Ubuntu Municipality

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REQUIREMENTS FOR SMALL-SCALE EMBEDDED GENERATION

Conditions and application process to become a small-scale embedded generator in the Ubuntu Municipality

Record of Significant Guideline Revisions

Date of Issue	Pages/Clause Updated	Description
Rev A-Dec 2019		Issued for Preliminary Use
Rev 0 – 17/06/2020		Approved – Issued for Use
Rev 1 – 18/03/2021	Entire Document Revised	Incorporated Latest SALGA/AMEU Guidance

Contents

i. Information on this document

Purpose of the document

The purpose of this document is to guide stakeholders regarding the requirements and application process of Ubuntu Municipality in connecting all forms of embedded generation to the municipal electricity network.

The need for this document

The parallel connection of any generator to the municipal electrical grid, however powered, has numerous implications for the local Municipality. It shall therefore be regulated and managed. This document serves to:

- Ensure the safety of the municipal staff, the public and the user of the Small Scale Embedded Generation (SSEG) installation.
- Uphold the power quality of the municipal electricity network.
- Clarify metering and billing requirements and options.
- Balance municipal revenue impact to enable continued operation of all municipal functions.

In addition, municipalities are faced with low carbon development imperatives and economic growth challenges. SSEG can play a role in both of these areas, and the document therefore also serves to:

- Promote the development of the SSEG industry by creating a conducive environment for growth.

Scope

This document covers:

- The connection of SSEG to the municipal electrical grid.
- Installations up to 1MVA (although different conditions apply above or below 350kVA – see later).
- Installations connected to low voltage networks.

This document does not cover:

- Systems above 1MW (anyone wanting to connect a SSEG system greater than 1MW will not be able to connect under the conditions of these requirements). Systems of 1MW or smaller do not require a generating licence from NERSA.
- Wheeling regulations.
- The connection of SSEG to the Eskom electrical grid.
- Systems connecting to MV and HV networks (although the NRS 097-1 standards covering MV and HV connections are not complete, such systems may be approved by the municipality, but are likely to require grid impact studies and should be discussed separately with the municipality).
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Defining small scale embedded generation

Small-scale embedded generation (SSEG) refers to power generation installations less than or equal to 1MW/1000kW which are located on residential, commercial or industrial sites where electricity is also consumed. SSEG is in contrast to large-scale generation units that generate large amounts of power, typically in the multi-Megawatt range.

A SSEG customer generates electricity on the customer's side of the municipal electricity meter, where the generation equipment is connected to, and synchronised with, the municipal electricity grid (i.e. 'embedded').

Who this document is for

This document will assist all relevant stakeholders involved in the commissioning, installation, management and ownership of a SSEG system, with generation capacity less than or equal to 1 MW (1000 kW), that is connected to the municipal electrical grid. It is intended to provide guidance in this regard to:

- SSEG project developers
- Residential and commercial property owners
- SSEG installers
- Energy consultants commissioned to design SSEG systems
- Municipal officials involved in SSEG generation
- Registered professional engineers, professional technologists or professional engineering technicians who are involved in SSEG commissioning

ii. Glossary & Definitions

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 municipal electrical grid whenever there is a power outage in the utility municipal electrical grid, thus preventing the export of electricity to the municipal electrical grid from the SSEG. This is done primarily to protect municipal electrical grid workers who may be working on the 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 sequential or simultaneous generation of multiple forms of useful energy (usually mechanical and thermal) in a single, integrated system.
Customer	In the context of this document, customers who also generate electricity shall be referred to as "customers", although in effect they are "customer/generators".
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 kilovolt Amperes (kVA), 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 by the system in its current configuration.
Grid-tied	An SSEG that is connected to the municipal electrical grid either directly or through a customer's internal wiring is said to be "grid-tied". The export of energy onto the municipal electrical grid is possible when generation exceeds consumption at any point in time. 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.
High voltage	Voltage levels greater than 35 kV.
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 municipal electrical grid.
Isolated	A section of an municipal electrical grid which is disconnected from all other possible sources of electrical potential is said to be isolated
Load profile	The profile or curve showing the variation of the customer's rate of electricity consumption (or demand) over time.
Low-voltage	Voltage levels up to and including 1 kV. (1kV= 1000 Volts)
Medium-voltage	Voltage levels greater than 1 kV up to and including 35 kV.
Net customer	A net customer is someone who purchases (imports) more kWh of electricity than they export (sell) over any 12 month period.
Net consumer	See net customer.
Net generator	A situation where the site generates more electricity than is consumed on site over a 12 month period, and therefore exports more power onto the municipal network than it draws from the network.
Off-Grid	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 SSEG and export of energy onto the utility grid by the generator is therefore not 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: • The normal mode of operation consists of supplying the load from the grid as primary power source. • When the grid 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.
Pr Eng or Pr Tech Eng or Pr Techni Eng	This refers to a professional engineer, professional technologist 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 municipal electrical 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 municipal electrical grid.
Shared Network	A section of the municipality's grid that supplies more than one customer.
Small Scale embedded generator	A small-scale embedded generator for the purposes of these guidelines is an embedded generator with a generation capacity of less than or equal to 1000 kW (1MW).
SSEG Connection Contract	The terms and conditions governing the connection of the SSEG installation to the municipal electrical network accepted by the customer.
Stand-alone generator/ off-grid generator	A generator that is not in any way connected to the municipal electrical grid. Export of energy onto the municipal electrical grid by the generator is therefore not possible.
The Municipality	Ubuntu Local Municipality
Utility	The electricity distribution service provider responsible for the electricity grid infrastructure to which the customer is connected.
Utility Network (or Utility Grid)	The interconnected network of wires, transformers and other equipment, covering all voltage ranges, and belonging to the Municipality which supply customers in the municipal 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.

iii. Abbreviations

AC	Alternating current
AMI	Advanced Metering Infrastructure
DC	Direct current
ECSA	Engineering Council of South Africa
EG	Embedded Generator
HV	High Voltage
kVA	kilo-Volt Ampere (unit of apparent electrical power, often similar in magnitude to kW)
kW	kilo-Watt (unit of electrical power)
kWp	kilo-Watt peak (the rated peak output of solar PV panels)
LV	Low Voltage
MV	Medium Voltage
MVA	Mega-Volt Amperes (1000 kVA)
MW	Mega-Watt (1000 kW)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
NRS	National Regulator of Standards
PPM	Prepayment Meter
PV	Photovoltaic
RPP	Renewable Power Plants
SANAS	South African National Accreditation System
SAPVIA	South African Photovoltaic Industry Association
SSEG	Small Scale Embedded Generation/Generator
SP	Single Phase
TP	Three Phase
VAT	Value Added Tax

1. Introduction

Due to increases in the price of electricity from the national grid and a steady decline in the price of decentralised generation options such as PV small-scale embedded generation (i.e. 'rooftop' type systems), these decentralised generation sources are becoming financially more attractive in South Africa. Increasingly such systems are being installed by businesses and residences. It is therefore important that approval procedures and standards are established and adhered to within municipal distributors to regularise this fast changing situation.

