.aspx>

⁵ www.capetown.gov.za/electricserviceforms

Customer Actions

EGD Actions



STEP 1: VISIT CITY WEBSITE

Visit the City's website and download the relevant⁶ application form/s as noted above. Alternatively, the forms are obtainable from the Customer Support Services (CSS) offices listed lower down. The GEN/EMB form requires both basic and technical information of the proposed SSEG project to ensure that all SSEG connections are done safely and legally and in compliance with all requirements. Information required includes type of energy conversion, the total generating capacity of the SSEG, electrical parameters, expected consumption, network connection point, synchronising method, anti-islanding method and generator control method amongst others (not all information is relevant for all generation system types).

STEP 2: COMPLETE GEN/EMB APPLICATION FORM AND, IF REQUIRED, THE GENERAL APPLICATION FORM FOR NEW OR MODIFIED CONNECTIONS.

The GEN/EMB form must be filled in for all installations which are to be grid-tied. The "General Application form for New or Modified Connections" must be filled in whenever there is to be a change to either the tariff or the meter. The City requires that the application form/s be signed by the property owner. Details of the proposed installer must also be provided. The property owner may need support from the proposed installer or a professional in completing the GEN/EMB application form. Details in the GEN/EMB form that will need particular consideration:

Preliminary design: a simple circuit diagram showing major system components and point of common coupling (PCC) 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.

Various electrical parameters of the system: these sections require information on the electrical specifications of the SSEG system. Not all sections of the GEN/EMB application form are applicable to all SSEG types.

System protection detail: this includes information about the synchronizing method, anti-islanding, power quality, etc.

Proposed peak power generation output: maximum power expected to be generated must be detailed in the application form. This must be within the maximum power limits given earlier in this document.

STEP 3: OBTAIN PERMISSION FROM OTHER CITY DEPARTMENTS

SSEG installations will require prior approval from other municipal departments such as Planning and Building Development Management, City Health Specialised Services. Note that photovoltaic (PV) SSEG applications will only require approval from Planning and Building Development Management and then only if the installation falls outside defined parameters. Applications to connect to the grid will not be considered until all relevant approvals have been obtained. All applicable approvals must be reflected in the relevant sections of the GEN/EMB application form. Requirements of these departments are summarised in the Appendix 2: *Approval from other Departments*.

⁶ www.capetown.gov.za/elecserviceforms

STEP 4: SUBMIT COMPLETED APPLICATION FORM AND ATTACHMENTS

Once the relevant forms ("GEN/EMB" and "General Application form for New or Modified Connections") have been completed and consent has been obtained from the other relevant City departments the form must be submitted to the relevant Customer Support Services office for the area in which the project is located. A map showing Area boundaries (Electricity Distribution Licence and Area Boundaries) can be found on the City's website⁷.

The table below shows the different area offices.

Customer Support Services: Area North		
Test & Metering Building Ndabeni Electricity Complex Melck St, Ndabeni, Cape Town	Ndabeni Electricity Complex Melck St, Ndabeni, Maitland 7405	Tel: 021 444 2096/7 Fax: 021 444 2112 email: sseg.north@capetown.gov.za
Customer Support Services: Area East		
Electricity Services Head Office Bloemhof Centre, Bloemhof Street Bellville	Private Bag X44 Bellville 7535	Tel: 021 444 8511/2 Fax: 021 444 8787 email: sseg.east@capetown.gov.za
Customer Support Services: Area South		
1st Floor, Wynberg Electricity Depot, Rosmead Avenue Wynberg, Cape Town	Wynberg Electricity Depot Rosmead Avenue Wynberg 7800	Tel: 021 763 5664/5723 Fax: 021 763 5687 email: sseg.south@capetown.gov.za

The Distribution System Development (DSD) section, a unit within the City's EGD, will then process the application.

STEP 5:EGD ISSUES "PERMISSION TO INSTALL" LETTER

After due consideration of the application, the applicant will be informed in writing whether the application has been successful. Once notified by means of a "Permission to Install" letter of a successful application, the applicant may commence installation.

STEP 6: INSTALLATION COMMENCEMENT UPON APPROVAL

The successful applicant may now commence with installation and commissioning of the SSEG system. Once fully installed, the system is ready for testing and commissioning by the SSEG installer. Note that permanent connection of the SSEG system to the electricity grid is only permitted on receipt of written permission from the City. However, the SSEG may temporarily connect to the utility grid for the commissioning process only, where after it must once again be disconnected until the "Commissioning Approval letter" is granted by the

⁷ www.capetown.gov.za/elecserviceforms

City. The applicant must pay for changes to metering and, if required by the EGD, relocate the metering position. The Supplemental contract must be completed with the assistance of DSD. This is a legally required contract that governs the relationship between the City and the customer. The contract is valid for as long as the project is in existence.

