

SOL PLAATJE LOCAL MUNICIPALITY

SMALL SCALE EMBEDDED GENERATION PHOTOVOLTAIC POLICY



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GENERAL POLICY PROVISIONS

1. LEGISLATIVE CONTEXT

1.1 The objects of Local Government as prescribed by our Constitution are:

“152. Objects of local government.—(1) The objects of local government are—
(a) to provide democratic and accountable government for local communities;
(b) to ensure the provision of services to communities in a sustainable manner;
(c) to promote social and economic development;
(d) to promote a safe and healthy environment; and
(e) to encourage the involvement of communities and community organisations in the matters of local government.”

1.2 Its powers and functions per the Constitution are:

“156. Powers and functions of municipalities.—(1) A municipality has executive authority in respect of, and has the right to administer—
(a) the local government matters listed in Part B of Schedule 4 and Part B of Schedule 5; and
(b) any other matter assigned to it by national or provincial legislation.

PART B

The following local government matters to the extent set out in section 155 (6) (a) and (7):

...
...
...
Electricity and gas reticulation
...”

1.3 The Local Government: Municipal Systems Act, 2000 (Act No. 32 Of 2000 prescribes inter alia:

“74. Tariff policy.—(1) A municipal council must adopt and implement a tariff policy on the levying of fees for municipal services provided by the municipality itself or by way of service delivery agreements, and which complies with the provisions of this Act, the Municipal Finance Management Act and any other applicable legislation.”

1.4 The Local Government: Municipal Finance Management Act, 2003 (Act 56 of 2003) per the Municipal budget and reporting regulations (Government Gazette No. 32141 - GN 393 of 17 April 2009)

“7. Preparing and amending budget-related policies.—(1) The municipal manager of a municipality must prepare, or take all reasonable steps to ensure the preparation of the budget-related policies of the municipality, or any necessary amendments to such policies, in accordance with the legislation applicable to those policies for tabling in the municipal council by the applicable deadline specified by the mayor in terms of section 21 (1) (b) of the Act.



Budget Related Policies are defined in section 1 of the Act as policies that affect or are affected by the annual budget of a municipality include—

- (a) the tariffs policy which the municipality must adopt in terms of section 74 of the Municipal Systems Act;
- (b) ...
- (n) any policies related to managing electricity and water including—
 - (i) a policy related to the management of losses; and
 - (ii) a policy to promote conservation and efficiency;
- (o) ...”

1.5 The National Energy Regulator Act, 2004 (Act No. 40 of 2004) provided for the establishment of a single regulator to regulate the electricity, piped-gas and petroleum pipeline industries; and to provide for matters connected therewith.

1.6 The Electricity Regulation Act, 2006 (Act No. 4 of 2006) has as its purpose *inter alia* to establish a national regulatory framework for the electricity supply industry; to make the National Energy Regulator of South Africa the custodian and enforcer of the national electricity regulatory framework; to provide for licences and registration as the manner in which generation, transmission, distribution, reticulation, trading and the import and export of electricity are regulated; to regulate the reticulation of electricity by municipalities; and to provide for matters connected therewith.

“CHAPTER II OVERSIGHT OF ELECTRICITY INDUSTRY (ss 3-6)

3 Regulator

(1) The National Energy Regulator established by section 3 of the National Energy Regulator Act is the custodian and enforcer of the regulatory framework provided for in this Act.

4 Powers and duties of Regulator

The Regulator-

(a) must-

- (i) consider applications for licenses and may issue licences for-
 - (aa) the operation of generation, transmission or distribution facilities;
 - (bb) the import and export of electricity;
 - (cc) trading;
- (ii) regulate prices and tariffs;
- (iii) register persons who are required to register with the Regulator where they are not required to hold a licence;
- (iv) issue rules designed to implement the national government's electricity policy framework, the integrated resource plan and this Act;
- (v) establish and manage monitoring and information systems and a national information system, and co-ordinate the integration thereof with other relevant information systems;
- (vii) enforce performance and compliance, and take appropriate steps in the case of non-performance;
- (b) ...”

1.7 The National Energy Regulator Consultation Paper on Embedded Generation provided further guidance into the formulation of this policy.