Municipal distributors are obliged to ensure that distribution grid power quality and safety standards are upheld to protect municipal staff working on the distribution system, to protect the public in general, and to protect municipal infrastructure. Also, the potential revenue impact of accelerating SSEG installations needs to be managed. This require that specific SSEG tariffs are introduced.

Municipalities are obliged to provide open and non-discriminatory access to embedded generators according to the Distribution Code, and also are moving to embrace low-carbon energy and green economic growth opportunities. Municipalities play a vital role in facilitating the growth of the SSEG market. A user-friendly framework around installation application and approval is important in this regard. Such a framework will also minimise systems being installed without permission, thereby potentially not meeting required safety and quality standards.

This document outlines the municipal requirements and processes for prospective SSEG installations to connect to the municipal electrical network such that the above factors are balanced.

2. Indemnity, Legal Requirements & Curtailment

2.1. Legal and Illegal Connections to the municipal electrical grid

Customers wishing to connect SSEG legally to the municipal electrical grid shall be required to follow the normal application procedure as detailed in this document, and comply with the regulations and standards listed herein.

The Municipality's Electricity Supply By-Law (as promulgated) and national regulations state that no electrical generation equipment may be connected to the municipal electrical network without the express consent of the Municipal Electricity Distributor.

Failure to obtain this consent constitutes an offence which could lead to a fine and/or imprisonment. Furthermore, the installation may also be in contravention of the Occupational Health and Safety Act, for which punitive sanctions also apply.

Customers found to have illegally connected SSEG to the municipal electrical grid (either before or after their electricity meter) shall be instructed to have the installation disconnected from the municipal electrical grid and a penalty will be levied. A Certificate of Compliance issued by a registered electrical contractor shall be required as proof of such disconnection. Should the customer fail to have the SSEG disconnected from the municipal electrical grid, the Electrical Department shall disconnect the electricity supply to the property (as provisioned for in the Electricity Supply by- Law).

In cases where unauthorised reverse feed-in takes place which results in the meter reversing to the benefit of the customer, the municipality will institute action to recover lost revenue and relevant punitive fines will be applicable. The customer will also have to correct the installation to meet the SSEG requirements set forth in this policy document or face further penalties and disconnection from the grid.

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

2.2. Generation Curtailment

In the event of operating conditions resulting in municipal electrical grid parameters not meeting statutory minimum quality-of-supply standards it may become necessary 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.

2.3. Right to adapt rules & regulations

In the event of provincial or national legislative changes to the regulatory environment, or other technical developments, it may become necessary to implement changes to the municipal requirements which SSEGs are to comply with. The Municipality will take into account the implications for existing customers of such changes, and will require these only where grid safety or other important criteria are potentially compromised. All SSEGs, new and existing, will be obliged to comply with such changes, and will do so at their own cost.

2.4. Right to deny access

It is essential that all customers wishing to install a SSEG system, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval to commence is received from the Municipality before system installation starts.

The Municipality needs to ensure that, amongst other considerations, the SSEG installation can be accommodated on the municipal electrical grid and that the total SSEG capacity of the municipal electrical grid has not been exceeded, considering parameters in the NRS097-2-3 and other applicable standards. Equipment should not be purchased prior to obtaining written approval from the Municipality to commence, as approval is not guaranteed and the Municipality shall not be held liable for equipment expenses where approval is denied.

2.5. Unsuccessful Applications

Where proposed SSEG systems are not approved by the Municipality, the Municipality will provide information to the customer on amendments to the proposed system required, and/or advise on conditions to be met, for it to be acceptable to the Municipality.

2.6. Contract with the Municipality

All SSEG customers are required to enter into an SSEG contract with the municipality. The document *General Terms and Conditions: Contract for Connection of an Embedded Generator* is available on the municipal website (if published) or from municipal electricity department offices. In signing the SSEG Application Form, the customer agrees to be bound by the terms and conditions in this document.

2.7. Transfer/change of Ownership

If a transfer of the property and/or change of ownership of the electricity accountholder takes place, the new owner needs to sign the declaration in Annex B, which must be submitted to the electricity department.

Alternatively the SSEG installation shall be decommissioned as set out in paragraph 3.6.

3. General Guidelines - Small Scale Embedded Generators

This section covers important considerations in terms of the Municipality's SSEG rules and regulations that apply to all customers, including residential, commercial and industrial customers, who wish to connect an SSEG system.

3.1. Registration or Generation Licence

In terms of the Electricity Regulation Act (2006), any person that owns or operates a generation facility is required to obtain a generation licence to be issued by NERSA unless otherwise exempt as per Schedule 2 in the Act. NERSA has different requirements for different system sizes, as per Table 1.

Table 1: NERSA Requirements for different size systems (March 2020 revision of ERA Schedule 2)

System size	NERSA requirements	Other requirements
0-100kVA	No registration or license necessary	Approval by distributor
101kVA – 1MW	NERSA registration necessary	Approval by distributor
>1MW	NERSA license necessary	Approval by distributor Grid impact study likely to be necessary (such installations are beyond the scope of this document – discuss with distributor before proceeding)

If a generation licence is required in terms of the Electricity Regulation Act (2006), or registration is required, then it is the customer's responsibility to interact with NERSA in this regard. The Municipality is obliged to report to NERSA on a regular basis regarding all municipal electrical network connected generation and it is also obliged to disconnect generators that are not adhering to regulations.

3.2. All SSEGs shall be net consumers

All SSEG installations shall consume more energy than they produce over the 12-month period of the Municipality's financial year. SSEGs that are net generators are not allowed by the Municipality. Should a customer become a net generator, the municipality has the right to request the customer to rectify the situation to ensure a net consumer status. Further steps can be taken by the Municipality should the customer fail to address the situation.

