Midstream Electrical Supplies (Pty) Ltd (MES)

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REQUIREMENTS FOR SMALL-SCALE EMBEDDED GENERATION

Application process to become a small-scale embedded generator in Midstream

This document does not apply to a system with generation capacity greater than 1 MVA.

For Off-grid SSEG, please refer to point 6 on page 11, Section A point 1.2(i) & Appendix 4

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Foreword

Small Scale Embedded Generation (SSEG) will play an integral part in the future of electricity generation yet how exactly, still needs to be determine. MES acknowledge that we need to keep on developing and improving to deliver more efficient energy. This document sets standards that will change as development progress and will be updated as and when required.

MES is of the opinion that SSEG is primarily to assist the private individuals in maintaining their daily routine / lifestyle during load shedding or power outages. Hence, a grid-tie connection should therefor never be installed for the purpose of co-generation only, therefore MES will only allow grid tie systems which comprise of a battery backup system to enable the client to continue his lifestyle during outages.

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

It is important to ensure that you have the latest version of the various application forms and other relevant documents before proceeding with a SSEG application. Note that this document should be read in conjunction with the standard terms and condition of MES. These are available on the MES website: https://mes.midstream.co.za

Indemnity

Anyone using these Requirements for Embedded Generation in part or in full as a basis for their own small-scale embedded generation program does so on the basis that they indemnify and hold harmless Midstream Electrical Supplies (Pty) Ltd and its successors or assigns in respect of any claim, action, liability, loss, damage or lawsuit arising from their use of these Requirements.

Scope

The purpose of this document is to give guidance regarding MES requirements and application process for connecting all forms of small-scale sustainable embedded generation such as photovoltaic panels to the MES electricity network, including both renewable energy and cogeneration.

The approval process for a small-scale embedded generation (SSEG) installation in Midstream varies depending on the size of the system and customer category. This guide applies to systems with a generation capacity smaller than 100kVA, and all SSEG applicants up to this limit are required to comply with the conditions and process described herein.

This document does not apply to those who wish to install a system with generation capacity of greater than 100kVA should this be the objective a meeting must be arranged with MES in order to establish the necessary requirements and application process, for Example above 1MVA NERSA approval will be required

Glossary

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

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

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

Cogeneration
The generation of electricity using waste heat.

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

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

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

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

Grid-tied SSEG
SSEG that is connected to the utility's electricity grid either directly or through a customer's internal wiring is said to be "grid-tied". SSEG that is connected to the grid through a reverse power flow blocking contactor is also considered to be grid-tied.

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

Inverter
A power device that converts direct current to alternating current at a voltage and frequency which enables the generator to be connected to the utility grid.

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

Glossary (continue)

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

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

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

Net-Consumers
A net consumer purchases (imports) more kWh of electricity than they export (sell) over any 12 month period.

Net-Generators
A net generator exports (sells) more kWh of electricity than they purchase (imports) over any 12 month period.

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

Passive standby UPS utilised as off-grid hybrid SSEG
Applies to any UPS operation functioning according to the following principle:

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

Such a system is regarded as off-grid provided it is equipped with a suitably interlocked change-over switch, selectable as follows:

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

Glossary (continue)

Point of Common Coupling

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

Point of Connection

An electrical node on a distribution system where the customer's electrical assets are physically connected to the utility's grid.

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

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

Reverse power flow

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

Reverse power flow blocking

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

Shared network

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

SSEG-Small-scale embedded generator

A small-scale embedded generator for the purposes of these Requirements is an embedded generator with a generation capacity of less than 100kVA.

Suitably interlocked change-over switch

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

MES

'MES' refers to Midstream Electrical Supplies (Pty) Ltd and will be referred to as such throughout this document.

Utility

The electricity distribution service provider responsible for the electricity grid infrastructure to which the customer is connected.

Glossary (continue)

Utility Network (or Utility Grid)

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

Wheeling - Not permitted in the MES network

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

Abbreviations

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

Important Notices

Compliance with the Law
MES bylaws states (section 40) that no generation equipment may be connected to the grid without the explicit consent of MES.