1.8 All definitions and regulations taken from the NRS 097-2-1:2010. Under the



general title: “Grid Interconnection of Embedded Generation”, the NRS 097 consists of the following parts and sections:

Part 1: Distribution standard for the interconnection of embedded generation.

The specification sets out the minimum technical and statutory requirements for the connection of embedded generators to medium-voltage and high-voltage utility distribution networks. The specification applies to embedded generators larger than 100 kW. This specification is still in the course of preparation.

Part 2: Small-scale embedded generation.

The specification sets out the technical requirements for the utility interface, the embedded generator and the utility distribution network with respect to embedded generation. The specification applies to embedded generators smaller than 100 kW connected to low-voltage networks. This specification is active and will be utilised within this policy.

- 1.9 Chapter 2, clause 5 of the SPM Electrical By-law of 2006 states that no person shall use an electricity supply from the Municipality unless such a person shall have entered into an agreement in writing the Municipality for such a supply. Chapter 2, clause 20, paragraph 1 states that unless otherwise authorised in writing by the Municipality, no person shall sell or supply electricity supplied to his or her premises under an agreement with the Municipality, to any other person(s) for the use on any other premises, or permit or suffer resale or supply to take place. Chapter 9, clause 61, paragraph 1 states that any person who contravenes any of the sections 5,7,13, 14, 20, 25, 26, 27, 29, and 30 shall be guilty of an offence. Failure of adhering to the above stated laws may constitute an offence which in turn could lead to a fine or even imprisonment.
- 1.10 The Constitution entitles everyone to administrative action which is lawful, reasonable and procedurally fair and to be given reasons for any such action which affects them.
- 1.11 The Promotion of Administrative Justice Act 3 of 2000 required by the Constitution to give effect to the right to just administrative action and in order



to promote an efficient administration and good governance and to create a culture of accountability, openness and transparency in public administration or in the exercise of a public power or the performance of a public function.

1.12 This policy incorporates the above principles by providing parameters and procedures to guide the municipality and its officers in implementing it, and thereby exercising a public power through a series of administrative actions. In so doing, this policy seeks to provide certainty on the part of those affected by it with regard to how the municipality will act in the circumstances covered by the policy and uniformity of action on the part of its officers.

1.13 The municipality commits itself and its officers to act fairly and justly in an open and transparent manner in implementing this policy.

2. SCOPE OF THE POLICY

2.1 Accordingly this policy document provides a framework for the approval and registration of Small Scale Embedded Generators of electricity as well as the regulation thereof relative to the requirements of Sol Plaatje Municipality and all other Policies, By-laws and Legislation applicable thereto.

2.2 The policy is applicable to all categorised as Small Scale Embedded Generators.

3. DEFINITIONS

“Alternating Current” the flow of electrical energy that follows a sine wave and changes direction at a fixed frequency (i.e. it ‘alternates’). Most residential and commercial uses of electricity require alternating current.

“Anti-islanding” The ability of an SSEG installation to instantly and automatically disconnect the generator from the 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.

“Bi-directional meter” A meter that separately measures electricity flow in both directions (import and export). Such a meter displays the



balance of the imported and exported electrical flow energy in a single register meter (net metering) or displays both imported and exported electrical flow energy in separate registers.

- “Cogeneration”** The generation of electricity using waste heat.
- “Consumer”** In the context of this document, consumers who also generate will be referred to as “consumers” although in actual fact they are “consumer/generators”.
- “Consumer dedicated network”** Section of the utility grid that exclusively supplies a single consumer.
- “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.
- “Disconnection Switching Unit”** Switching unit that disconnects the embedded generator operating parallel with the utility network from the network in response to restricted condition.
- “Embedded Customer”** A customer whose supply is taken from the distribution system.
- “Embedded Generator”** An entity that operates one or more generation sources that include energy conversion device(s), static power converter(s), if applicable and the control and protection gear within a customer’s network that operates in synchronism with the utility’s network.
- “Export tariff”** A payment for every kilowatt-hour (kWh) of surplus electricity a customer system exports to the electricity grid.
- “Feed-in tariff”** An administrative tariff or standard offer approved by the Energy Regulator for renewable energy generator or energy efficiency interventions.
- “Generating capacity”** The maximum amount of electricity measured in kiloVoltAmperes (kVA), which can flow out of the generation equipment into the consumer’s alternating wiring system. This is therefore the maximum alternating current power flow which can be generate.
- “Grid tied”** An SSEG that is connected to the utility electricity grid either directly or through a consumer’s internal wiring. The export of energy onto the utility grid is possible when generation exceeds consumption at any point in time. Such consumers would rely on the utility grid to supply them with electricity when their



