

REQUIREMENTS FOR ALTERNATIVE ELECTRICAL GENERATION

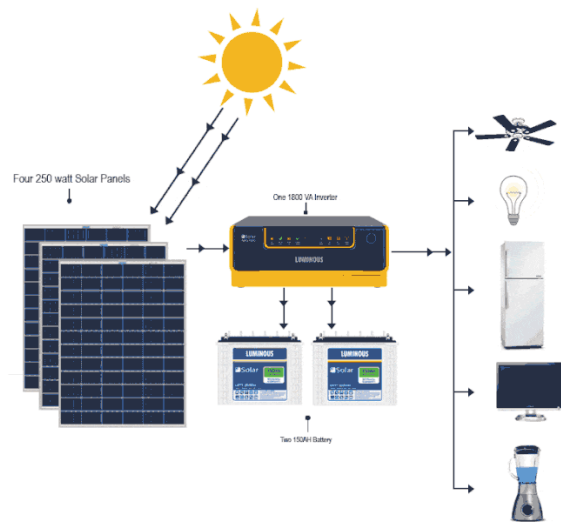


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FOREWORD

Note: Please ensure that you have the latest version of these Requirements, relevant application forms and associated documents before proceeding with an application. All of the relevant documents are available on the Municipality's website <https://www.langeberg.gov.za/alternative-energy>

INDEMNITY

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

SCOPE

The purpose of these Requirements is to define Langeberg Municipality's minimum requirements and application processes for all forms of alternative electrical generation equipment, such as Solar photovoltaic systems (including Solar photovoltaic Geysers), Uninterrupted power supplies, Alternative power supplies, Peak shaving or any additional power source equipment and LV standby generators in the Municipality's Licensed area of supply.

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

These Requirements do not apply to those who wish to install a system with a generation capacity of 1 MVA or more.

ABBREVIATIONS

ADMD	After Diversity Maximum Demand
AC	Alternating Current
AMI	Advanced Metering Infrastructure
BESF	Battery Energy Storage Facility
CoC	Certificate of Compliance
DC	Direct Current
DMRE	Department of Mineral Resources and Energy
ECSA	Engineering Council of South Africa
EG	Embedded Generation/Generator
EIR	Electrical Installation Regulations
ERA	Electricity Regulation Act
kVA	kilovolt-ampere (unit of apparent electrical power)
kW	kilowatt (unit of active electrical power)
kWp	kilowatt peak (the rated peak active power output of solar photovoltaic panels)
LM	Langeberg Municipality
LV	Low Voltage
MV	Medium Voltage
MVA	Megavolt-ampere (1 000 kVA)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
NRS	National Rationalised Specifications
NRS 097-2-1	National Rationalised Specifications 097-2-1 <u>latest edition</u>
OHS	Occupational Health and Safety
PCC	Point of Common Coupling
POC	Point of Connection
PGC	Point of Generator Connection
PUC	Point of Utility Coupling
PV	Photovoltaic
RE	Renewable Energy
RPP	Renewable Power Plant
PPM	Prepayment Meter
SABS	South African Bureau of Standards
SAGC	South African Grid Code
SANS	South African National Standards
SCP	Service Connection Planning (a branch within EGD)
SSEG	Small-scale Embedded Generation/Generator
UPS	Uninterruptible Power Supply
VAT	Value-Added Tax

GLOSSARY & DEFINITIONS:

Accredited installer:

An installer that have an PV green card accreditation, or any other equivalent accreditation.

Alternating current (AC)

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

Alternative supply

A combination of supply equipment connected to any electrical installation or part of an electrical installation.

Anti-islanding

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

Bi-directional meter

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

Co-generation

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

Customer/user

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

Dedicated assets/dedicated network

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

Direct current (DC)

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

Distribution network/grid

The network/grid owned and operated by a Distributor.