Furthermore, the power produced by the SSEG must be utilised on the property on which the generator is located, or fed into the utility network for purchase by the Municipality. The following are not allowed:

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

3.3. Testing of Inverters

Until such time as a SABS mark is issued for inverters, the Municipality shall require proof in the form of test certificates, of type tests having been successfully carried out by a third party testing authority certifying compliance of the inverters with NRS097-2-1 (and NRS097-2-2 when published). The use of inverters without such certification is not permitted, both in new and existing installations. The installation of reverse feed blocking does not exempt the customer from providing the NRS097-2-1 certification.

In general, the test certificate must be for the most recent version of NRS097-2-1. The municipality reserves the right not to accept test certificates for old versions of NRS097-2-1.

The certification body must be SANAS accredited or be recognised by 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.

The customer should require the inverter supplier to provide the necessary certification before the equipment is purchased.

3.4. Eskom Grid Connection

Customers residing within the municipal boundaries, but located in Eskom's area of supply, need to apply to Eskom for consent to connect SSEG to the Eskom electrical grid. The Municipality will not be involved in this process.

3.5. Battery or Other Storage

Battery or other storage may be included in the SSEG configuration. Where it is connected in standby power supply mode (i.e. it is not configured to provide power in parallel to the SSEG but only to operate in islanded mode) the provisions for 'island mode' generators in Section 3.7 **Error! Reference source not found.** apply.

Where storage is connected such that it can provide power onto the network, it shall do so via an NRS097-2-1 certified inverter. If this is achieved via a separate storage/battery inverter (even only to feed into the customers wiring which is in turn connected to the municipal network), the storage/battery inverter shall be NRS097-2-1 certified, and such a certificate of compliance provided to the municipality.

Battery charging limits: Note that the municipality reserves the right to restrict the permissible maximum battery charging current should it become evident that there are associated existing or potential adverse impacts on the grid due to battery charging demand. In this event all SSEG customers – new and existing - will be required to comply with such limits as their own cost. The municipality therefore advises that installed systems include a mechanism for such limitation should it become necessary.

3.6. Decommission of a SSEG System

The Municipality requires notice of any SSEG installation which has been decommissioned. The SSEG installation must, at the owners' cost, be disconnected from the municipal electrical network by the removal of the wiring that connects the SSEG with the municipal electrical network and a decommissioning report filed (on the prescribed form) – including the provision of a Certificate of Compliance to confirm disconnection.

At the time that the customer ceases to be on the SSEG tariff, any remaining credit balance will be reflected on the municipal account.

3.7. Islanding / Anti-Islanding Installations

Grid-tied inverters are required to have an anti-islanding function (immediate disconnection when there is a general power outage) as stipulated in the NRS 097-2-1. Certification to this effect is required (see Testing of Inverters).

Should the inverter or SSEG installation have the facility to both comply with these anti-islanding requirements AND operate in "islanded mode" where the SSEG installation supplies power to a portion of the customer's electrical grid during a general power outage, it shall be effectively isolated from the municipal electrical 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 Municipality's grid is restored, the generator may not be connected or reconnected to the grid until has been properly synchronised with it.

If the SSEG installation is to be configured as a standby supply after islanding from the municipal electrical grid, the generator will have to be connected to the existing internal wiring of the property and approval by the town's Electrical Engineer is required if the SSEG installation 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) shall install the SSEG 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 (Section on 'Alternative supplies including low voltage generating sets, installations, etc.') and Annexure P apply.

3.8. Fire Safety and Emergency Shut-off Switch

Emergency disconnection switching shall be in accordance with NRS 097-2-1.

It is of paramount importance that during an emergency, the entire system can be rendered safe for emergency services personnel and fire fighters. For this reason, the following features are required from the designer:

- Remote controlled switch-disconnectors on the DC circuit located as closely as possible to the PV modules or to the point of entry of DC cable in the building. This must effectively isolate the DC system. These switch-disconnectors shall be able to safely function under full load conditions.
- Should the system be able to island and operate from a battery backup, it must be able to shut down the inverter from an emergency point outside the building.

The emergency switch points listed above shall be clearly marked for identification by emergency personnel. If in an enclosure, this cannot be locked. A label at the most common entrance to the property shall indicate the presence of an alternative power supply and the position of the emergency switch points.

The designer shall discuss the placement of these points with the Electrical Department.

3.9. Dead Grid Safety Lock

Dead Grid Safety Lock shall be in accordance with SANS10142-1-2 (as published).

3.10. Off-grid system

Generators that are not connected to the electricity grid in any way, and are thus 'off-grid' generators, do not need approval from the Municipality's Electrical Department. However, customers with SSEG installations that they deem to be off-grid will be required to submit the following to substantiate that the SSEG installation is off-grid as defined and that the Electricity Supply Bylaw therefore does not apply to it:

a) A completed "Declaration for Off-grid Embedded Generation form" 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 the Electrical Department;
b) A Certificate of Compliance and test report, certifying that:
   i) the SSEG installation is physically separate from the Municipality's grid, and;
   ii) the part of the installation on the property that is being supplied from the Municipality'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 at the back of this document.
c) A schematic diagram showing details of the SSEG installation in relation to the rest of the installation and the Municipality's grid.

NOTE that an SSEG installation connected to the Municipality'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 Municipal departments such as Town Planning Services 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 directly.

3.11. Qualified Installers

The municipality recommends that customers installing solar PV SSEG use industry accredited installers under a third party quality assurance such as PV Green Card: A SAPVIA (South African Photovoltaic Industries Association) endorsed programme to ensure the quality and safety of PV installations (www.pvgreencard.co.za), or P4 quality assurance certification (https://pqrs.co.za/the-pv-quality-assurance-program/). The municipality intends to make such industry accreditation a requirement in future.

3.12. SSEG Sign-Off on Commissioning

Until SANS 10142-1-2 '*The wiring of premises; Specific requirements for embedded generation installations connected to the low voltage distribution Network in South Africa*' is published, upon commissioning, all SSEGs shall be signed off as follows:

- **Systems up to 100 kVA:**
  (for PV) Industry Accredited Installer* sign-off
  OR
  ECSA Registered Pr.Eng or Pr.Tech.Eng
- **Over 100 kVA:**
  ECSA Registered Pr.Eng or Pr.Tech.Eng

** - such as PV Green Card/P4*

Upon the publishing and implementation of the SANS10142-1-2, a registered person in terms of the Electrical Installation Regulations (1993) with appropriate knowledge and experience in applying the SANS10142-1-2 (acceptable to the Municipality) will be adequate to sign-off all SSEGs.