STEP 7: COMMISSIONING DOCUMENTATION TO BE SUBMITTED TO DSD

As detailed on page 11, commissioning of the system must be undertaken by a Pr Eng, Pr Tech Eng, Pr Cert Eng or Pr Techni Eng, who must complete and sign off the SSEG Installation Commissioning Report (To be found in the GEN/EMB application form)

In addition to the Commissioning Report, the following documentation must also be completed and submitted to the relevant DSD office:

- Final copy of circuit diagram
- An electrical installation Certificate of Compliance as per SANS 10142-1
- A signed Supplemental Contract for Embedded Generation.

The City has a right to inspect the installation if it so requires.

STEP 8: METERING QUOTATION ISSUED

If a change to metering is required, a metering Quotation letter will be issued by the City.

Step 9 CUSTOMER PAYS FOR ANY REQUIRED METERING CHANGES

Payment should be made as instructed in the Quotation letter.

STEP 10: INSTALLATION AND COMMISSIONING OF METER (IF REQUIRED)

If a change to the metering is required, after the customer has paid for any associated costs and (if so requested) relocated the metering position the EGD will install and commission the new meter. If all of the above is satisfactory, the City will issue a "Commissioning Approval" letter.

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 change was required, from the date of issue of the Commissioning Approval Letter.

STEP 12: REPEAT THE PROCESS IN THE CASE OF SSEG CAPACITY MODIFICATION OR EXPANSION

Should an expansion or a change to the system be required, a new application must be completed.

Note: Any queries regarding any matter regarding SSEG must be referred to the relevant Customer Support Services area office as listed in STEP 4 above

SECTION B:

COMMERCIAL AND INDUSTRIAL SMALL-SCALE EMBEDDED GENERATORS

2. General Requirements: Commercial and Industrial

2.1. Generation size limitations

This document does not cover systems over 1MVA (1000kVA).

All LV commercial and industrial customers planning to install SSEG systems under 1MVA must comply with the sizing limitations specified in NRS 097-2-3.

MV commercial and industrial customers planning to install SSEG systems under 1MVA may require a bespoke engineering study to determine the impact of the proposed SSEG system size on the network. For systems over 17,3kVA an initial consultation with the City is strongly recommended to determine maximum permissible generation size due to grid parameters.

Generation size refers to the total output capacity of the generator. For PV systems in particular, this refers to the maximum output of the inverter as limited either by hardware, or by software settings. The system designer/installer will provide guidance here.

2.2. Electricity Generation Licences

Presently, customers wishing to install an SSEG with a generation capacity of less than 1000kVA are not required by the City to obtain a generating licence from NERSA before consent is given by the City to connect to the electricity grid. Customers authorised by the City may still be required by NERSA to obtain a generation licence. Such customers are responsible directly to NERSA for obtaining a generation licence and the City accepts no liability should NERSA refuse a generation licence and the City suspends registration and authorisation. The City is obliged to report to NERSA regarding all grid connected generation. Should NERSA refuse a generation licence the generator must be disconnected from the grid unless the customer has received an exemption from NERSA in this regard.

2.3. Metering

Commercial and industrial customers wanting to connect SSEG to the grid and to be compensated for reverse power flow will require a bi-directional AMI credit meter. This includes customers currently using prepayment meters. The City will provide and install the necessary meters at the customer's cost.

Customers wanting to connect SSEG to the grid but not be compensated for reverse power flow will be required to install reverse power flow blocking protection to prevent reverse power flow onto the electricity grid. The consumers may then, subject to the ruling policies for tariffs and metering, keep their existing prepaid meter and remain on the SPU 2 electricity consumption tariff. Prepayment meters are never allowed to run backwards.

Customers (whether with single or three phase supplies) wishing to participate in the SSEG tariff might be required to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box or meter room already exists on the street-front property boundary or where access to the current metering accommodation is considered adequate. 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. Only in cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, will customers be required to provide metering accommodation to the City's specifications on the street-front property boundary. Such a meter box must face outwards and be locked with a standard EGD lock.

When a customer changes to the SSEG tariff and has an AMI (credit) meter installed, unused Prepayment meter (PPM) units will be refunded fully or partially according to the ruling policy.

Customers drawing less than 100 A with credit meters will be required to have their credit meter replaced with a prepayment meter at the City's cost. Customers drawing more than 100 A will be required to either reduce their capacity below 100 A, or alternatively have a bi-directional AMI meter supplied and installed by the City at the customer's cost and be placed on the SPU 1 tariff. In other words, conventional credit and prepayment meters are never allowed to "run backwards".