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

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

Failure to obtain this consent constitutes an offence in terms of section 27(2) and (3) of the Electricity Act, 1987 (Act 41 of 1987), and makes the perpetrator guilty of an offence and liable on conviction to a fine and / or imprisonment. (Also refer to MES bylaws section 29).

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

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

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

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

No exemption from any of the requirements will be granted for “retrospective applications”.

Generating licences
Existing legislation requires that anyone generating electricity “not for own use” must obtain a generating licence from the National Energy Regulator of South Africa (NERSA). NERSA has issued a communication giving licence exemption to SSEG installations in municipal areas under 100kVA. MES will therefore only permit net consumers.

MES will register and authorise grid connection of SSEGs up to a maximum of 100KVA without evidence of a generation licence, unless legislation changes.

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

Anyone wanting to connect more than1 MVA must produce evidence of compliance with Sections 8, 9 and 10 of the Electricity Regulation Act regarding the licensing of generation and the registration of generation with the Regulator failing which the application will not be considered.

Professional Sign-off
Until such time as

1. SANS 10142-Parts 1, 3 and 4 (The Wiring of Premises) are updated and published, and

2. accredited embedded generation installation and commissioning

electricians/technicians exist, all embedded generation systems installed on the MES grid must be certified as complying with requirements as follows:

- ECSA-registered professional engineers, ECSA-registered professional technologists and certificated engineers may certify industrial, commercial and residential SSEG installations. (Discipline: electrical)

- ECSA-registered professional technicians may only certify residential SSEG installations. (Discipline: electrical)

Testing of Inverters
Until such time as a SABS mark is issued for inverters, MES will require proof of test certificates, of type tests having been successfully carried out by a third-party test house certifying compliance of the inverters with NRS097-2. Details of requirements regarding the Type Testing of inverters are found in Appendix 3.

1. Introduction

Heightened environmental awareness, dramatic increases in the price of electricity, rapidly decreasing costs of photovoltaic (PV) panels, and the risk of national power blackouts have all resulted in electricity distributors around the country being inundated with requests to allow electricity customers to connect PV and other SSEGs to the electricity grid. Such SSEGs would be connected to the electrical Installation on the customer's premises which is in turn connected to, and supplied by, the MES electricity network – thus these generators are 'embedded' in the local electricity grid.

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

Consequently, the MES's Electricity Supply By-law (section 40) requires that anyone wanting to connect a generator to the MES electricity grid must obtain explicit consent from MES. This document outlines the requirements in this regard and lays out the associated application processes.

Although the electricity distribution industry is highly regulated, SSEGs have not yet been adequately covered in national policy or legislation. In this void, MES have developed policies and practices which it believes are consistent with the broader national policy.

MES is an Eskom customer and therefor MES will not purchase electricity at a greater cost than the relevant Eskom tariff. The Eskom standard energy charge will therefore be used as a baseline.

2. Defining small-scale embedded generation

Small-scale embedded generation (SSEG) refers to power generation under 1MVA, such as PV systems, small wind turbines and diesel/petrol standby generators which are located on residential, commercial and industrial sites where electricity is also consumed. SSEG contrast with large-scale wind farms and PV parks that generate large amounts of power, typically in the multi-Megawatt range. Most of the electricity generated by a SSEG is consumed directly at the site but times arise when generation exceeds consumption and typically a limited amount of power flows in reverse - from the customer onto the utility grid. An SSEG therefore generates electricity that is “embedded” in the local electricity distribution network in that it is connected to the utility network on the customer’s side of the utility’s electricity meter.

3. Who the document is for?

This guideline is to assist customers who wish to connect an SSEG, with generation capacity smaller than 100kVA, to the MES electricity grid. It is intended to provide guidance in this regard to:

- Residential building owners
- SSEG installers
- Energy consultants commissioned to design SSEG systems
- Professional Engineers or Technologists involved in SSEG commissioning

It is essential that all customers wanting to install a grid tied SSEG, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval is received from MES before system installation commences. MES needs to ensure that, amongst other considerations, the SSEG installation can be accommodated on the electrical network and that the total SSEG generation capacity of the network has not been exceeded. Equipment should therefore not be purchased prior to obtaining written approval from MES as approval is not guaranteed and MES will not be held liable for equipment expenses where approval is denied.