3.13. Advice for the Customer

Load Profile Management to Maximise Benefit to the Customer

Customers will generally find it most financially beneficial to ensure that they utilise as much of the generated electricity as they can and avoid or minimise reverse power flow. For example, with a residential SSEG PV system, loads such as geysers and pool pumps could be shifted to the middle of the day when solar generation is typically at its highest – between mid-morning and mid-afternoon.

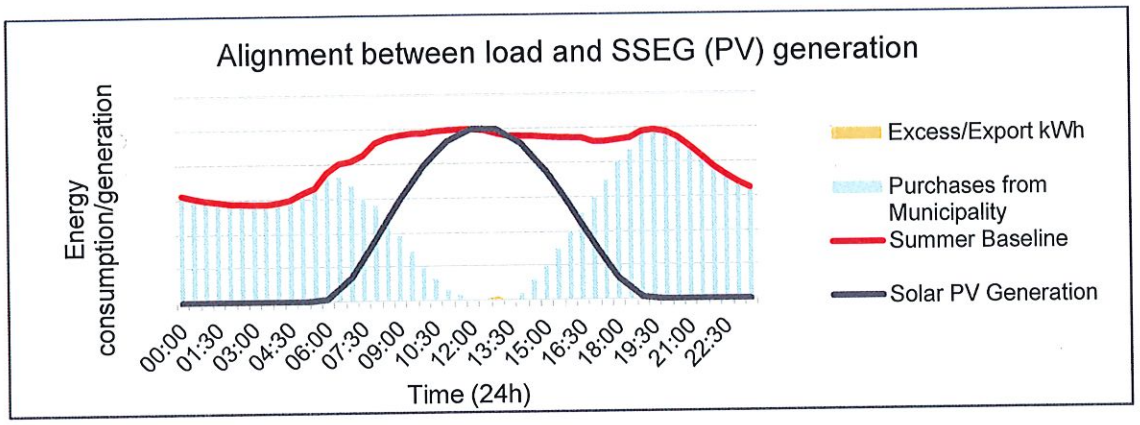


Figure 1: Load profile management - alignment between load profile (red line) and SSEG (PV) generation.

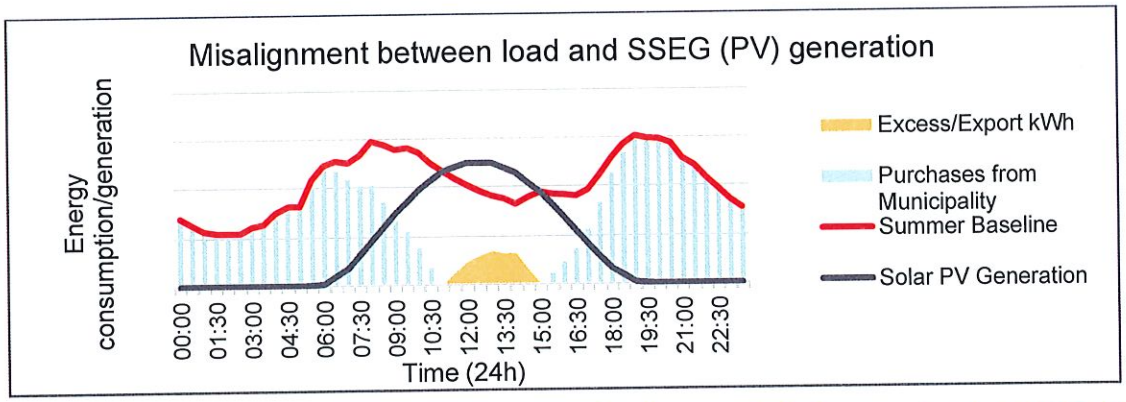


Figure 2: Load profile management - misalignment between load profile (red line) and SSEG (PV) generation.

Roof Strength for PV Installations

Customers should ensure that their installer has checked the load (weight) bearing capacity of the roof on which the PV panel installation is to take place. In some cases this may involve obtaining an engineer's report on the roof strength. Note that in normal circumstances roof design strength is adequate to accommodate PV panels.

Installer Experience and Accreditation

Customers are advised to check that the installer they intend to use has adequate competence and experience to undertake such projects. For solar PV SSEG third party quality assurances such as PV Green Card or P4 can be used:

- PV Green Card: A SAPVIA (South African Photovoltaic Industries Association) endorsed programme to ensure the quality and safety of PV installations (www.pvgreencard.co.za).
- P4 quality assurance certification (https://pqrs.co.za/the-pv-quality-assurance-program/).

3.14. Applicable Technical Standards

Most of the technical requirements that SSEGs are required to comply with are covered in the following standards:

1. NRS 097-2: *Grid Interconnection of Embedded Generation: Part 2 Small Scale Embedded Generators (Sections 1 to 4)*

In addition, SSEG installations are to comply with the following standards, legislation and regulations:

1. **South African Renewable Power Plant Grid Code (although the NRS 097-2 series cover most issues relevant to SSEG)**

   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.

2. **NRS 048: Electricity Supply – Quality of Supply**

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.

3. **SANS 10142-1 The Wiring of Premises - Low-voltage installations (as amended and published)**

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 registered person in terms of the Electrical Installation Regulations is required to sign off on your system.

4. **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 (as amended and published)**

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 registered person in terms of the Electrical Installation Regulations is required to sign off on your system.

5. **SANS 10142-3 & 4 The Wiring of Premises (as amended and published)**

6. **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.

7. **Electricity Regulation Act (ERA), Act 4 of 2006 and the Regulation Amendment Act, 28 of 2007 as amended.**

   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.

8. **South African Distribution Code (all parts)**

   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.

9. **South African Grid Code (all parts)**

   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.

10. **Occupational Health and Safety Act 1993 as amended**

    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.

11. **Ubuntu Municipality 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.