2.4. Tariffs

Tariffs are determined annually by the City and are subject to approval by NERSA. SSEG applicants should check the City's website for the latest tariffs - the applicable tariff is the *commercial and industrial small-scale embedded generation tariff* and can be found on the City's website⁸.

Customers on tariffs which have a daily service charge will see no difference to the tariff other than the addition of a generation credit component which is simply a rate/kWh exported.

Note that commercial customers with a prepayment meter on the SPU 2 tariff will be changed to SPU 1 tariff and will require a bi-directional AMI credit meter unless their supply connection does not exceed 100A and they install reverse power flow blocking protection.

VAT will only be payable by the City on the purchase by the City of excess electricity if the customer is a registered VAT vendor with SARS.

In terms of Interpretation Note number 56 (dated 31 March 2010) of the Value-added Tax Act (number 89 of 1991) customers will not have to submit invoices to the City for payment by the City for excess generation.

2.5. Load Profile Management

The SSEG tariff has been structured in such a way that customers will find it most beneficial to ensure that they utilise as much of the generated electricity as they can and avoid or minimise reverse power flow. For example, where a PV system is installed, electrical loads should be shifted to occur during the middle of the day when generation is typically at its highest – from mid-morning to mid-afternoon (roughly from 10:00 until 15:00).

2.6. Grid Studies

Should the generation site not meet the criteria for a simplified utility connection for an LV connected SSEG in terms of NRS 097-2-3, grid studies may be necessary and will be carried out at the SSEG applicant's cost.

⁸ www.capetown.gov.za/electricserviceforms

2.7. Who Pays for What

- The commercial and industrial customer is responsible for all the costs involved in the supply and installation of meters.
- If the metering point is required to be changed the customer will be responsible for any rearrangement of the installation or meter accommodation including the moving of the metering point to the property boundary. The cost of providing a meter kiosk in the road reserve will be borne by the City unless the kiosk cannot be accommodated there due to the pavement being too narrow in which case the customer will be required to provide a metering kiosk to the City's specifications inside the property on the road boundary.
- The customer will be responsible for the cost of any specialist grid studies.
- The customer will be responsible for any changes required to the utility network upstream of the connection point as a result of the SSEG installation.
- The customer will be responsible for all the costs associated with 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.

2.8. Applicable technical standards

Most of the technical requirements for SSEGs are covered in the following standards (note that these do not necessarily cover all requirements for SSEG systems - see Appendix 1 for the complete list):

1. NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation
2. South African Renewable Power Plant Grid Code

The above standards cover aspects such as voltage range; flicker; DC injection; frequency operating range; harmonics and waveform distortion; power factor; synchronization; safe disconnection from the network; overvoltage and undervoltage; sudden voltage dips and peaks; voltage change; overfrequency and underfrequency; anti-islanding; DC current injection; network faults; response to utility recovery; isolation; earthing; short-circuit protection; labelling.

The design and installation of all SSEG equipment will need to comply with these requirements. Consult your supplier and/or installer to ensure that these conditions are met.

2.9. How to apply for permission to install Grid-Tied SSEG

The GEN/EMB application form must be completed for all forms of grid-tied embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plant. **Should** a tariff or metering change be required for the SSEG installation, the “Application form for new or modified electricity supply service” must also be completed. (Off-Grid installations must be declared as laid out in Paragraph 6 on page 15).

The forms are available on the City's website.⁹ The text box below highlights some important points to consider prior to applying. Figure 1 that follows outlines the application process:

Purchasing your equipment: SSEG equipment that is to connect to the grid must comply with the City's requirements. It is therefore important for customers to be familiar with these requirements **before purchasing the equipment**. This is of particular relevance to the inverter. Specific technical information and certificates are required for submission with the initial application form. It is the responsibility of the customer to ensure that equipment complies with the required standards. A list of inverters which have been shown to comply with the City's requirements can be found at on the City's website: www.capetown.gov.za/ElecServiceForms

Where there is no existing electricity service connection: Where an SSEG is to be connected at a location where there is currently no connection to the utility network, an “Application form for new or modified electricity supply service” should be submitted simultaneously as a separate document to the SSEG application form. This application form can be found on the City's website⁹.

Where the SSEG installation requires a tariff or metering change: **Should** a tariff or metering change be required for the SSEG installation, the “Application form for new or modified electricity supply service” must also be completed.

Future expansion: Consent to connect the SSEG to the electricity grid is only granted for the declared generation capacity. Customers wishing to increase the capacity of their generation or make changes to their current installation must obtain approval for the expansion or change. Application must again be made through the submission of a completed GEN/EMB application form. It is important that the customer remains a ‘net customer’.