This document does not apply to those who wish to install a system with generation capacity between 100kVA and 1MVA or greater than 1 MVA (1000kVA). For such systems a meeting should be arranged with MES in order to establish the necessary requirements and application process. Anyone wanting to connect more than 1 MVA will not be able to connect under the conditions of these requirements. In addition, a generating licence or exemption letter from NERSA will be required before connection is considered.

4. SSEG systems not permitted

Transfer of power to a different location is not permitted:

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

1. Installation on a different property to where the power is used (e.g. installing PV panels on a neighbour’s house's roof)

2. Supplying power from a SSEG on your premises to another premises (e.g. selling power to neighbours or to another premises elsewhere in Midstream). This is also known as wheeling that is not allowed on the MES electricity network.

5. SSEG Installations for net-grid connections with battery back-up supply.

Grid-tie Inverters will only be accepted where the system can operate in Island mode with battery backup. This can either be an inverter with integrated UPS functionality or two systems linked together.

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 MES 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 MES grid is restored, the SSEG may not be connected or reconnected to the grid until

1. 20-minute delay has passed
2. It has been properly synchronised with it.

If the system doesn’t have the ability to delay the switch back, then MES will install equipment for the customer’s cost.

A registered person in terms of the Electrical Installation Regulations (2009) must install the generator and issue a Certificate of Compliance to the owner if the generator is to be connected to the existing internal wiring of the property. Requirements of SANS 10142-1 – Clause 7.12 (Alternative supplies) applies.

Note: Approvals from the various HOAs is also a requirement. It is the responsibility of the prospective stand-alone generator owner to obtain the necessary approvals from the HOA directly.

6. SSEG Installations only for off-grid operation.

SSEG’s that are not connected to the electricity grid in any way and are thus ‘off-grid’ SSEG. 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 By-law therefore does not apply to it:

1. A completed “Declaration for Off-grid Small Scale Embedded Generation form” (SSEG-OG-D) with details of the customer and the installation, declaring that the SSEG installation is deemed to be off-grid.
2. A certificate of compliance (CoC) and test certificate signed by an ECSA registered technician / engineer for electrical installations certifying that the SSEG installation is physically separated from the MES grid and the part of the installation on the property that is being supplied from the MES network. If a suitably interlocked change-over switch is required for a passive standby UPS utilised as off-grid hybrid SSEG, the certificate of compliance and the test report must certify that the change-'over switch complies with the requirements as detailed in Appendix 4.
3. A schematic diagram showing details of the SSEG installation in relation to the rest of the installation and the MES's grid signed by an ECSA registered technician / engineer.
4. MES inspection.

A SSEG installation connected to the MES 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.

Note: Approvals from the various HOAs is also a requirement. It is the responsibility of the prospective stand-alone generator owner to obtain the necessary approvals from the HOA directly.

7. SSEG system decommissioning

MES requires notice of a SSEG system which has been decommissioned. A SSEG system which has been decommissioned must be disconnected from the grid at the customer's cost.

An Off-grid application SSEG-GT-D form must be completed and submitted to the MES office.

8. Change of property ownership

When transfer of ownership of a property takes place which has SSEG installed, the new owner will be required to sign a new contract (SSEG-GT-A) or alternatively the SSEG system must be decommissioned (SSEG-GT-D) as detailed in paragraph above. The Certificate of Compliance which is required to be issued as a condition of transfer of ownership of the property and a Test Certificate (SSEG-CERT) signed by an ECSA registered technician / engineer. At the time that the customer ceases to be on the SSEG tariff, any remaining credit balance will be refunded to the customer on written request provided that the customer has no other outstanding debt.