instantaneous generation is insufficient to supply their instantaneous consumption.

“Import tariff”	A payment for every kilowatt-hour (kWh) of electricity imported to a customer from the electricity grid.
“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.
“Island”	The state in which a portion of the utility or customer’s network, containing load and generation, continues to operate isolated from the rest of the grid. The generation and loads may be any combination of customer-owned and utility-owned
“Isolated”	A section of an electrical network which is disconnected from all other possible sources of electrical potential.
“Load Profile”	The variation of consumers’ rate of electricity consumption over time.
“Low Voltage”	Nominal voltage levels up to and including 1kV.
“Medium Voltage”	Nominal voltage level greater than 1kV up to and including 33kV.
“Municipality”	Sol Plaatje Local Municipality
“Net consumer”	Someone who purchases/imports more kWh of electricity than they sell/export over any 12 month periods.
“Net-metering”	A service to an electric consumer under which electric energy generated by that electric consumer from an eligible on-site generating facility and delivered to the local distribution facilities may be to offset electric energy provided by the electric utility to the electric consumer during the applicable billing period.
“Network Charges”	A tariff charge payable per premise monthly. The network charge recovers network costs (including capital, operations, maintenance and refurbishment) associated with the provision of the network capacity required and reserved by the customer. The network charge in the retail tariff or in the Distribution use system charges, may or may not be the same in structure of value.
“Network Service Provider”	A legal entity that is licensed to provide network services through the ownership and maintenance of an electrical network.



“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 or Pr Tech Eng”	This refers to a professional engineer or professional technologist who is registered with the Engineering Council of South Africa (ECSA).
“Preventing of islanding”	Embedded generator’s ability to detect loss-of-grid and prevent the condition of unintended islanding.
“Reverse power flow”	The flow of energy from the consumer electricity installation onto the utility grid 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 grid that provides one or more customer.
“SSEG”	Small Scale Embedded Generation. For the purpose of this policy; an embedded generator with a generation capacity of less than 1000kVA (1MVA).
“Stand-alone generator”	A generator that is not in any way connected to the utility grid. Export of energy onto the utility grid by the generator is therefore not possible.
“Tariff”	A combination of charging parameters applied to recover measured quantities such as consumption and capacity costs as well as service costs.
“Time-of-use tariff”	A tariff with energy charges that change during time-of-use periods and seasons.
“Utility”	The interconnected network of wires, transformers and other equipment, covering all voltage ranges and belonging to Sol Plaatje Local Municipality which supplies consumers within the Municipality jurisdiction with electricity.
“Wheeling”	The deemed transportation of electricity, over a utility’s electrical network from an SSEG to a third party electricity consumer.

4. ACRONYMS AND ABBREVIATIONS



ADMD:	After Diversity Maximum Demand
AC:	Alternating Current
AMI:	Advanced Metering Infrastructure
CB:	Circuit Breaker
COC:	Certificate of Compliance
DC:	Direct Current
DG:	Distributed Generation
DoE:	Department of Energy
ECSA:	Engineering Council of South Africa
EA:	Electrical Association
EG:	Embedded Generation
E/L:	Earth Leakage
ESD:	Electrical Services Department
FIT:	Feed-in Tariff
IPP:	Independent Power Producer
IRP:	Integrated Resource Plan
kVA:	kilo-Volt Ampere (unit of electrical apparent)
kW:	kilo-Watt (unit of electrical real power)
kWp:	kilo-Watt peak (the rated peak output of solar PV panels)
LV:	Low Voltage
MV:	Medium Voltage
MVA:	Mega-Volt Amperes (1000kVA)
NERSA:	National Energy Regulator of South Africa
NMD:	Notified Maximum Demand
PCC:	Point of Common Coupling
PUV:	Point of Utility Connection
PV:	Photovoltaic
REEEP:	Renewable Energy Efficiency Programme