Professional sign off: As detailed on page 11, the final installed SSEG system must be signed off by a professional engineer or technologist registered with ECSA. For more information regarding professional personnel, visit: <https://www.ecsa.co.za/default.aspx>

⁹ www.capetown.gov.za/electricserviceforms

Customer Actions

EGD Actions

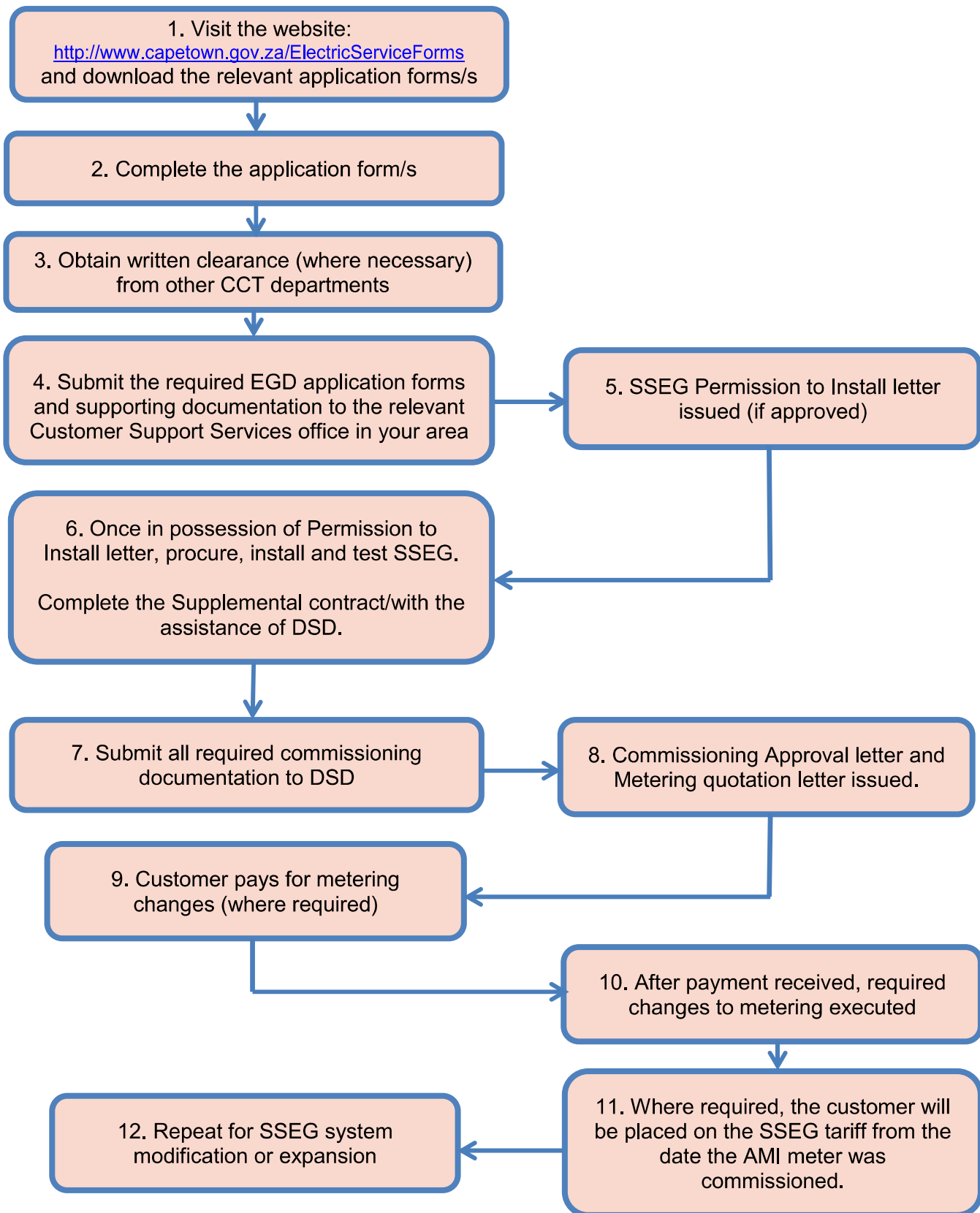


Figure 2: Summary of SSEG application and approval process.

STEP 1: VISIT CITY WEBSITE

Visit the City's website and download the relevant¹⁰ application form/s as noted above. Alternatively, the forms are obtainable from the Customer Support Services (CSS) offices listed lower down. The GEN/EMB form requires both basic and technical information of the proposed SSEG project to ensure that all SSEG connections are done safely and legally and in compliance with all requirements. Information required includes type of energy conversion, the total generating capacity of the SSEG, electrical parameters, expected consumption, network connection point, synchronising method, anti-islanding method and generator control method amongst others (not all information is relevant for all generation system types).