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

Electricity customers can access historical graphs of their premises' electricity consumption and excess generation on the following website, click on MES consumer login https://mes.midstream.co.za

SECTION A:
RESIDENTIAL
SMALL-SCALE EMBEDDED GENERATORS

1. General Requirements: Residential

1.1. Generation size limitations

MES is following a considered, calculated approach regarding the introduction of embedded generation onto its electricity grid. The maximum energy permissible to be fed back onto the grid is 1200kWh/month per phase (provided that the electricity purchase exceeds the electricity fed back on grid). The maximum connection allowed is specified in table 1

No. of Phases	Service connection Service Circuit Breaker Size (A)	Maximum Total Generation Capacity of SSEG* (kVA)
1	60A or 80A	4.6
3	60A or 80A	13.8

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

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

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

In the event of operating conditions resulting in electricity network parameters not meeting statutory minimum quality-of-supply standards – to impose peak generation limits on embedded generator installations.

Note: A single phase Inverter can be installed at a three-phase connection if the capacity is 4,6 kVA or less. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases. A qualified electrician, engineer or technologist should be consulted here.

1.2. Metering and Tariffs

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

i. Customers wanting to connect SSEG to the grid without being compensated for reverse power flow will be required to install reverse power flow blocking protection to prevent reverse power flow onto the electricity grid.
ii. Residential customers installing SSEG who wish to participate in the SSEG tariff must have a bi-directional meter installed. MES will provide and install the requisite meters. The SSEG tariff is limited to 1200kWh per phase per billing period (provided that the electricity purchase exceeds the electricity fed back on grid).

Customers (whether with single or three phase supplies) wishing to participate in the SSEG tariff will have to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter kiosk or meter ripple box already exists on the street-front property boundary or side wall of the premises.
Tariffs are determined annually by MES. The current tariffs are to be found on the MES website and SSEG-GT-A form. The Eskom standard energy charge will be used as a baseline.

The applicable SSEG tariff is the R*esidential small-scale embedded generation tariff* and comprises:
A rate per kWh at which MES will purchase residential generation up to a maximum of 1200kWh per phase per billing period (provided that the electricity purchase exceeds the electricity fed back on grid).
MES will purchase from SSEG's based on the current Eskom tariff structure excluding VAT.

1.3. Customer's own Load profile management

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

1.4. Who pays for what?

In general, MES will pay for the changes to the grid and the customer for changes at their specific premises

- Currently MES is responsible for all the costs involved in the supply and installation of meters. The cost of changing an existing meter will be borne by MES
- The customer will be responsible for any rearrangement or re-inspection of the installation or meter accommodation including the moving of the metering point to the property boundary should it be required
- The customer will be responsible for the cost of any specialist grid studies (although such studies are unlikely in the case of residential SSEG installations).
- The customer will be responsible for any changes required to the utility network upstream of the connection point as a result of the SSEG installation (although the need for such changes is unlikely).
- The customer will be responsible for all the costs associated with specialist tests that need to be carried out, e.g. Inverter testing, as well as for obtaining the required certification of the design and installation as detailed below.

1.5. Applicable technical standards

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

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

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

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

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

The SSEG-GT-A application form must be completed for all forms of grid-tied embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plant. (Off-Grid installations must be declared as laid out in Paragraph 6 on page 11).

The forms are available on the MES website. The text box below highlights some important points to consider prior to applying.

Purchasing your equipment: SSEG equipment that is to connect to the grid must comply with all regulatory requirements and national standards. 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.

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

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 SSEG-GT-A application form and required documents.

Professional sign off: As detailed on page 9, the final installed SSEG system must be signed off on commissioning as complying with MES requirements by a professional engineer or technologist registered with ECSA. For more information regarding professional personnel, visit: https://www.ecsa.co.za/default.aspx

STEP 1: COMPLETE SSEG-GT-A APPLICATION FORM

Visit the MES website and download the relevant application form/s as noted above. Alternatively, the forms are obtainable from the MES office situated at Shop 9 Square@Midstream. The SSEG-GT-A form must be filled in for all installations which are to be grid-tied. MES requires that the application form/s to be signed by the property owner. Details of the proposed installer must also be provided. The property owner may need support from the proposed installer or a professional.

STEP 2: PROVIDE MES WITH DETAIL OF THE PROPOSED INSTALLATION

MES requires both basic and technical information of the proposed SSEG project to ensure that all SSEG connections are done safely and legally and in compliance with all requirements. On the website you will find a list of systems for which we have received certificates.