Distributor

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

Electrical installation

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

Electrically Separated

Means that all the conductors energized by the electricity generated by the Generator:

- i. Cannot be connected to any electrical conductors which can also be energized at any time from the electrical grid supply, and;
- ii. Are not terminated in or drawn through any enclosure or junction box in which conductors can be energized from the utility grid supply that are drawn or terminated through.

Embedded generation

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

Embedded generator

A generator that is connected directly (parallel) to the utility grid or through the customer's internal wiring (electrically connected), or through a reverse flow blocking relay is not considered to be Off-grid, but rather an Embedded generator (EG). The generator is connected to the grid supply irrespective if export is possible.

ECSA registered professional

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

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

Generator

A device that generates motive power (steam, turbines, gas turbines, water turbines, wind turbines, internal combustion engines and even hand cranks.) Includes a power device that converts direct current to alternating current at a voltage and frequency which enables the generator to be connected to an installation (also see inverter).

Generation/generating capacity

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

Grid-tied SSEG

SSEG that is connected in parallel to the distribution network either directly or through a customer's internal wiring is said to be grid-tied. SSEG that is connected to the grid through a reverse power flow blocking relay is also considered to be grid-tied. This is irrespective if export to the grid is possible. (Inverter without the function to export).

Grid-tied hybrid SSEG

SSEG that islands after interruption of the distributor supply or when the applicable electrical service conditions are outside stated limits or out of required tolerances and then supplies the load from the inverter, operating in the stored-energy mode via a suitably interlocked change-over switch. Include a Static UPS interconnected with the electrical installation with no external change-over switch to prevent the utility and inverter supply to parallel.

Group development (Sectional title community)

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

Inverter

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

Isolated

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

Load Profile

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

Low voltage (LV)

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

Maximum total generation/generating capacity

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

Medium voltage (MV)

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

Municipality

Refers to the Langeberg Municipality and will be referred to as such throughout this document.

Net-consumer

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

Off-grid Generator

Generator that is physically separated, electrically isolated and not interconnected with the electrical installation or the distribution network – either directly or through a customer's internal wiring. (Must have an external change-over switch complying with the requirements detailed in Appendix 4). Charging of batteries also not permitted from the grid. Customer loads cannot be simultaneously connected to the distribution network and the Generator installation, irrespective if the inverter have the ability to export to the grid. SSEG that is connected to the network through a reverse power flow blocking relay is not considered to be off-grid.

Passive standby UPS utilised as standby hybrid SSEG (Grid-tied)

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

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

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

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

Peak shaving

Peak shaving is the use of an additional power source (such as a generator) in synchronisation with the mains power supply (grid), to deliver enough power to meet the peak demand that cannot be met by the mains supply (grid).

Peak lopping

See “peak shaving”.

Point of common coupling (PCC)

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

Point of connection (POC)

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

Point of generator connection (PGC)

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

Point of utility coupling (PUC)

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

Renewable power plant (RPP) categories

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

a. Category A: 0 – 1 MVA

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

I. Category A1: 0 – 13.8 kVA

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

II. Category A2: 13.8 – 100 kVA

This sub-category includes RPPs of Category A with rated power in the range greater than 13.8 kVA but less than 100 kVA

III. Category A3: 100 kVA – 1 MVA

This sub-category includes RPPs of Category A with rated power in the range greater than 100 kVA but less than 1 MVA.

Note: For RPPs connected to multi-phase supplies (two- or three-phase connection at the POC), the difference in installed capacity between phases may not exceed 4.6 kVA per phase.

b. Category B: 1 MVA – 20 MVA

This category includes RPPs with rated power in the range equal or greater than 1 MVA but less 20 MVA.

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

c. Category C: 20 MVA or higher

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

Reverse power flow

The flow of energy from the customer's SSEG onto the distribution grid (i.e. export) as a result of the instantaneous generation exceeding the instantaneous consumption at the customer's site.

Reverse power flow blocking

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

Shared network

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

Small-scale Embedded Generator (SSEG)

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

Solar PV water heating

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

- directly to a DC geyser heating element or
- to a combination of AC and DC geyser heating element that is interconnected with the distributor grid supply that requires an external change-over switch that comply with the requirements listed in Appendix 4.