STEP 2: COMPLETE GEN/EMB APPLICATION FORM AND, IF REQUIRED, THE GENERAL APPLICATION FORM FOR NEW OR MODIFIED CONNECTIONS.

The GEN/EMB form must be filled in for all installations which are to be grid-tied. The "General Application form for New or Modified Connections" must be filled in whenever there is to be a change to either the tariff or the meter. The City requires that the application form/s be signed by the property owner. Details of the proposed installer must also be provided. The property owner may need support from the proposed installer or a professional in completing the GEN/EMB application form. Details in the GEN/EMB form that will need particular consideration:

Preliminary design: a simple circuit diagram showing major system components and point of common coupling (PCC) must be provided.

Site plan: this includes the exact coordinates of the intended generation site as well as details of connection points, generator transformers and the surrounding buildings.

Earthing arrangement: this must be in accordance to SANS 10142-1. Earthing requirements for common earthing systems are described in NRS 097-2-1.

Various electrical parameters of the system: these sections require information on the electrical specifications of the SSEG system. Not all sections of the GEN/EMB application form are applicable to all SSEG types.

System protection detail: this includes information about the synchronizing method, anti-islanding, power quality, etc.

Proposed peak power generation output: maximum power expected to be generated must be detailed in the application form. This must be within the maximum power limits given earlier in this document.

STEP 3: OBTAIN PERMISSION FROM OTHER CITY DEPARTMENTS

SSEG installations will require prior approval from other municipal departments such as Planning and Building Development Management, City Health Specialised Services. Note that photovoltaic (PV) SSEG applications will only require approval from Planning and Building Development Management and then only if the installation falls outside defined parameters. Applications to connect to the grid will not be considered until all relevant approvals have been obtained. All applicable approvals must be reflected in the relevant sections of the GEN/EMB application form. Requirements of these departments are summarised in the Appendix 2: *Approval from other Departments*.

¹⁰ www.capetown.gov.za/electricserviceforms

STEP 4: SUBMIT COMPLETED APPLICATION FORM AND ATTACHMENTS

Once the relevant forms ("GEN/EMB" and "General Application form for New or Modified Connections") have been completed and consent has been obtained from the other relevant City departments the form must be submitted to the relevant Customer Support Services office for the area in which the project is located. A map showing Area boundaries (Electricity Distribution Licence and Area Boundaries) can be found on the City's website¹¹.

The table below shows the different area offices.

Customer Support Services: Area North

Test & Metering Building Ndabeni Electricity Complex Melck St, Ndabeni, Cape Town	Ndabeni Electricity Complex Melck St, Ndabeni, Maitland 7405	Tel: 021 444 2096/7 Fax: 021 444 2112 email: sseg.north@capetown.gov.za
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Customer Support Services: Area East

Electricity Services Head Office Bloemhof Centre, Bloemhof Street Bellville	Private Bag X44 Bellville 7535	Tel: 021 444 8511/2 Fax: 021 444 8787 email: sseg.east@capetown.gov.za
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Customer Support Services: Area South

1st Floor, Wynberg Electricity Depot, Rosmead Avenue Wynberg, Cape Town	Wynberg Electricity Depot Rosmead Avenue Wynberg 7800	Tel: 021 763 5664/5723 Fax: 021 763 5687 email: sseg.south@capetown.gov.za
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The Distribution System Development (DSD) section, a unit within the City's EGD, will then process the application.

STEP 5: EGD ISSUES "PERMISSION TO INSTALL" LETTER

After due consideration of the application, the applicant will be informed in writing whether the application has been successful. Once notified of a successful application by means of a "Permission to Install" letter the applicant may commence installation.

STEP 6: INSTALLATION COMMENCEMENT UPON APPROVAL

The successful applicant may now commence with installation and commissioning of the SSEG system. Once fully installed, the system is ready for testing and commissioning by the SSEG installer. Note that permanent connection of the SSEG system to the electricity grid is only permitted on receipt of written permission from the City. However, the SSEG may temporarily connect to the utility grid for the commissioning process only, where after it must once again be disconnected until the "Commissioning Approval letter" is granted by the City. The applicant must pay for changes to metering and, if required by the ESD, relocate the metering position. The Supplemental contract must be completed with the assistance

¹¹ www.capetown.gov.za/electserviceforms

of DSD. This is a legally required contract that governs the relationship between the City and the customer. The contract is valid for as long as the project is in existence.

STEP 7: COMMISSIONING DOCUMENTATION TO BE SUBMITTED TO DSD

As detailed on page 11, commissioning of the system must be undertaken by a Pr Eng, Pr Tech Eng or Pr Cert Eng, who must complete and sign off the SSEG Installation Commissioning Report (To be found in the GEN/EMB application form)

In addition to the Commissioning Report, the following documentation must also be completed and submitted to the relevant DSD office:

- Final copy of circuit diagram
- An electrical installation Certificate of Compliance as per SANS 10142-1
- A signed Supplemental Contract for Embedded Generation.