3.15. Disconnection from the Grid

Should a customer disconnect completely from the Municipality's electrical grid (due to alternative power sources, etc.), the customer will be charged for the following:

- A disconnection fee for the disconnection from the Municipality's electrical grid.
- Monthly service and/or network charges for the maintenance of the electrical network and associated services (including street lights, pumps, call centre, etc.).
- A reconnection fee should the client decide to reconnect to the Municipality's electrical grid.
- All other costs involved for the reconnecting to the Municipal grid.

These fees will be as determined and published by the Municipality and revised as required.

If a customer never had an electrical connection, but electrical reticulation infrastructure exist at his stand boundary to service his property, he will be charged the monthly service and/or network charges.

3.16. SSEG Applications from Sub-Tenants or Other Non-Municipal Customers

The municipality will only engage with applications from their existing or new customers. Where an SSEG installation is intended but the person purchases electricity from a re-seller (e.g. landlord/lady), for example, not directly from the municipality, the application will need to come from the re-seller who is a municipal electricity customer.

4. Metering

4.1. Municipal electrical grid connection and reverse power flow/ feed-in to the municipal electrical grid

Customers installing SSEG shall have a bi-directional SSEG approved meter. The Municipality shall provide and install the requisite meters or elect to have the customer's electrician install a specific meter at the customer's cost.

Until the municipality has a specific SSEG tariff in place which is approved by NERSA, reversed feed will be allowed but will not be compensated for (note that this is a temporary situation pending the operationalising of SSEG tariffs).

Conventional credit or prepayment meters are not allowed to run backwards.

4.2. Modification of electrical installation

All customers moving onto a SSEG tariff shall adapt their electrical installations in such a way that metering is 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 no kiosk exists or there is no room for the meter in an existing kiosk, a meter kiosk shall be installed in the road reserve at the customer's cost. Only in cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, shall customers be required to provide metering accommodation on the street-front property boundary. Such a meter box shall face outwards and be locked with a standard Electrical Department lock.

4.3. Refunds of electricity already pre-purchased

Where applicants currently have Prepayment meters, these will need to be replaced with meters appropriate for SSEG systems and tariffs. Refund of Prepayment meter units when a customer changes to the SSEG tariff and has an appropriate meter installed will not be given. The customer should therefore delay the installation of an SSEG-appropriate meter until the units purchased are used. Otherwise units purchased on the PPM will be forfeited.

5. SSEG Connection Criteria

Simplified SSEG connection criteria are specified in the NRS 097-2-3, and applications for systems that fall within these parameters are likely to be easily processed by the municipality, and only in rare cases will require grid impact studies in their assessment. Such parameters include:

- Systems not larger than 350kVA
- Connecting to a LV network

Applications for systems which exceed the parameters of the NRS097-2-3 but do not exceed 1MW will also be accepted by the municipality, but may require specialist grid-impact studies in their assessment. The municipality will advise the customer of such needs after the application form is received.

There are different criteria for simplified connection in shared and dedicated LV feeders, as described below (for details see the relevant sections of the NRS097-2-3):

Note that the below is a summary of parts of the NRS097-2-3 (2014), and is provided for information purposes. The parameters and criteria in the latest version of the NRS097-2-3 may differ from the below and, where this is the case, they supersede the below information. It is therefore important to consult the latest version of the NRS097-2-3 as the criteria therein will be used to assess the SSEG application.

5.1. Shared LV feeders

The NRS 097-2-3 specifies that the maximum individual generation limit in a shared LV feeder (which applies to most small commercial and residential situations) shall not exceed 25% of the consumer's NMD, and be up to a maximum of 20kVA. The following SSEG size limitations are derived from NRS 097-2-3 for Shared LV connections.

Table 2: SSEG size limitations - NRS 097-2-3 for Shared LV connections

Service connection		
No. of Phases	**Service Circuit Breaker Size (A)**	**Maximum Total Generation Capacity of SSEG (kVA)**
1	40	2.3 (10A)
1	60	3.5 (15A)
1	80	4.6 (20A)
3	40	6.9 (30A)
3	60	10.4 (45A)
3	80	13.9 (60A)
3	100	17.3 (75A)

Notes to table:

- 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.
- 'Maximum total 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. Due to system losses this is typically 10 to 20% lower than the maximum output of the PV panels, which is specified in DC kilo-Watt-peak (kWp). The system designer/installer will provide guidance here.

In addition, the total generation supplied by shared LV feeders should be limited to 25% of the MV/LV transformer rating. For example, a 200kVA MV/LV transformer can supply up to 50kVA of generation supplied through shared LV feeders connected to that transformer.

5.2. Phase Balancing

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. Systems above 4.6 kVA are required to be balanced across the phases.

5.3. Dedicated LV feeders

On dedicated LV feeders the maximum generator size is limited to 75% of the NMD.

Furthermore, the feeder cable size is limited such that the voltage rise between point of supply and transformer busbar is limited to 1%.

5.4. Cumulative SSEG capacity and impact on LV and MV networks

Should the cumulative installed capacity of an SSEG installation be such that it may impact negatively on local LV or MV network functioning, as per the stipulations of NRS097-2-3, the municipality will not allow further SSEG connections until they can be demonstrated to be undertaken without such negative impact. Increasing the SSEG carrying capacity on feeders may require network hardware upgrades. Specialist grid impact studies may be requested of the new SSEG applicant to demonstrate the impact, even if the individual system size falls within the NRS097-2-3 parameters.

Currently these include:

- The total generation (i.e. shared LV generation and dedicated LV generation) supplied by a transformer should be less than 75% of the transformer rating, and
- The total generation supplied by a MV feeder should be less than 15% of the MV feeder peak load.

5.5. Group Developments and Blocks of Flats

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

5.6. Grid Impact Studies

Should the SSEG being applied for cause the parameters in the NRS097-2-3 (Simplified Connection Criteria) to be exceeded, a Grid Impact Study is likely to be requested by the municipality before the application can be assessed. Content and coverage of such a study may vary depending on the circumstance.[1]

Should such impact studies be required by the municipality, details of method, data and payment requirements should be discussed with the municipality. Responsibilities of the municipality (who has the network data) and the customer in completing the study will also need to be clarified. Even in the case of SSEG with no reverse feed, scenarios such as Load Rejection may still need to be assessed in the study.
Further information on Grid Impact Studies is given in Annex C.