Standby Alternative supply (Off-grid)

SSEG as an alternative supply system that provides a switched alternative supply to

the grid supply to supply the electrical installation and is interconnected with the electrical installation by means of an external change-over switch that comply with the requirements listed in Appendix 4.

Suitably interlocked change-over switch

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

Stand-alone generator

See "Off-grid generator"

Wheeling

The financial transactions representing the transportation of third-party electrical energy (kWh) over the Municipality's distribution network which allows for the third-party supplier to sell this electrical energy to the Municipality's customer at that customer's point of supply.

IMPORTANT NOTICES

Compliance with the Law

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

The Municipality's Electricity Supply By-law states that no alternate electricity equipment provided by a consumer in terms of any Regulations or for his own operational requirements shall be connected to any installation without the prior written approval of the Municipality.

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

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

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

Generation Licenses

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

Approved Inverters

Until such time as a South African Bureau of Standards (SABS) mark is issued for inverters, the Municipality will require proof of type tests (in the form of test certificates) having been successfully carried out by a third-party test house certifying compliance of the inverters with the Municipality's requirements and the NRS 097-2-1. Details of the Municipality's requirements regarding the type testing of inverters is provided in Appendix 3.

Professional Sign-off

All grid-tied alternative generating equipment installed in the Municipality's distribution area must be certified for compliance with the Municipality's requirements as follows:

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

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

1. GENERAL REQUIREMENTS

1.1 INTRODUCTION

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

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

Currently, SSEG is not adequately regulated at the national level, despite ongoing attempts by the DMRE and NERSA to develop overarching regulatory rules and frameworks. In the absence of a national regulatory framework, the Municipality has

developed its own rules for the registration and authorisation of alternate electrical equipment (especially SSEG) in its Licensed area of supply. The Constitution of the Republic of South Africa provides that electricity reticulation is a Municipal competency. This means that a Municipality is responsible for providing electricity reticulation services to the customers within its jurisdiction. The electricity reticulation function extends to the obligation on municipalities as licensed distributors to provide open and non-discriminatory access to the Municipal distribution network. Accordingly, its electricity reticulation function includes, inter alia, administering the connection of generation systems to the Municipal distribution network.

1.2 DEFINING SSEG

As defined in the Glossary and as per the SAGC, an embedded generator refers to a legal entity that operates one or more electricity generation unit(s) that is connected to the distribution network. Alternatively, a legal entity that desires to connect one or more electricity generation unit(s) to the distribution network. For the purposes of these Requirements, an SSEG is an embedded generator with a generation capacity less than 1 MVA (1 000 kVA) which is located on residential, commercial or industrial sites where electricity is also consumed. Such SSEG would be connected to the wiring on the customer's premises which is in turn connected to, and supplied by, the Municipality's electricity network – thus these generators are considered to be 'embedded' in the local electricity network.

1.3 APPLICABILITY

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

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

It is essential that all customers who wish to install any type of alternative electrical equipment, regardless of generation capacity, complete the relevant sections of the

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

Eskom Customers

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

1.4 NET CONSUMER REQUIREMENT

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

Net generators are not permitted by the Municipality.

1.5 ON-SITE CONSUMPTION OF ELECTRICITY

The electricity produced by the SSEG system must be consumed on the property on which the SSEG is located or exported to the Municipality's network for purchase by the Municipality. Transfer of electricity to a different property i.e. wheeling, is not allowed by the Municipality.