The City has a right to inspect the installation if it so requires.

STEP 8: METERING QUOTATION ISSUED

If a change to metering is required, a metering Quotation letter will be issued.

Step 9 CUSTOMER PAYS FOR ANY REQUIRED METERING CHANGES

Payment should be made as instructed in the Quotation letter.

STEP 10: INSTALLATION AND COMMISSIONING OF METER (IF REQUIRED)

If a change to the metering is required, after the customer has paid for any associated costs and (if so requested) relocated the metering position the EGD will install and commission the new meter. If all of the above is satisfactory, the City will issue a "Commissioning Approval" letter.

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 change was required, from the date of issue of the Commissioning Approval Letter.

STEP 12: REPEAT THE PROCESS IN THE CASE OF SSEG CAPACITY MODIFICATION OR EXPANSION

Should an expansion or a change to the system be required, a new application must be completed.

Note: Any queries regarding any matter regarding SSEG must be referred to the relevant Customer Support Services area office as listed in STEP 4 above

Appendix 1: Relevant Standards and Regulations

The City requires that SSEG installations comply with the necessary standards and regulations in order for the system to be approved and put into commission. This section provides an overview of these legislative requirements. The Professional Engineer / Technologist will highlight aspects most applicable to the SSEG system in question.

List of Standards and Regulations

There are a number of standards and regulations that the project developer has to be aware of. The most relevant standards and regulations that must be complied with are:

- ✓ Electricity Regulation Act, Act 4 of 2006 and Electricity Regulation Amendment Act, 28 of 2007 as amended
- ✓ South African Distribution Code (all parts)
- ✓ South African Grid Code (all parts)
- ✓ South African Renewable Power Plants Grid Code
- ✓ Occupational Health and Safety Act 1993 as amended
- ✓ City of Cape Town Electricity Supply By-Law
- ✓ SANS 10142- Parts 1 to 4: The Wiring of Premises
- ✓ SANS 474/ NRS 057 Code of Practice for Electricity Metering
- ✓ NRS 048: Electricity Supply– Quality of Supply
- ✓ NRS 097-1: Code of Practice for the interconnection of embedded generation to electricity distribution networks: Part 1 MV and HV (Eskom 240-61268576 / DST 34-1765: Standard for the interconnection of embedded generation, is applicable until published)
- ✓ NRS 097-2: Grid interconnection of embedded generation: Part 2 Small scale embedded generation

Guidance on their applicability and coverage is given below.

Standards of Importance

Of the compliance standards and regulations stated above, two of these standards are the most important for embedded generation, namely:

1. NRS 097-2: Grid interconnection of embedded generation: Part 2 Small-scale embedded generation
2. South African Renewable Power Plants Grid Code

These two set the majority of regulatory requirements in order for compliance to be granted by the City for the installation and operation of an SSEG and therefore should be consulted with care. This section will provide an overview of key aspects of both documents. These overviews should be seen only as summaries, and the standards themselves will need to be referred to for a complete picture. Applicants will require assistance from their installer and professional engineer/technologist to ensure full compliance.

NRS 097-2-1 (Part 2: Small-scale Embedded Generation, Section 1)

This document serves as the standard for the interconnection of SSEGs to the utility network and applies to embedded generators smaller than 1000kVA connected to LV networks of type single, dual or three-phase.

NRS 097-2-3 (Part 2: Small-scale Embedded Generation, Section 3)

This document provides simplified utility connection criteria for low-voltage connected generators.

South African Renewable Power Plants Grid Code (SARPPGC)

This document sets out the technical and design grid connection requirements for renewable power plants (RPP) to connect to the transmission or distribution network in South Africa. This guideline is of concern to embedded generators of Category A that are connected to a low-voltage (LV) network.

i) **Category A: 0 – 1MVA (Only LV connected RPPs)**

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:

ii) **Category A1: 0 – 13,8kVA**

This sub-category includes RPPs of Category A with *rated power* in the range of 0 to 13,8kVA.

iii) **Category A2: 13,8kVA – 100kVA**

This sub-category includes RPPs of Category A with *rated power* in the range greater than 13,8kVA but less than 100kVA.

iv) **Category A3: 100kVA – 1MVA**

This sub-category includes RPPs of Category A with *rated power* in the range 100kVA but less than 1MVA. This category also includes RPPs of Category A1 and A2 with a *rated power* less than 100kVA that are directly connected to a MV-LV transformer.

Note: RPPs with a *rated power* greater than 4,6kVA must be balanced three-phase.