REFIT:	Renewable Energy Feed-in Tariff
REIPP:	Renewable Energy Independent Power Producer
RPP:	Renewable Power Plant
SPM:	Sol Plaatje Local Municipality
SSEG:	Small Scale Embedded Generation/Generator
TOU:	Time-of-use
VAT:	Value added tax

5. PRINCIPLES APPLICABLE TO THIS POLICY

- 5.1 Consumers are not allowed to connect SSEG without the consent of either NERSA or the Municipality. Consumers 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 a disconnection. Should the consumer fail to have the SSEG disconnected from the grid, the Electrical Services department reserves the right to disconnect the electricity supply as stipulated within the Electrical By-laws.
- 5.2 Consumers who wish to connect SSEG to SPM'S grid are required to follow the application procedure as detailed in this policy. Any applications dealt with and approved prior to the adoption of this Policy will have to reapply to ensure compliance with this policy.
- 5.3 Existing legislation requires that anyone generating electricity “not for own personal use”, must obtain a generating license from the National Energy Regulator of South Africa. In the absence of such clarity, SPM will not require SSEG'S smaller than 1MVA to obtain such a license provided that, over any consecutive 12-month period, they do not feed more electricity onto SPM'S grid than they purchase from the Municipality.
- 5.4 Sol Plaatje Local Municipality will register and authorise grip connection of SSEG'S up to 1MVA without evidence of a generating license. Anyone wanting to connect 1MVA or greater must produce a generating license or exemption



letter from NERSA with their application. Failure to do so, will result in the application not being considered.

- 5.5 Consumers authorized by SPM may still be required by NERSA to obtain a generating license. Consumers are thus directly responsible to NERSA for obtaining a generating license. SPM accepts no liability should NERSA refuse a generating license and SPM thus subsequently withdraws registration and authorisation. The Municipality is primarily obligated to report to NERSA on a regular basis regarding all grid connected generation. Should NERSA refuse a generating license, the generator must be disconnected from the grid unless the consumer has received an exemption from NERSA in this regard.
- 5.6 All embedded generation systems installed within Sol Plaatje Local Municipality's grid must be signed off on commissioning by an ECSA registered professional engineer or technologist. This procedure will be applicable until such a time as SANS 10142-Part 3 (The Wiring of Premises – Embedded Generators) and 4 (The Wiring of Premises – Direct Current Photovoltaic) are published. The latter also applies until such time as the SABS mark is issued for inverters.
- 5.7 Until such a time as a SABS mark is issued for inverters, SPM will require proof in the form of test certificates, of the type of tests having been successfully performed by a third party test expert certifying compliance of the inverters with the requirements of the Municipality and NRS097-2-2.
- 5.8 The municipality is committed to equitable and sustainable provision of services achieved through the economic and effective funding of efficient services.

6. MUNICIPAL MANAGER AS RESPONSIBLE AND ACCOUNTABLE OFFICER

- 6.1 The Municipal Manager is responsible and accountable for the implementation and enforcement of the provisions of this policy and must take the necessary steps to do so.
- 6.2 The Municipal Manager shall from time to time report to the Executive Mayor on matters relating to this policy, the efficacy of the tariffs set by the Council in terms hereof, the administrative mechanisms, resources, processes and procedures



related to its implementation and the extent to which the policy is achieving the objectives of the Council.

- 6.3 All the necessary power and authority is hereby delegated to the Municipal Manager to enable him/her to fulfil his/her functions, responsibilities and obligations in terms hereof, with full authority to further delegate any specific responsibility.