1.6 OPERATION OF LV GENERATORS AS A BACK-UP SUPPLY

Grid-tied inverters are generally not designed to operate in island mode (where the generator supplies power to a portion of the customer's network during a general power outage). Should the inverter be able to operate in an island state, it must be effectively isolated from the Municipality's grid during operation (as is legally required of any standby generator). SANS 10142-1 Annexure P gives examples of what is required in this regard. If the SSEG is to be configured as a standby supply after

islanding from the utility supply, the generator will have to be connected to the existing internal wiring of the property and written approval by the Municipality is required if the generator is connected to the customer's network via a break-before-make switch with an appropriate change-over switch interlock. A registered person in terms of the EIR must install the generator and issue a CoC to the owner if the generator is to be connected to the existing internal wiring of the property. Requirements of SANS 10142-1 – Clause 7.12 (Alternative supplies) and Annexure P, apply.

1.7 ALTERNATIVE ELECTRICAL GENERATION SYSTEM DECOMMISSIONING AND ILLEGAL INSTALLATIONS

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

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

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

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

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

The relevant Decommissioning Form accompanied by the CoC that the system is in fact disconnected from the installation must be completed by a registered person and submitted to the Municipality's Electrical department via email.

1.8 CHANGE OF PROPERTY OWNERSHIP

When transfer of ownership of a property takes place that has an SSEG installed that export into the Municipality's network, the new owner will be required to sign a new Supplemental Contract or alternatively the SSEG system must be decommissioned as detailed in section 1.8.

The CoC which is required to be issued as a condition of transfer of ownership of the property must include a statement regarding the state of connection or disconnection. The moment when transfer of the property took place, and the new owner did not sign a new Supplemental Contract with the Municipality, the new owner is not entitled to any compensation for surplus electricity exported to the Municipality. The Municipality is entitled to debit any credit that was given after the change of ownership on the Municipal account.

1.9 METERING AND METER ACCOMMODATION

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

a) Export

Grid-tied SSEG customers who wish to participate in the SSEG Feed-in Tariff must have a Bi-directional AMI meter installed. The Municipality will supply and install the requisite meter, at the customers cost. The SSEG Feed-in Tariff is only available to customers who are net consumers of electricity over a rolling 12-month period. An SSEG contract must also be signed.

b) Non-Export

Grid-tied SSEG customers who do not wish to participate in the SSEG Feed-in Tariff, must have their inverters set to export 0%. Customers who are on a Prepaid tariff, may keep their existing PPMs and remain on the relevant tariff. It will be compulsory for residential Customers on the conventional tariff to convert to an PPM and the

relevant tariff at the customers cost. It will be compulsory for all Agricultural, Commercial and Industrial Customers on the conventional tariff to have a Bi-directional meter supplied and installed by the Municipality, at the customers cost.

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

Metering Accommodation

Grid-tied SSEG customers who wish to participate in the SSEG Feed-in Tariff will be required to adapt their electrical installation to allow for the AMI meter to be accommodated in a meter kiosk in the road reserve. Customers will be required to provide metering accommodation at their own cost (according to the Municipality's specifications) on the street-front property boundary. Such a meter kiosk must face outwards and be locked with a standard Municipal Electricity Department lock.

1.10 TARIFFS

Tariffs are determined annually by the Municipality and subject to approval by both Council and NERSA. The latest tariff book for all customer categories is available on the Municipality's website (<https://www.langeberg.gov.za/>).

1.11 GENERATION CURTAILMENT

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

1.12 GRID STUDIES

In the event that Grid impact studies are required for the proposed PV installation; the cost will be for the customer's cost. Grid impact studies are usually required for installations bigger than 350 kVA, but the Municipality could require Grid impact studies for any installation 100 kVA and larger.

1.13 AMOUNTS PAYABLE

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

1.14 APPLICABLE TECHNICAL STANDARDS

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

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

The above standards/specifications cover aspects such as voltage range, flicker, DC injection, frequency operating range, harmonics and waveform distortion, power factor, synchronisation, safe disconnection, over- and under-voltage, sudden voltage dips and peaks, over- and under-frequency, anti-islanding, network faults, response to utility recovery, isolation, earthing, protection and labelling.

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

3. SSEG GENERATION SIZE LIMITATION

3.1 SHARED LV FEEDERS

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

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

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

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

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

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

**** Maximum battery storage capacity is not defined but maximum battery charging current limits are according to these values (25%.)