[1] *Note that studies undertaken in the City of Tshwane indicate that there is considerable capacity on the network for PV SSEG penetration beyond NRS097-2-3 levels without adverse impact, and future revisions of the NRS097-2-3 may extend the scope for PV penetration without impact studies as more information emerges.*

6. SSEG Tariffs

The Municipal SSEG tariffs, once approved by NERSA, will be available on the municipal website or from the electricity department offices on request. Tariffs are updated annually. Where SSEG tariffs have not yet been approved by NERSA, reverse feed will be accepted but will not be compensated for (note that this is a temporary situation pending the operationalising of SSEG tariffs).

General information on SSEG tariffs is given below:

6.1. Residential SSEG Tariff

The Residential SSEG tariff comprises 3 parts:

Fixed charge: This comprises (1) a Network charge, which ensures that fixed costs associated with maintaining and operating the municipal electrical network are recovered through appropriate charges, and (2) a Service charge that covers the fixed costs associated with providing a retail service network (metering, billing, customer call centre) are recovered through appropriate service charges.

Energy charge (c/kWh): The variable cost associated with the volume of energy consumed is recovered through appropriate charges. This is billed on a per kWh basis and may be simple (Flat or Inclining Block tariff) or complex (Time of Use or other tariff).

Export (Feed-in) credit (c/kWh): The customer should be compensated for energy provided back onto the network through an export credit.

6.2. Billing Period

The daily service charge along with charges for consumption and credits for feed-in shall be billed monthly. Any credits from excess SSEG generation in a particular month will be rolled over to the following month. Credits will not be paid out to the customer.

6.3. Increased Costs

The Municipality bares no responsibility should the customer's electricity bill increase due to changes in the applicable tariff. It is up to the customer to ensure that they understand the financial implications of having an SSEG system installed and the applicable tariffs.

6.4. Example Tariff

The following table illustrates how the above tariff components may be quantified.

Table 3: Example Municipality Residential SSEG Tariff

Domestic Embedded Generation Tariff	
Daily (service & network) charge	R13.03
Energy 0-600kWh	R1.09 /kWh
Energy 600kWh +	R2.14 /kWh
Export tariff	57c/kWh (VAT Excluded)

6.5. Commercial and Industrial SSEG Tariff

Commercial and industrial customers that are on tariffs which already have a fixed service charge and network demand charge will remain on this tariff, and an export (feed-in) generation tariff component

will be added for reimbursement for energy exported onto the municipal electrical grid. Customers on a tariff that does not include fixed service charge and demand charge will be changed to an appropriate tariff.

Commercial and Industrial customers should note that the demand charge component of the tariff is unlikely to change after the installation of the SSEG because the monthly maximum demand is unlikely to reduce due to the regular occurrence of cloudy weather.

Tariffs are determined annually by the Municipality and are subject to approval by NERSA. SSEG applicants should check the published tariffs as available from the NERSA website.

6.6. Connection Costs

The Municipality may stipulate a connection cost to be paid by SSEG customers prior to system generation approval. This will be reflected in the currently applicable tariff and charge schedule.

6.7. Time-of-Use Tariffs

Time of Use tariffs are considered best practice for both consumption and export (feed-in) tariffs, and municipalities may increasingly move all customers to such tariffs over time.

7. Approvals Required from other Municipal Departments

Approvals required of other municipal departments are to be obtained prior to submission of the SSEG application form, and reflected on the form.

7.1. Town Planning Services

No building plans are required to be submitted provided the SSEG installation does not project more than 1.5 m, measured perpendicularly, above the roof and/or not more than 600mm above the highest point of the roof. If the above parameters are exceeded then full building plans, including an engineer's endorsement, are required. A relaxation in terms of the Zoning Scheme Regulations is also required under either one or both of the above circumstances.

Wind turbines require building plans that are approved by the municipality. Approval from the applicant's neighbours are also required. The wind turbine supplier shall also have to provide a certificate that clearly states the amount of noise generated by the turbine under working conditions.

Ground-mounted PV systems: 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.

Any PV installation shall consider the reflection of the sun's rays and shall not have a negative impact on the adjacent neighbours.

7.2. Environmental Approvals

Solar PV SSEG installations covered by this document do not require Environmental Approval[2].

7.3. Health and Air Quality Approvals

The Air Quality and Mechanical Engineering (Noise) Units do not need to be consulted with SSEG applications where diesel-fuelled mechanical engine generators 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 the Municipality's health department.

[2] Large-scale embedded generation installations would require environmental authorisation (EA) in terms of the NEMA 2010 EIA Regulations if they generate > 10 MW electricity. In addition the electrical transmission infrastructure that may be associated with a large scale embedded generation system would also require EA if it has a capacity of 275 kV or more within an urban area, or more than 33kV outside urban areas.

8. Disposal of Hazardous Waste

The customer shall take into consideration the life cycle of all components used in the planned installation with emphasis on hazardous waste (solar panels, batteries, etc.). Replacing or discarding any component considered as hazardous waste, shall only be done at a waste facility that is registered to handle hazardous waste. If the waste is recycled, it shall only be done at an approved recycler. In both instances, a certificate is issued for material dumped or recycled and may be required by the Municipality during audits of the SSEG site or at decommissioning.

Ubuntu Municipality does not operate a registered/approved hazardous waste facility.

Costs for the proper disposal of hazardous waste are for the customer's account.

9. Who pays for what?

The customer is responsible for paying for the following:

- The supply and installation of meters (in accordance with the Municipality's metering policy).
- Specialist municipal electrical grid impact studies (if required).
- Any changes required to the municipal electrical grid upstream of the connection point as a result of the SSEG installation.
- Specialist test that are required, e.g. Inverter testing.
- Any other costs associated with obtaining approval for the SSEG connection to the municipal grid.

10. Residential, Commercial and Industrial SSEG application process

The *Application for the Connection of Small-Scale Embedded Generation* form shall be completed for all embedded generation. Should metering changes be required for the SSEG installation, the general application form for new or modified connections shall also be completed.