STEP 3: PROVIDE MES WITH A COPY OF THE PLANNED CIRCUIT DIAGRAM

MES requires a copy of the planned circuit diagram signed by an ECSA registered Technician / Engineer (Discipline: Electrical)

Preliminary design: a simple circuit diagram showing major system components and point of common coupling (PCC) must be provided **and signed off by an ECSA registered technician / engineer**

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

Various electrical parameters of the system: these sections require information on the electrical specifications of the SSEG system.

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

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

STEP 4: OBTAIN PERMISSION FROM HOA
SSEG installations will require prior approval from the estate HOA. Note that photovoltaic (PV) SSEG applications will first require aesthetical approval from the HOA. Applications to connect to the grid will not be considered until all relevant approvals have been obtained. All applicable documentation must attach to the application

STEP 5: SUBMIT COMPLETED APPLICATION FORM AND ATTACHMENTS
Once the relevant forms ("SSEG-GT-A") and PV specification / NRS certification of the system have been completed and consent has been obtained from the relevant HOA, the form must be submitted to MES together with the system details. (Shop 9, Square@Midstream, Midstream Estate)

STEP 6: MES ISSUES "PERMISSION TO INSTALL" LETTER
After due consideration of the application, the applicant will be informed in writing whether the application has been successful. Once notified by means of a "Permission to Install" SSEG-L1 letter of a successful application, the applicant may commence installation. The successful applicant may now commence with installation and commissioning of the SSEG system.

Once fully installed, the system is ready for testing and commissioning by the SSEG installer. Note that permanent connection of the SSEG system to the electricity grid is only permitted on receipt of written permission from MES.

The Supplemental contract must be completed. This is a legally required contract that governs the relationship between MES and the customer. The contract is valid for 1 year and can be renewed annually.

STEP 7: COMMISSIONING DOCUMENTATION TO BE SUBMITTED TO MES AND BOOK INSPECTION
As detailed on page 9, commissioning of the system must be undertaken by an ECSA registered Pr. Eng., Pr. Tech. Eng., Pr. Cert. Eng. or Pr. Techni. Eng., who must complete and sign off the MES SSEG Test Certificate (SSEG-CERT)

The following documentation must be completed and submitted to the MES office:

- Copy of final as-built circuit diagram, signed by an ECSA registered technician / engineer
- An electrical installation Certificate of Compliance as per SANS 10142-1
- A signed Supplemental Contract for Embedded Generation. (SSEG-GT-A)
- Test Certificate (SSEG-CERT) signed by an ECSA registered technician / engineer

However, the SSEG may temporarily connect to the utility grid for the commissioning process only, where after it must once again be disconnected until the "Commissioning Approval letter SSEG-L2" is granted by MES.

MES will inspect the installation. (For any re-inspection due to faults in the installation, MES will charge a re-inspection fee)

STEP 8: MES ISSUES "APPROVAL" LETTER ON COMPLIANCE
If a change to the metering is required, MES will install and commission the new meter. If all the above is satisfactory, MES will issue a "Commissioning Approval SSEG-L2" letter.

STEP 9: 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 grid tie meter was commissioned, or, if no change was required, from the date of issue of the Commissioning Approval Letter.

Should an expansion or a change to the system be required, a new application (SSEG-GT-A) must be completed. (This includes change of property ownership)

1.7. Annual Renewal

The contract period is only valid for 1 year as the rules and regulations in respect of solar installations may have changed or been adjusted and it is important to ensure the quality of supply into the MES grid annually. The Customer must prevail himself of all the documents and changes and if required make the necessary changes to their system.

It is therefore required that a SSEG customer who feeds back more than 300kWh on average per month on the grid, must submit the SSEG Application for grid tie (SSEG-GT-A) and a Test Certificate (SSEG-CERT) signed by an ECSA registered technician / engineer annually to our offices annually. This entails that a qualified person must test your system annually and by issuing the Certificate of Compliance for this installation they take full responsibility for the quality of power to be injected into the grid for the contract period.

Customers who do not feedback more than 300kWh on average per month on the grid, must still submit the SSEG Application for grid tie (SSEG-GT-A) annually to our offices.