Notes:

- i. The generation size limits in Table 1 apply to standard connections on a shared LV network.
- ii. If SSEG generation capacity is 4.6 kVA or less, a single-phase inverter can be installed even if the customer has a three-phase connection at the PoC. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases and the difference in installed capacity between phases may not exceed 4.6 kVA per phase. A qualified electrician, engineer or technologist should be consulted in this regard.
- iii. **The maximum individual generation limit in a shared LV feeder is 25 % of the customer's NMD, up to a maximum of 17.3 kVA (generators greater than 17.3 kVA should be connected through a dedicated LV feeder).**

3.2 DEDICATED LV AND MV FEEDERS

Langeberg Municipality **limit** the maximum generation **exported into the grid** on dedicated LV and MV feeders to **40%** of the Customer's **NMD**.

The maximum inverter capacity that can be installed is **100%** of the Customer's **NMD**.

Where batteries are charged from the Municipal electrical network, the charging current / power shall not exceed **25%** of the Customer's **NMD**.

All LV and MV commercial and industrial customers who wish to install SSEG systems with a generation capacity less than 1 MVA, must comply with the size limitations specified in NRS 097-2-3, as well as Langeberg Municipality's requirements for Alternative electrical generation.

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

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

3.3 ALTERNATIVE ELECTRICAL GENERATION CATEGORIES

I. Grid-tied SSEG

- a) Inverter Maximum Total Generation Capacity for export to the grid is in accordance with Table 1.
- b) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.

II. Grid-tied Hybrid SSEG

(Include a Passive standby UPS and VSD interconnected with the installation)

- a) Inverter Maximum Total Generation Capacity for export to the grid is in accordance with Table 1.
- b) Maximum inverter capacity is limited to the circuit breaker size of the customer's service connection, as per Table 1.
- c) Battery capacity is unlimited.
- d) Maximum Battery Charging Current Limit is 25% of the circuit breaker size of the customer's service connection, as per Table 1. This limit must be specified on the inverter's serial-plate or if software adjustable, the setting must be password protected.

III. Grid-tied Peak Shaving power source

Is the use of an additional power source (such as a generator) in synchronisation with the mains power supply, to deliver enough power to meet the peak demand that cannot be met by the mains supply.

An ECSA registered professional engineer/technologist must design and approve the complete installation.

IV. Solar PV Geyser (DC and AC element)

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

- a) directly to a DC geyser heating element or
- b) to a combination of AC and DC geyser heating element that is interconnected with the distributor grid supply that requires an external change-over switch that comply with the requirements listed in Appendix 4.

V. Off-grid LV Standby generator: (Separate and not interconnected with electrical installation)

- a) Compulsory external automatic change-over switch must comply with requirements detailed in Appendix 4.
- b) If momentary synchronisation/paralleling with the Municipal grid are required prior to operating the interlocking device when the Municipal supply is restored, an ECSA registered professional engineer/technologist must design and approve the complete installation.

VI. Off-grid Alternative supply (Separate and not interconnected with the electrical installation)

Alternative supply as per SANS 10142

- a) Maximum inverter capacity is unlimited.
- b) Battery capacity is unlimited.
- c) No charging from the distribution network allowed.
- d) No export allowed.
- e) Compulsory external automatic change-over switch must comply with requirements detailed in Appendix 4.

4. APPLICATION PROCESS

The customer must complete and submit the APPLICATION FOR THE REGISTRATION / CONNECTION OF ALTERNATIVE ELECTRICAL GENERATION EQUIPMENT Form (hereafter called the APPLICATION Form) together with all of the requisite supporting documentation. This is required for all types of alternate electricity equipment including Grid-tied, Grid-tied Hybrid (include Static Back up UPS), Grid-Tied Peak shaving power source, Solar PV Geyser, Off-grid , and LV standby generator systems and includes renewable energy and cogeneration.