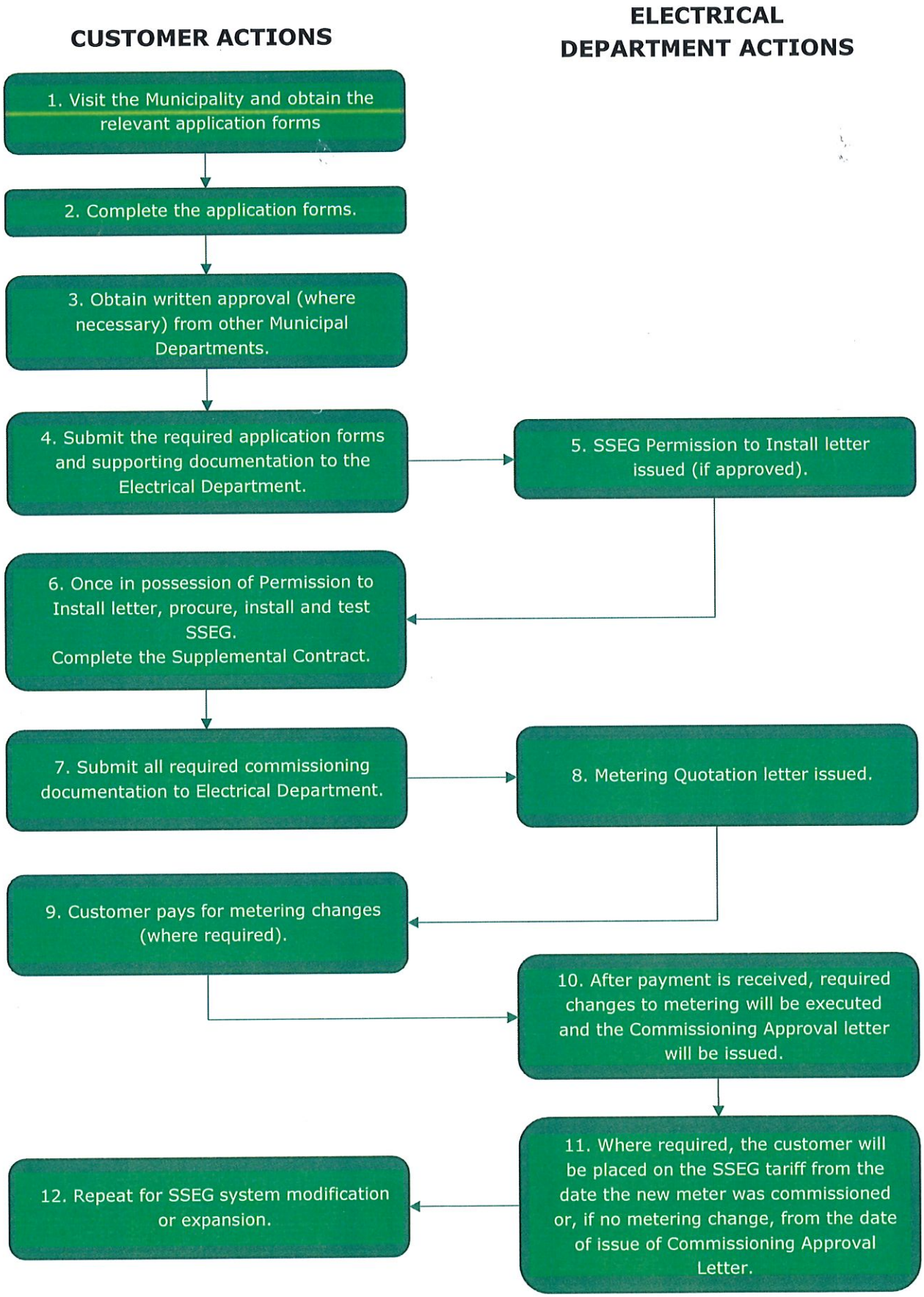
The points below highlights some important points to consider prior to applying. Figure 1 that follows outlines the application process.

- ***Purchasing your equipment**: SSEG equipment that is to connect to the grid must comply with the Municipality'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 that comply is available.*

- ***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 at the Electrical Department.*

- ***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. This application form can be found at the Electrical Department.*

- ***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 "APPLICATION FOR THE CONNECTION OF SMALL-SCALE EMBEDDED GENERATION" form. It is important that the customer remains a 'net customer'.*


CUSTOMER ACTIONS
ELECTRICAL DEPARTMENT ACTIONS
1. Visit the Municipality and obtain the relevant application forms
2. Complete the application forms.
3. Obtain written approval (where necessary) from other Municipal Departments.
4. Submit the required application forms and supporting documentation to the Electrical Department.
5. SSEG Permission to Install letter issued (if approved).
6. Once in possession of Permission to Install letter, procure, install and test SSEG.
Complete the Supplemental Contract.
7. Submit all required commissioning documentation to Electrical Department.
8. Metering Quotation letter issued.
9. Customer pays for metering changes (where required).
10. After payment is received, required changes to metering will be executed and the Commissioning Approval letter will be issued.
11. Where required, the customer will be placed on the SSEG tariff from the date the new meter was commissioned or, if no metering change, from the date of issue of Commissioning Approval Letter.
12. Repeat for SSEG system modification or expansion.

- **Step 1: Visit the Municipality**
  - Visit the Municipality Electrical Department and receive the relevant application form/s as noted above.
- **Step 2: Complete application for the connection of small-scale embedded generation form and, if required, the general application form for new or modified connections**
  - The Municipality requires that the application form/s be signed by the current electricity account holder.
  - Details of the proposed installer shall also be provided.
  - The application form for a new or modified connection may also need to be completed.
  - The applicant may need support from the proposed installer or a registered professional in completing the application form.
  - By signing the application form the customer agrees to the *General Terms and* Conditions: Contract for Connection of an Embedded Generator (this document is available on the municipal website or on request from the electricity department offices).
- **Step 3: Obtain permission from other Municipality departments**
  - The Electrical Department requires prior approval of the proposed SSEG installation from Town Planning Services. Applications to connect to the grid will not be considered until all relevant approvals have been obtained.
- **Step 4: Submit completed application form/s and attachments**
  - Form/s shall be submitted to the relevant contacts at the Electrical Department.
  - Attachments to the application include an initial design circuit diagram (for >100kVA systems) and the inverter certification of compliance with NRS 097-2-1.
- **Step 5: Electrical Department issues 'Permission to Install' Letter**
  - After due consideration of the application, the applicant will be informed in writing whether the application has been successful within 14 calendar days (December/January holiday period may cause this timeframe to be extended).
  - If further information or grid studies are required by the municipality, the applicant will be notified thereof.
  - Position of the fire safety and emergency shut-off switch to be agreed upon between Electrical Engineer and applicant.
- **Step 6: Installation commencement upon approval from the Municipality**
  - Once notified of a successful application, the applicant may commence installation (it is advised that the applicant does not pay for any equipment until municipal approval to install is granted in writing, as such approval is not guaranteed).
  - Once fully installed, the system is ready for testing and commissioning by the SSEG installer.
  - Note that permanent connection of the SSEG to the electrical grid is only permitted on receipt of written permission from the municipality. The SSEG may however 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 Municipality.
- **Step 7: Commissioning and documentation to be submitted to the Electrical Department.**