A Test Certificate (SSEG-CERT) signed by an ECSA registered technician / engineer and a Certificate of Compliance (CoC) by a MES registered electrician must be submitted every 5 years for all SSEG clients.

Average monthly units back on grid	**Annual renewal documentation required**	**Documentation required every 5 years**
< 300 kWh	1. Application renewal *(SSEG-GT-A)*	1. Application renewal *(SSEG-GT-A)* 2. Test Certificate *(SSEG-CERT)* 3. Certificate of Compliance (CoC)
> 300 kWh	1. Application renewal *(SSEG-GT-A)*; 2. Test Certificate *(SSEG-CERT)*	1. Application renewal *(SSEG-GT-A)* 2. Test Certificate *(SSEG-CERT)* 3. Certificate of Compliance (CoC)

SECTION B:
Appendices

Appendix 1: Relevant standards and regulations

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

List of Standards and Regulations

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

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

Guidance on their applicability and coverage is given below.

Standards of Importance

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

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

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

NRS 097-2-1 (Part 2: Small-scale Embedded Generation, Section 1)
This document serves as the standard for the interconnection of SSEGs to the utility network and applies to embedded generators smaller than 1000kVA connected to LV networks of type single, dual or three-phase.

NRS 097-2-3 (Part 2: Small-scale Embedded Generation, Section 3)
This document provides simplified utility connection criteria for low voltage connected generators.

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

i) Category A: 0 – 1MVA (Only LV connected RPPs)
This category includes RPPs with rated power of less than 1 MVA and connected to the LV voltage (typically called 'small or micro turbines'). This category shall further be divided into 3 sub-categories:

ii) Category A1: 0 – 13,8kVA
This sub-category includes RPPs of Category A with rated power in the range of 0 to 13,8kVA.

iii) Category A2: 13,8kVA – 100kVA
This sub-category includes RPPs of Category A with rated power in the range greater than 13,8kVA but less than 100kVA.

iv) Category A3: 100kVA – 1MVA
This sub-category includes RPPs of Category A with rated power in the range 100kVA but less than 1MVA. This category also includes RPPs of Category A1 and A2 with a rated power less than 100kVA that are directly connected to a MV-LV transformer.

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

Other Standards and Legislation

Electricity Regulation Act, Act 4 of 2006 (ERA)
All applicants should familiarize themselves with the ERA. The act states that no person may, without a licence issued by the regulator (NERSA), operate any generation facility. The ERA holds that exemption is held for non-grid-tied projects. Note that NERSA has issued a communication giving licence exemption to SSEG installations in municipal areas under 100kW.

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

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

Occupational Health and Safety Act, 1993
The Occupational Health and Safety Act provides for the health and safety of the people by ensuring that all undertakings are conducted in such a manner so that those who are, or who may be, directly affected by such an activity are not negatively harmed as far as possible and are not exposed to dangers to their health and safety.

MES's Electricity Supply By-Law
This document provides the general conditions of supply of electricity, outlines the responsibility of the customers, systems of supply, measurement of electricity and the electrical contractors' responsibilities.

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

SANS 10142-2 The Wiring of Premises - Medium-Voltage installations above 1kVac not exceeding 22kVac and up to and including 3 000kW installed capacity
This document serves as the South African national standard for the wiring of premises in medium-voltage networks. The aim of the document is to ensure that people, animals and property are protected from dangers that arise during normal as well as fault conditions, due to the operation of an electrical installation. Compliance to the standards and regulations as laid out SANS 10142-2 is required, and proof should be provided via an electrical installation certificate of compliance. The implication is that a qualified electrician is required to sign off on your system.

SANS 474 / NRS 057 Code of Practice for Electricity Metering
SANS 474 specifies the metering procedures, standards and other such requirements that must be adhered to by electricity licensees and their agents. It refers specifically to new and existing metering installations for the purpose of billing. It further specifies the initial calibration and certification requirements as well as compliance testing of metering installations and the subsequent procedures to ensure continued compliance. It specifies the procedures for the manipulation and storage of metering data and sets a standard format for the numbering of electricity meters.
For more specific details about the metering for SSEG purposes, NRS 097-2-1 should be consulted and the requirements as defined by MES must be adhered to.