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

Purchasing of Equipment

SSEG equipment to be connected to the grid must comply with the Municipality's Requirements. It is therefore important for customers to be familiar with these Requirements before purchasing any equipment. This is of particular relevance to the inverter. Specific technical information and certificates are required to be submitted with the application form. It is the responsibility of the customer to ensure that equipment complies with the Municipality's Requirements. Only equipment with an NRS 097-2-1 compliance certificate will be allowed to connect to the Municipal Grid.

No Existing Electricity Service Connection

Should a customer wish to connect an SSEG system to the installation at a location where there is no existing electricity service connection, the customer must also complete and submit the APPLICATION Form with all the required documentation.

Future Expansion

Authorisation to connect the SSEG to the distribution network is only granted for the declared generation capacity. Customers who wish to increase their generation capacity or make any material changes to their installation must obtain

authorisation from the Municipality before doing so. The customer must once again complete and submit the APPLICATION Form. The customer must remain a Net Consumer of electricity over a rolling 12-month period.

Professional Sign Off

As detailed above, the SSEG installation must (upon commissioning) be signed off as complying with the Municipality's Requirements. This sign off must be done by an ECSA registered professional. For further information regarding registered professionals, please visit ECSA's website (www.ecsa.co.za/default.aspx).

Step 1: Visit the Municipality's Website

Visit the Municipality's website on <https://www.langeberg.gov.za/alternative-energy> and download the relevant application form/s as noted above. Alternatively, the forms can be obtained from the Municipality's Electrical Department office's, or requested via email. The application form/s require both basic and technical information of the proposed Alternative electrical installation to ensure that all Alternative electrical installation connections are done in a safe and legal manner and in compliance with all relevant requirements. For grid-tied systems, the information required includes type of energy conversion, total generating capacity, electrical parameters, expected consumption, network connection point, synchronising method, anti-islanding method and generator control method amongst others.

Step 2: Complete the APPLICATION Form

The APPLICATION Form must be completed for all types of Alternate electricity installations as defined in 3.3. The Municipality requires that the APPLICATION Form be signed by the property owner. The property owner will need the support of the proposed installer in order to complete the forms. If the installer complete the Application on the owner's behalf, and duly signed Proxy letter by the owner, and the relevant copies of ID documents will be required by the Municipality.

Details in the APPLICATION Form that will need particular consideration are highlighted in the text box below:

Technical Information

Type of energy source, total capacity, battery storage, export, site lay out showing location of the inverters, NRS 097-1-2 Inverter test certificate, weight of PV panels on a roof structure.

Preliminary Design

Electrical single line circuit diagram showing major system components, Municipal & generator supply, change over switch and energy source must be provided.

Earthing Arrangement
This must be in accordance to SANS 10142-1. Earthing requirements for common earthing systems are described in NRS 097-2-1.
Electrical Parameters of the System
Various electrical parameters of the system must be provided. Different sections are applicable for the different system types.
System Protection Detail
This includes information about the synchronizing method, anti-islanding, power quality, change-over switch, etc.
Peak Power Generation Output
The expected peak power generation output of the system. Note that this must be in line with the limits described in these Requirements.

Step 3: Obtain Permission from others

Some Alternative electrical generation installations (SSEG's/LV Standby generators) may require prior approval from others (Planning and Building Department, Department of Environmental Affairs etc.). Please note that for Solar PV SSEG installations, approval from the Planning and Building Department will only be required if the installation falls outside defined parameters. Applications will only be considered when all relevant approvals are obtained and this must be reflected in the relevant sections of the application forms. The requirements of others are summarised in Appendix 2.

Step 4: Submit Completed Form/s and Supporting Documentation

Once the relevant application form/s have been completed and approval has been obtained from other Municipal departments (if required), the form/s and supporting documentation must be submitted to the Municipal Electrical offices. Completed forms and supporting documentation may also be submitted via email as indicated on the APPLICATION Form. If the application is not acknowledged via email within 14 days, it must be deemed not received by the Municipality. It remains the Customers responsibility to ensure that he/she receive written confirmation that the application was received.