7. SMALL SCALE EMBEDDED GENERATION DEFINITION

- 7.1 Small-scale embedded generation (SSEG) refers to power generation under 1MVA, such as PV systems or small wind turbines which are located on residential, commercial or industrial sites where electricity is also consumed. SSEG is in contrast to large-scale wind farms and solar parks that generate large amounts of power, typically in the multi-MegaWatt range. Most of the electricity generated by an SSEG is consumed directly at the site but times arise when generation exceeds consumption and typically a limited amount of power is allowed to flow in reverse - from the consumer onto the utility grid.
- 7.2 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 consumer’s side of the utility’s electricity meter.

8. TO WHOM THIS POLICY APPLIES

- 8.1 This Policy applies to consumers who wish to connect an SSEG, with generation capacity smaller than 1 MVA (1000 kVA), to the SPMs electricity grid. It is intended to provide guidance in this regard to:
- SSEG project developers
 - Commercial and Industrial building owners
 - Residential buildings owners
 - SSEG installers
 - Energy consultants commissioned to design SSEG systems
 - Municipal officials involved in SSEG generation
 - Professional Engineers or Technologists involved in SSEG commissioning



- 8.2 It is essential that all consumers desiring to install an SSEG and connecting to SPM's infrastructure, regardless of generation capacity, complete the relevant sections of the application process in full, and that written approval is received from the SPM before system installation commences. SPM 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 SPM as approval is not guaranteed and SPM will not be held liable for equipment expenses where approval is denied.
- 8.3 For commercial and industrial systems in particular an initial consultation with SPM to determine the full set of requirements is highly recommended prior to submission of the application form.
- 8.4 This document does not apply to those who wish to install a system with generation capacity of greater than 1 MVA (1000 kVA). For such systems a meeting should be arranged with the SPM in order to establish the necessary requirements and application process. Anyone wanting to connect 1 MVA or greater will not be able to connect under the conditions of these guidelines/policy. In addition a generating licence or exemption letter from NERSA will be required before connection is considered.
- 8.5 Consumers residing in Sol Plaatje Local Municipality, but are supplied directly by Eskom, are excluded from the application of this Policy.
- 8.6 Generators that are not connected to the electricity grid in any way, and are thus 'stand-alone' generators, do not need permission from the SPM ESD. However, approvals from other SPM departments are still necessary, such as from the Planning and Building Development Management Department. It is the responsibility of the prospective stand-alone generator installer or owner to directly obtain these necessary approvals.

9. TYPES OF SSEG SYSTEMS NOT PERMITTED

- 9.1 SSEGs which are net generators are not permitted by the SPM:



9.1.1 SSEGs can either be net consumers or net generators: Net consumers on average (over a one year period) purchase more electricity from the utility than they feed back into the utility grid.

9.1.2 Net generators on average (over a one year period) purchase less electricity from the utility than they feed back into the utility grid.

9.2 Transfer of power to a different location is not permitted:

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

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

9.2.1.2 Supplying power from an SSEG on your premises to other premises (e.g. selling power to neighbours or to other premises elsewhere within the Municipality). This is also known as wheeling.

10. OPERATION OF GENERATORS DURING GENERAL GRID POWER OUTAGES

10.1 Grid-tied inverters are generally not designed to operate in "islanded mode" where the generator supplies power to a portion of the consumer's network during a general grid power outage. Should the inverter have this facility, it must be effectively isolated from SPM's grid during operation (as is legally required of any back-up generator). SANS 10142-1:2012. Annexure 1 gives an example of what is required in this regard.

10.2 The generator may not be reconnected to SPM's grid unless properly synchronised with the SPM's grid. If the embedded generator is to be configured as a standby supply after islanding from the utility supply, the generator will have to be connected to the existing internal wiring of the property. Approval by the City's Electricity Services Department is not required. 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 (including low-voltage generating sets, photovoltaic installations, etc.) and Annexure 1, apply.



11. SSEG SYSTEM DECOMMISSIONING

- 11.1 Sol Plaatje Municipality requires notice of any SSEG system which has been decommissioned.
- 11.2 An SSEG system which has been decommissioned must be disconnected from the grid at the consumer's cost by the removal of wiring which connects the inverter/s with the grid.
- 11.3 The Decommissioning Report must be completed and submitted to the relevant ESD office.