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

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

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

Appendix 2 HOA Approvals

Architectural and Aesthetical rules

1. SOLAR PANELS

"The use of solar panels for the heating of water is encouraged. Only the solar panels (either the vacuum tube-type or flat panel-type) may be visible – no external geyser, header tanks or coiled pipes may be visible. The solar panels must be incorporated flush onto the adjoining structure and my not be placed on an elevated structure"

"The roof design from inception must allow for immediate or future installation of solar panels. Panels on concrete roofs must be within a screened yard and may not be visible from any direction."

"All retro fitted geysers on flat roofs are to be enclosed in an aesthetical pleasing enclosure. (Details to be submitted for approval)"

2. STANDBY GENERATORS

"All standby generators must comply with the minimum requirements of Midstream Electrical Supplies. Generators must be installed in such a way that it does not create a nuisance to neighbours. In addition to the requirements above, generators that are permanently or semi-permanently installed (semi-permanently shall be a unit being in the same position for more than 30 days), must be visibly screened and indicated on plans approved by the HOA"

Appendix 3: Inverter Type Testing Requirements

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

1. A 3rd party accredited body must perform the inverter type test certification in terms of NRS 097-2-1. The accredited body must be SANAS accredited or by a member of the recognition arrangements of the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.

2. The accredited body must:
   a. Issue a Certificate of Conformity for all GTIs and ancillary equipment (e.g. network and system grid protection voltage and frequency Contactors for the centralised disconnect switch) in terms of the requirements of current NRS 097-2-1 document.

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

3. NRS 097-2-1: 2017 was published on 8 March 2017 and replaces NRS 097-2-1: 2010. Inverter requirements are as follows:

   a. Retrospective compliance of installed NRS 097-2-1: 2010 type tested inverters to the new NRS 097-2-1: 2017 version: Retrospective compliance of the installed SSEG base with the new version is not required.

   b. New installations with existing certified NRS 097-2-1: 2010 type tested inverters:
   i. SSEG installations and applications in process (inclusive of SSEG system modification or expansion) will be accepted until 31 December 2018 only.
   ii. Commissioned inverter settings shall be in accordance with the new NRS 097-2-1: 2017 version.

   c. New inverter type test certification:
   i. All the existing NRS097-2-1: 2010 type tested inverters must be SANAS re-certified in accordance with new NRS097-2-1: 2017 with effect from 1 January 2019 if the inverter is being considered for a new embedded generation application.
   ii. New inverter type test certifications must be in accordance with the new NRS 097-2-1: 2017 version and the embedded generation installation using such inverters shall be compliant with new version.

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

a. This includes interrupters, transfer switches, bypass switches, isolation switches and tie switches.

b. The switch shall provide feedback of its position to the inverter/charger so that if the contacts fail to operate or malfunction [e.g. fused-closed contacts, inadvertent energising of the change-over switch coil, etc.], use of the inverter mode will be impossible.

c. The requirements of SANS 10142-1 Section 7.12.2.5 are applicable.

d. It shall be a separate, controllable switch, compatible with the applicable electrical service conditions and to the performance requirements of the passive standby UPS, in accordance with SANS / IEC 60947-6-1 and the following product specifications:

- Static transfer systems (STS): SANS / IEC 62310-3.
- Automatic transfer systems (ATS): SANS / IEC 60947-6-1.
- Manual isolation, tie and transfer switches (MTS): SANS / IEC 60947-3.

e. The switch shall have a rated lightning impulse withstand voltage (BIL) of 4 kV at 1,2/50 µs in accordance with SANS / IEC 60947-1 (Tables H.1 and 12).

f. Characteristics of the transfer shall be break-before-make (open transition) – no transient cross-conduction during transfer. The transfer time of the switch shall be ≥ 20ms.

g. The contactor gap of the switch shall exceed 4 mm in accordance with SANS 60950-1, S 2.10.3.3 and Table 2K for a fixed installation with overvoltage category 2.

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

Appendix 5: Battery backup required

MES will only permit systems to connect to the grid if the system comprises of a battery backup system of minimum 3 kWh, thus enabling the client to continue his lifestyle during load shedding or power outages.