Step 5: "Provisional Installation Approval" Letter Issued

After due consideration of the application, the applicant will be informed in writing regarding the outcome of the application. Successful applications will be issued with a "Provisional installation approval" Letter and only thereafter can system installation commence. The SSEG supplementary contract will also be issued to the applicant for signature. A cost estimate for any meter changes and or electrical network changes

to accommodate the proposed installation will be issued if applicable. Customers who proceed with the installation without written "provisional installation approval" will be contravening the Municipality's Electrical bylaw (no alternate electricity generation equipment shall be connected to any installation without prior written consent from the Municipality), and will be treated as such. The applicable fines and or disconnection of Electrical supply to the premises may be implemented.

Step 6: Installation Commencement Upon Approval

The successful applicant may now commence with installation of the proposed Alternate electrical system. Once the installation is complete, the system is ready for testing by the installer. Note that the permanent connection of the Alternative electrical generation system to the installation is only permitted on receipt of written permission from the Municipality i.e. "Final utilization approval" Letter. However, the Alternative electrical generation system may temporarily be connected to the installation only for the purpose of testing. **Once the testing process is completed, the system must be disconnected from the installation until the "Final utilization approval" Letter is issued by the Municipality (failure to comply will result in an illegally connected installation and will be subject to a fine.)** The applicant must pay for changes to metering as well as other cost as per Municipal cost estimate, if required. The Supplemental Contract must be completed for grid-tied SSEG with the assistance of the Municipality. This contract is a legal requirement that governs the relationship between the Municipality and the customer and is valid for as long as the system, as approved (without modifications), is in existence.

Step 7: Inspection/Tests/Commissioning

As soon as the installation is completed, the Municipality must be notified. An inspection/test/commissioning will then be scheduled **on condition that all costs are paid to the Municipality regarding meter changes/electrical network changes and the signed SSEG contract is received** by the Municipality. The Municipality will then issue a test/inspection report for internal record keeping.

Step 8: Submission of Commissioning Documentation

As detailed above, commissioning of the SSEG system must be done by an ECSA registered professional who must complete and sign off the GRID-TIED SSEG INSTALLATION COMMISSIONING REPORT (Appendix 1 of the APPLICATION Form). In

addition to the INSTALLATION COMMISSIONING REPORT, the following documentation must also be submitted:

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

Step 9: "Final Utilization Approval" Letter Issued

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

Step 11: Customer Placed on Appropriate Tariff and Generation Commences

The customer will be placed on the appropriate tariff which will be applied from the date of issue of the "Final Utilization Approval" Letter.

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

Should the customer wish to modify or expand the SSEG system, a new application must be submitted. If there is a change of ownership of the property, a new SSEG supplementary contract must be signed.

5. SSEG TARIFFS

The tariffs are subject to change and are reviewed and revised annually. Customers should check the municipality's website <https://www.langeberg.gov.za/> for the latest tariffs.

5.1 RESIDENTIAL SSEG TARIFFS

The Residential SSEG tariff comprises of:

- A monthly service and
- Network charge
- Electricity consumption charges for kWh consumed
- A rate per kWh at which the Municipality shall purchase residential generation exported to the grid (compensation only on a credit basis).

a) Service charge

The fixed costs associated with providing a retail service network (metering, billing, customer call centre) are recovered through appropriate service charges.

b) Network charge

This charge ensures that fixed costs associated with maintaining and operating the municipal grid are recovered through appropriate charges.

c) 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 another tariff).

d) Export (Feed-in) rate (c/kWh)

The SSEG customer should be compensated through an export tariff for any resulting reduction of cost to the utility (energy bulk purchase and line loss costs). Compensation will always be on a credit basis.

e) Billing Period

The daily service charge with charges for consumption and credits for feed-in shall be billed monthly (as is done for other municipal services e.g. water and rates). Tariffs are determined annually by the Municipality and are subject to Nersa and/Council approval. SSEG customers should check the Municipality's website <https://www.langeberg.gov.za/> for the latest tariffs.

f) Increased Costs

The Municipality bears 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.