12. CHANGE OF PROPERTY OWNERSHIP

- 12.1 When transfer of ownership of a property takes place which has SSEG installed, the new owner will be required to sign a new Supplemental Contract or alternatively the SSEG system must be decommissioned as detailed above.
- 12.2 The Certificate of Compliance which is required to be issued as a condition of transfer of ownership of the property must include a statement regarding the state of connection or disconnection.
- 12.3 At the time that the CONSUMER ceases to be on the SSEG tariff, any remaining credit balance will be refunded to the CONSUMER on written request provided that the CONSUMER has no other outstanding municipal debt.

13. EFFECTIVE DATE OF POLICY

This Policy will become effective from the date of approval by the Sol Plaatje Municipal Council.

Tariffs contemplated within this Policy will be formulated as part of the annual budget approval process and will become effective pursuant to the dates stipulated therein.



SECTION A: RESIDENTIAL SMALL-SCALE EMBEDDED GENERATORS

1. General Requirements:

1.1 Generation Size Limitations

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

Service Connection		
No. of Phases	Service Circuit Breaker Size (A)	Maximum Total Generation Capacity of SSEG (kVA)
1	40	2.3
1	60	3.5
1	80	4.6
3	40	6.9
3	60	10.4
3	80	13.9
3	100	17.3

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

To determine if you have a single-phase or three-phase connection, check the main circuit-breaker on the distribution board. A single-phase supply will generally have a single main circuit-breaker, and a three-phase a triple main circuit-breaker. If in doubt consult an electrician. Please note that the feed-in-current must not be more than 25% of the Service Circuit Breaker Size.

Generation Capacity refers to the total output capacity of the generator. For PV systems in particular, this refers to the maximum output of the inverter. Due to system losses this is typically 10 to 20% lower than the maximum output of the PV panels, which is specified in DC kilo-Watt-peak (kWp). The system designer/installer will provide guidance here.

kVA and kW ratings for SSEG's are similar in most cases and can be used interchangeably for estimation purposes.



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

Note: If SSEG generation capacity is 4.6 kVA or less, a single-phase inverter can be installed even if the consumer has a three-phase connection. However, it is the responsibility of the consumer to ensure that their load is balanced across all three phases. A qualified electrician, engineer or technologist should be consulted here.

1.2 Electricity Generation Licences

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

1.3 Metering and Tariffs

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

- 1.3.1 Consumers 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. The consumers may then, subject to the ruling policies for tariffs and metering, keep their existing meter and remain on the relevant



electricity consumption tariff. In other words, for this option the conventional credit or prepayment meter is NOT allowed to run backwards.

- 1.3.2 Residential consumers installing SSEG who wish to participate in the SSEG tariff must have a bi-directional AMI credit meter installed. The City will provide and install the requisite meters at the consumer's cost. The SSEG tariff is only available to consumers who are "net consumers" and it is specifically not available for consumers who are "net generators". In order to qualify for the Residential SSEG tariff consumers must have excess (net) generation to regularly require the facility to feed excess power back onto the municipal grid. It will be at the Electricity Services Department's discretion to decide whether consumers will be allowed on the residential SSEG tariff. Consumers may be moved off the tariff if they do not have sufficient regular excess (net) generation. They will be required at their own cost to install reverse power flow blocking protection and a prepayment meter and they will forfeit any expenditure they incurred on having bi-directional metering installed.
- 1.3.3 Consumers (whether with single or three phase supplies) wishing to participate in the SSEG tariff will have to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box or meter room already exists on the street-front property boundary.
- 1.3.4 If no kiosk exists or there is no room for the meter in an existing kiosk, a meter kiosk will be installed in the road reserve at the SPMs cost. Only in cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, will customers be required to provide metering accommodation on the street-front property boundary. Such a meter box must face outwards and be locked with a standard ESD lock.
- 1.3.5 Refund of Prepayment meter (PPM) units when a consumer changes to the SSEG tariff and has an AMI (credit) meter installed:



1.3.5.1 PPM vending unit tokens already loaded on the PPM:

1.3.5.1.1 The consumer may delay the installation of an AMI meter until the electricity units already loaded on the PPM have been used up. (If the consumer wishes to proceed with grid connected SSEG with a PPM then a reverse power flow blocking protection system must be installed)

1.3.5.1.2 Alternatively the consumer may elect to forfeit the units on the PPM and proceed directly with the installation of the AMI meter.