Other Standards and Legislation

Electricity Regulation Act, Act 4 of 2006 (ERA)

All applicants should familiarize themselves with the ERA. The act states that no person may, without a licence issued by the regulator (NERSA), operate any generation facility. The ERA holds that exemption is held for non-grid-tied projects. Note that NERSA has issued a communication giving licence exemption to SSEG installations in municipal areas under 100kW.

South African Distribution Code

The South African Distribution Code applies to all entities connected to the distribution network, including EGs. It sets the basic rules for connecting to the distribution network, ensures non-discrimination to all users connected to the distribution network and specifies the technical requirements to ensure the safety and reliability of the distribution network. A more detailed guideline pertaining to the connection of SSEGs to the utility network and the specific requirements involved is found in the NRS 097-2-1.

South African Grid Code

The South African Grid Code contains the connection conditions that are required by all generators, distributors and end-users (customers) connected to the utility grid, as well as the standards used to plan and develop the transmission system. Page 5 of the Network Code provides a summary of the grid code requirements applicable to specific ratings of non-hydro units, while page 6 provides those for hydro units. For SSEGs the requirements for ratings below 20MVA should be adhered to accordingly as per the South African Grid Code.

Occupational Health and Safety Act, 1993

The Occupational Health and Safety Act provides for the health and safety of the people by ensuring that all undertakings are conducted in such a manner so that those who are, or who may be, directly affected by such an activity are not negatively harmed as far as possible and are not exposed to dangers to their health and safety.

City of Cape Town Electricity Supply By-Law

This document provides the general conditions of supply of electricity, outlines the responsibility of the customers, systems of supply, measurement of electricity and the electrical contractors responsibilities.

SANS 10142-1 The Wiring of Premises - Low-voltage installations

This document serves as the South African national standard for the wiring of premises in low-voltage networks. The aim of the document is to ensure that people, animals and property are protected from dangers that arise during normal as well as fault conditions, due to the operation of an electrical installation. Compliance to the standards and regulations as laid out SANS 10142-1 is required and proof should be provided via an electrical installation certificate of compliance. The implication is that a qualified electrician is required to sign off on your system.

SANS 10142-2 The Wiring of Premises - Medium-Voltage installations above 1kV a.c. not exceeding 22kV a.c. and up to and including 3 000kW installed capacity

This document serves as the South African national standard for the wiring of premises in medium-voltage networks. The aim of the document is to ensure that people, animals and property are protected from dangers that arise during normal as well as fault conditions, due to the operation of an electrical installation. Compliance to the standards and regulations as laid out SANS 10142-2 is required and proof should be provided via an electrical installation certificate of compliance. The implication is that a qualified electrician is required to sign off on your system.

SANS 474 / NRS 057 Code of Practice for Electricity Metering

SANS 474 specifies the metering procedures, standards and other such requirements that must be adhered to by electricity licensees and their agents. It refers specifically to new and existing metering installations for the purpose of billing. It further specifies the initial calibration and certification requirements as well as compliance testing of metering installations and the subsequent procedures to ensure continued compliance. It specifies the procedures for the manipulation and storage of metering data and sets a standard format for the numbering of electricity meters.

For more specific details with regard to the metering for SSEG purposes, NRS 097-2-1 should be consulted and the requirements as defined by the City must be adhered to.

NRS 048

The NRS 048 series covers the quality of supply parameters, specifications and practices that must be undertaken to ensure correct and safe operation. The NRS 048-2 and NRS 048-4 have the most relevance to the operation and connection of SSEG's to the utility network:

NRS 048-2: 'Voltage characteristics, compatibility levels, limits and assessment methods' sets the standards and compatibility levels for the quality of supply for utility connections as well as for stand-alone systems. It is intended that generation licensees ensure compliance with the compatibility levels set in this document under normal operating conditions.

NRS 048-4: 'Application Requirements for utilities' sets the technical standards and Requirements for the connection of new customers. It also sets the technical procedures for the evaluation of existing customers with regards to harmonics, voltage unbalance and voltage flicker.

Appendix 2 City Department Approvals

Planning and Building Development Management

Roof top installations

No building plans are required to be submitted provided the panel(s) in its installed position does not project more than 1,5 meters, measured perpendicularly, above the roof and/or not more than 600mm above the highest point of the roof.

Full building plans, including an engineer's endorsement, are required if the panel(s) in its installed position;

- Project more than 1,5 meters in its installed position measured perpendicularly, above the roof and/or;
- Projects more than 600mm above the highest point of the roof.

A relaxation in terms of the Zoning Scheme Regulations is also required under either one or both of the above circumstances.

Installations on the ground

No building plans are required to be submitted provided the panel(s) in its installed position does not project more than 2,1 metres above the natural/finished ground level.