- Commissioning of the system shall be undertaken by a registered professional, who shall complete and sign off the *SSEG Installation Commissioning Report*.
- In addition to the Commissioning Report, the following documentation shall also be completed:
  - Final as-built circuit diagram
  - Inverter type test certificate according to NRS 097-2-1.
  - An electrical installation Certificate of Compliance as per SANS 10142-1 (and SANS 10142-3 when published).
  - A signed *SSEG Contract*. This is a legally required contract that governs the relationship between the Municipality and the customer. The contract is valid for as long as the project is in existence.
- All completed documentation shall be submitted to the Electrical Department.
- The Electrical Department has a right to inspect the installation if it so requires.

- **Step 8: Metering Quotation issued**
  - If a change in metering is required, a metering Quotation letter will be issued by the Municipality.
- **Step 9: Customer pays for any required metering changes**
  - Payment should be made as instructed by the Quotation letter.
- **Step 10: Installation and Commissioning of the meter (if required) & approval granted to connect**
  - If a change in metering is required, after the customer has paid for any associated costs and (if so requested) relocated the metering position the Electrical Department will install and commission the new meter
  - Approval to connect SSEG to the municipal electrical grid shall be provided by the Electrical Department to the customer, in writing, together with any operation and other requirements deemed necessary.
- **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 new 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 expansion**
  - Should an expansion or a change to the system be required, a new application shall be completed.

11. Changes to Existing Approved Systems

SSEG installations that have previously been approved by the municipality but where changes to the SSEG are planned, will require the following:

A new application shall be completed when the following is intended:

- An expansion in the SSEG capacity
- A change in the SSEG configuration (e.g. adding storage with synchronisation capabilities in parallel to the existing SSEG)

A new commissioning process needs to be undertaken, and a new Commissioning Report completed, when the following changes are made:

- Significant components are replaced (i.e. inverter, anti-island device, dead grid safety lock, other protection equipment) but system capacity is not increased
- A system is moved but no changes to capacity or significant components are made (i.e. inverter, anti-island device, dead grid safety lock, and other protection equipment all stay the same)

Addendum A: Suitable 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 1,2/50µs 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.
g) The contactor gap of the switch shall exceed 4mm 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 Section 3 and 4 of the SANS 10142-1 Test Report.

Addendum B: New Owner/Account Holder Declaration

In the event of transfer of property and/or ownership, the below Declaration is to be signed by new owner / account holder:

Declaration regarding the SSEG system located at:			
Property Erf number:			
Physical address:			
Township / Suburb / Farm		Post code:	
Site GPS coordinates:	Latitude (dd mm ss)	S ° ' "	
	Longitude (dd mm ss)	E ° ' "	
Name of owner/account holder:			
Electricity Account Number:			
Telephone Number:	Land:		
	Mobile:		
Email Address:			

Acceptance of Terms and Conditions

I, the Customer (Account Holder) acknowledge that I have read and understood the General Terms and Conditions: Contract for Connection of Embedded Generator and that by signing this application form, I agree to be bound by the General Terms and Conditions: Contract for Connection of Embedded Generator, should approval for the Embedded Generator be granted by the municipality. A copy of the General Terms and Conditions: Contract for Connection of Embedded Generator can be found on the Municipal website or is obtainable from the electricity department offices on request. Any amended terms and conditions found on the aforementioned website will form part of the terms and conditions of the General Terms and Conditions: Contract for Connection of Embedded Generator, to which terms I, the Customer, agree to be bound. The information provided in the SSEG Application Form accepted by the Municipality also forms part of the General Terms and Conditions: Contract for Connection of Embedded Generator.

Customer (Account Holder) Signoff:

Name	Date	Signature

The declaration must be submitted to the electricity department.

Addendum C: Grid Impact Study Overview

In cases where an SSEG application falls outside the simplified connection criteria in NRS097-2-3, it may be necessary to conduct grid impact studies. These studies will assess whether the grid or electrical network remains within prescribed technical limits[3] after the connection of the SSEG. The municipality will provide specific requirements in this regard. Some general information is below.

General Grid Impact Studies

For most SSEG systems connecting to LV networks grid impact studies can be relatively simply undertaken – often with only hand calculations - and do not require detailed grid simulation. They can thus be undertaken without power system simulation software. More detailed guidelines on assessing such impacts can be found in Recommended practice for assessing the connection of small generators based on renewable energy sources to low-voltage and medium-voltage municipal grids (Moeller & Poeller Engineering, May 2018 – Final Draft).

Requirements for More Complex Grid Impact Studies

Where more complicated grid impact studies are required, power system simulation may need to be undertaken using appropriate software.

The municipality will be required to utilise their geographic and operational knowledge of the network to determine the areas that could potentially be affected by the SSEG. In order to conduct the studies the municipality will need to have a representative model of the network affected in the format required by the simulation software tool.

Table 4: Grid impact studies to be conducted

Type of study	Notes
Loadflow • Voltage limits (regulation) • Thermal loadings	To be undertaken for: - Peak load, max gen - Light load, max gen - Peak load, min gen - Light load, min gen
Voltage changes • Generator rejection (combined impact of all embedded generation on that part of the network)	To be undertaken for: - Peak load, max gen - Light load, max gen
Short circuit studies • Equipment ratings	
Protection coordination	

* - note that where reverse feed will never take place (i.e. reverse feed blocking acceptable to the distributor is installed), only limited impact study may be required - covering voltage changes with load / generator rejection and voltage limits/regulation.

[3] As a minimum these limits should be in line with the South African Grid Code (SAGC), Distribution Code and the SAGC Requirements for Renewable Power Plants

Grid Impact Study Specification Guide

A grid impact study specification guide is available at the below link. This may be used by a municipal distributor to specify exactly what is required in such a study. It provides a checklist of parameters to be examined as well as description of the data needs for a simulation study.
https://www.sseg.org.za/grid-impact-study-specification-guide/