1.3.5.2 PPM vending unit tokens not yet loaded onto the meter:

1.3.5.2.1 The consumer may request a refund. The token will be validated to confirm that it has not been used after which the consumer will be refunded at the original tariff rate at which the token was purchased. The refund will be credited to the customer's municipal account and will not be paid out in cash.

1.3.6 Tariffs are determined annually by the SPM and are subject to approval by NERSA.

1.3.7 The applicable SSEG tariff is the *Residential small-scale embedded generation tariff* and its structure and tariffs will be determined as part of the annual budget process as well as the tariffs submitted to NERSA for approval

1.4 Load Profile Management

The SSEG tariff will be structured in such a way that consumers will find it most beneficial, from a financial and practical point of view, to ensure that the consumers utilises 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 consumers 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.

1.5 Grid Studies

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

1.6 Responsibilities of Residential Consumer

- 1.6.1 The residential consumer is responsible for all the costs involved in the supply and installation of meters. The cost of providing a meter kiosk in the road reserve will be borne by the SPM.
- 1.6.2 The consumer will be responsible for the cost of any specialist grid studies (although such studies are unlikely in the case of residential SSEG installations).
- 1.6.3 The consumer 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).
- 1.6.4 The consumer 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.



1.7 Applicable Technical Standards

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

1.7.1.1 NRS 097-2: Grid interconnection of embedded generation: Part 2 Small scale embedded generation

1.7.1.2 South African Renewable Power Plant Grid Code

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

1.7.3 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.

1.8 How to apply for Permission to Install SSEG

1.8.1 The GEN/EMB application form must be completed for all forms of embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plant. Should tariff or metering changes be required for the SSEG installation, the general application form for new or modified connections must also be completed.



SECTION B: COMMERCIAL AND INDUSTRIAL SMALL-SCALE EMBEDDED GENERATORS

1. General Requirements: Commercial & Industrial

1.1 Generation Size Limitations

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

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

MV commercial and industrial consumers planning to install SSEG systems under 1MVA may require a bespoke engineering study to determine the impact of the proposed SSEG system size on the network.

1.2 Electricity Generation Licences

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

1.3 Metering and Tariffs

Commercial and industrial consumers wanting to connect SSEG to the grid and



to be compensated for reverse power flow, require a bi-directional AMI credit meter. This includes consumers currently using prepayment meters. SPM will provide and install the necessary meters at the consumer's cost.

- 1.3.1 Consumers wanting to connect SSEG to the grid but not be compensated for reverse power flow will be required to install reverse power flow blocking protection to prevent reverse power flow onto the electricity grid. The consumers may then, subject to the ruling policies for tariffs and metering, keep their existing meter and remain on the relevant electricity consumption tariff. In other words, for this option conventional credit or prepayment meters are NOT allowed to run backwards.
- 1.3.2 Consumers (whether with single or three phase supplies) wishing to participate in the SSEG tariff will have to adapt their electrical installations in such a way that metering will be accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box or meter room already exists on the street-front property boundary.
- 1.3.3 If no kiosk exists or there is no room for the meter in an existing kiosk, a meter kiosk will be installed in the road reserve at the SPMs cost. Only in cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, will customers be required to provide metering accommodation on the street-front property boundary. Such a meter box must face outwards and be locked with a standard ESD lock.
- 1.3.4 Refund of Prepayment meter (PPM) units when a consumer changes to the SSEG tariff and has an AMI (credit) meter installed:
 - 1.3.4.1 PPM vending unit tokens already loaded on the PPM:
 - 1.3.4.1.1 The consumer may delay the installation of an AMI meter until the electricity units already loaded on the PPM have been used up. (If the consumer wishes to proceed with grid connected SSEG with a PPM then a reverse power flow blocking protection system must be installed



1.3.4.1.2 Alternatively the consumer may elect to forfeit the units on the PPM and proceed directly with the installation of the AMI meter.