Full building plans are required where any part of the installation projects more than 2,1 metres above the ground level.

Other installations

Clearance required for other embedded generation such as wind.

Health and Air Quality Approvals

Air Quality and Mechanical Engineering (Noise) Units do not need to be consulted with SSEG applications where diesel fuelled mechanical engine generator are not part of the installation.

Should a mechanical engine which burns fuel or generates noise be incorporated in the installation, such applications should be referred to City Health.

Environmental Approvals

Large-scale PV installations would require environmental authorisation (EA) in terms of the NEMA 2010 EIA Regulations if they generate >10MW electricity, or <10MW but cover an area of 1ha or more.

Electrical transmission infrastructure that may be associated with a large scale PV system would require EA if it has a capacity of 275kV or more within an urban area, or more than 33kV outside urban areas.

The Cape Town International Airport would count as inside an urban area.

Large scale roll-out of SSEG PV would not require EA. There may however be heritage compliance issues in some areas of the City.

Household installation of PV would not require an EA unless it exceeds the electricity generation threshold mentioned above, which is highly unlikely.

Appendix 3: Inverter Type Testing Requirements

The City's requirements for grid tied inverter (GTIs) and ancillary equipment type test certification are as follows:

1. A 3rd party accredited body must perform the inverter type test certification in terms of NRS 097-2-1. The accredited body must 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.
2. 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 current NRS 097-2-1 document.
 - b. Provide summary Test Report [excluding sensitive information test results] comprising of:
 - i. 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 dress, test report documentation version control;
 - ii. Test item particulars, test case verdicts [N/A, pass and fail], test and issue dates, general remarks;
 - iii. Copy of GTIs and ancillary equipment name plate data;
 - iv. General product information, preferably with the inclusion of the GTIs and ancillary equipment electrical block diagram;
 - v. Summary of NRS 097-2-1 indicating all clauses, clause description/requirement/test, result/remark and verdict [N/A, pass or fail];
 - vi. Test overview summary.
3. NRS 097-2-1: 2017 was published on 8 March 2017 and replaces NRS 097-2-1: 2010. Inverter requirements are as follows:
 - a. Retrospective compliance of installed NRS 097-2-1: 2010 type tested inverters to the new NRS 097-2-1: 2017 version: Retrospective compliance of the installed SSEG base with the new version is not required.
 - b. New installations with existing certified NRS 097-2-1: 2010 type tested inverters:
 - i. SSEG installations and applications in process (inclusive of SSEG system modification or expansion) will be accepted until 31 December 2018 only.
 - ii. Commissioned inverter settings shall be in accordance with the new NRS 097-2-1: 2017 version.
 - c. New inverter type test certification:
 - i. All the existing NRS097-2-1: 2010 type tested inverters must be SANAS re-certified in accordance with new NRS097-2-1: 2017 with effect from 1 January 2019 if the inverter is being considered for a new embedded generation application.
 - ii. New inverter type test certifications must be in accordance with the new NRS 097-2-1: 2017 version and the embedded generation installation using such inverters shall be compliant with new version.

Appendix 4: Suitably interlocked change-over switch for grid-tied hybrid SSEG and a passive standby UPS utilised as off-grid hybrid SSEG

- a. This includes interrupters, transfer switches, bypass switches, isolation switches and tie switches.
- b. The switch shall provide feedback of its position to the inverter/charger so that if the contacts fail to operate or malfunction [e.g. fused-closed contacts, inadvertent energising of the change-over switch coil, etc.], use of the inverter mode will be impossible.
- c. The requirements of SANS 10142-1 Section 7.12.2.5 are applicable.
- d. It shall be a separate, controllable switch, compatible with the applicable electrical service conditions and to the performance requirements of the passive standby UPS, in accordance with SANS / IEC 60947-6-1 and the following product specifications:
 - Static transfer systems (STS): SANS / IEC 62310-3.
 - Automatic transfer systems (ATS): SANS / IEC 60947-6-1.
 - Manual isolation, tie and transfer switches (MTS): SANS / IEC 60947-3.
- e. The switch shall have a rated lightning impulse withstand voltage (BIL) of 4 kV at 1,2/50 μ s in accordance with SANS / IEC 60947-1 (Tables H.1 and 12).
- f. Characteristics of the transfer shall be break-before-make (open transition) – no transient cross-conduction during transfer. The transfer time of the switch shall be $\geq$ 20 ms.
- g. The contactor gap of the switch shall exceed 4 mm in accordance with SANS 60950-1, S 2.10.3.3 and Table 2K for a fixed installation with overvoltage category 2.

Note: The Certificate of Compliance with the accompanied test report must provide detail of the suitably interlocked change-over switch as above in Sections 3 and 4 of the SANS 10142-1 Test report.