5.2 COMMERCIAL, INDUSTRIAL, RURAL AND AGRICULTURE SSEG TARIFFS

Commercial, Industrial, Rural and Agriculture customers that are on tariffs which already have a fixed service 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 into 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, Industrial, Rural and Agriculture customers should note that the demand charge component of the tariff is unlikely to change after the installation of 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 NERSA and or Council approval. Alternative Energy Generation customers should check the Municipality's website <https://www.langeberg.gov.za/> for the latest tariffs.

6. APPENDIX 1: RELEVANT REGULATIONS, STANDARDS AND SPECIFICATIONS

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

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

7. APPENDIX 2: APPROVALS FROM OTHERS

Planning and Building Department

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

If the solar PV panels (in their installed position) exceed the above limits, building plans (incl. an engineer's endorsement) will be required. A relaxation in terms of the Zoning Scheme Regulations will also be required.

- Ground-mounted Solar PV Installations: No building plans will be required provided that the solar PV panels (in their installed position) do not project more than 2.1 meters (measured perpendicularly) above the natural/finished ground level.
- Clearance will be required for other SSEG technologies such as wind turbine generators.

Department of Environmental Affairs

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

8. APPENDIX 3: INVERTER TYPE TESTING

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

- I. An accredited (3rd party) body must perform the inverter type test certification in terms of NRS 097-2-1. The accredited body must according to the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006, be SANAS accredited or by a member of the recognition arrangements of the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.
- II. The accredited body must:
 - a) Issue a Certificate of Conformity for all GTIs and ancillary equipment (e.g. network and system grid protection voltage and frequency relays for the centralised disconnect switch) in terms of the requirements of latest NRS 097-2-1 edition.
 - b) Provide summary Test Report [excluding sensitive information test results] comprising of:
 - Report reference number, test laboratory name, client/applicant's name and reference, test specification and report form, test item description/name/model/types, ratings, lab and testing location, name and signature of test person and approval authority, manufacturer name and address, test report documentation version control;
 - Test item particulars, test case verdicts [N/A, pass and fail], test and issue dates, general remarks;
 - Copy of GTIs and ancillary equipment name plate data;
 - General product information, preferably with the inclusion of the GTIs and ancillary equipment electrical block diagram;
 - Summary of NRS 097-2-1 (latest edition) indicating all clauses, clause description/requirement/test, result/remark and verdict [N/A, pass or fail];
 - Test overview summary.
- III. An accredited body Certificate of Conformity is required for any brand and model. Manufacturer declaration is not accepted.

- IV. Inverters certified and already installed in terms of NRS 097-2-1: 2010 edition do not require modifications until retrospective requirement must be implemented as described in Compliance with the Law above.
- V. Type tested network and system grid protection voltage and frequency relays shall be programmed in terms of NRS 097-2-1 or the applicable South African Grid Codes and may only be used in conjunction with approved NRS 097-2-1 type tested inverters.

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

- a) Grid-tied inverters (compliant with NRS 097-2-1) without a disconnect switch integrated into the inverter whilst meeting all the other requirements, e.g. quality of supply, short circuit levels, DC injection, flicker, voltage unbalance, power factor, electromagnetic compatibility, synchronisation. This typically applicable to micro inverters.
- b) Grid-tied SSEG central disconnect switch for > 30 kVA.

9. APPENDIX 4: COMPULSORY EXTERNAL AUTOMATIC CHANGE-OVER SWITCH FOR GRID-TIED SOLAR PV GEYSER'S, OFF-GRID ALTERNATIVE SUPPLIES' AND STANDBY LV GENERATORS.

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

Notes:

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

10. APPENDIX 5: SOUTH AFRICAN GRID CODE SIGNAL AND CONTROL REQUIREMENTS

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

Consult the applicable standards for technical requirements and the Municipality Electrical Department for more information.