1.3.4.2 PPM vending unit tokens not yet loaded onto the meter:

1.3.4.2.1 The consumer may request a refund. The token will be validated to confirm that it has not been used after which the consumer will be refunded at the original tariff rate at which the token was purchased. The refund will be credited to the customer's municipal account and will not be paid out in cash.

1.4 Load Profile Management

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

1.5 Grid Studies

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

1.6 Responsibilities of Commercial and Industrial Consumer

1.6.1 The commercial and industrial consumer is responsible for all the costs involved in the supply and installation of meters. The cost of providing a meter kiosk in the road reserve will be borne by SPM.

1.6.2 The consumer will be responsible for the cost of any specialist grid studies.



1.6.3 The consumer will be responsible for any changes required to the utility network upstream of the connection point as a result of the SSEG installation.

1.6.4 The consumer will be responsible for all the costs associated with specialist tests that need to be carried out, e.g. Inverter testing, as well as for obtaining the required certification of the design and the installation as detailed below.

1.7 Applicable Technical Standards

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

1.7.1.1 NRS 097-2: Grid interconnection of embedded generation: Part 2 Small scale embedded generation

1.7.1.2 South African Renewable Power Plant Grid Code

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

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

1.8 How to apply for Permission to Install SSEG

The GEN/EMB application form must be completed for all forms of embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval to install small-scale embedded generation plant. Should tariff or metering changes be required for the SSEG installation, the general application form for new or modified connections must also be completed.



Appendix 1: Relevant Standards and Regulations

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

List of Standards and Regulations

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

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

Guidance on their applicability and coverage is given below.

Standards of Importance

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

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

These two set the majority of regulatory requirements in order for compliance to be granted



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

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

This document serves as the standard for the interconnection of SSEG's 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 – 1 MVA (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 - 13.8 kVA

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

iii) Category A2: 13.8 kVA – 100 kVA

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

iv) Category A3: 100 kVA – 1 MVA

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

Note: *RPPs* with a *rated power* greater than 4.6 kVA 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 license 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 license 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 SSEG's 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 (consumers) 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 SSEG's the requirements for ratings below 20 MVA 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.

Sol Plaatje Local Municipality Electricity Supply By-Law

This document provides the general conditions of supply of electricity, outlines the responsibility of the consumers, 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 1 kV a.c. not exceeding 22 kV a.c. and up to and including 3 000 kW 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 10142-3 The Wiring of Premises – LV Embedded Generator Code (once published)

SANS 10142-4 The Wiring of Premises – Direct Current and Photovoltaic wiring guide (once published)

SANS 474 / NRS 057 Code of Practice for Electricity Metering

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

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

NRS 048

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

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

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



EXPLANATORY NOTES

Drastic increases in the price of electricity, elevated environmental awareness, rapidly decreasing costs of photovoltaic (PV) panels, and the high risk of national power blackouts have all resulted in electricity distributors around the country being overwhelmed with requests to allow electricity consumers to connect PV and other SSEGs to the electricity grid. Such SSEGs would be connected to the wiring on the consumer's premises which is in turn connected to, and supplied by, the SPMs electricity network grid. Such generators are hence considered to be 'embedded' in the local municipal electricity grid. One of the major advantages of such a grid connected system is obviating the need for backup batteries which stand-alone renewable energy generators usually require.

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

Consequently the SPMs Electricity Supply By-law requires that anyone wanting to connect a generator to the City's electricity grid must obtain consent from the City Electrical Engineer of the Electricity Services Department (ESD). This document/policy outlines the SPMs requirements in this regard and lays out the associated application processes.

Although the electricity distribution industry is highly regulated, SSEG's have not yet been adequately covered in national policy or legislation. In this void, using the City of Cape Town's Guidelines as a benchmark, Sol Plaatje Local Municipality aims to develop policies and practices which it believes are consistent with broader national policy. In particular, the SPM does not believe nor is it mandated to purchase electricity at a greater cost than it would have paid Eskom for the generated electricity. SPM also does not believe consumers are permitted by national legislation to sell electricity to the Municipality in excess of what they purchase from the SPM over any consecutive 12-month period.

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