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GUIDELINES FOR EMBEDDED GENERATION

Guidelines, Application and Approval process to become an embedded generator in the Stellenbosch Municipality area

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i. Guideline information

Guideline Title	Embedded Generation Guidelines in Stellenbosch Municipality

Guideline Goals	The parallel connection of any generator to the municipal electrical grid, however powered, has numerous implications for the local Municipality. It shall therefore be regulated and managed. The goals of this guideline are to: • Ensure the safety of the municipal staff, the public and the user of the EG installation. • Mitigate the impact of the physical presence of the EG installation on neighbours (e.g. visual, noise). • Mitigate the impact on the quality of the municipal electricity supply, and metering and billing issues. • Mitigate the impact on cross subsidisation of indigent customers and other municipal services. • Promote growth in the EG industry by creating a conducive environment for growth.
Intended outcome	The purpose of this document is to give each stakeholder relevant guidance regarding the municipal EG rules, regulations, tariffs and application process.
Scope	This document covers: • The connection of EG to the municipal electrical grid only • On-grid (grid tied and grid limited) and off-grid EG installations. • installations for “self-consumption” only This document does not cover: • Wheeling regulations • The connection of EG to the Eskom electrical grid. • Inverter testing regulations and procedures
Defining embedded generation	Embedded Generation (EG) refers to power generation of any capacity, which is located on residential, commercial or industrial sites where electricity is also consumed. The majority of the electricity generated by an EG should be consumed directly on site. Times shall arise when generation exceeds consumption and typically a limited amount of power is allowed to flow in reverse - from the customer onto the municipal electrical grid. An EG customer therefore generates electricity on the customer’s side of the municipal electricity meter.

ii. Glossary & Definitions

Alternating current	The flow of electrical energy that follows a sine wave and changes direction at a fixed frequency (i.e. it „alternates"). Most residential and commercial uses of electricity require alternating current.
Alternative supply	A combination of supply to an electrical installation or part of an electrical installation which is not connected to the main supply of the distributor or a supply to an electrical installation or part of an electrical installation as an alternative to the main supply of the distributor that is separated by means of an interlocked change-over switching device that shall disconnect the supply before the alternative supply is switched on in such a way that the distributor supply and the alternative supply cannot be connected to the electrical installation or part of the electrical installation at the same time.
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.
Anti-Islanding	The ability of an EG installation to instantly and automatically disconnect the generator from the municipal electrical grid whenever there is a power outage in the utility municipal electrical grid, thus preventing the export of electricity to the municipal electrical grid from the EG. This is done primarily to protect municipal electrical grid workers who may be working on the grid and who may be unaware that the grid is still being energized by the EG.
Bi-directional meter	A meter that separately measures electricity flow in both directions (import and export)
Cogeneration	The sequential or simultaneous generation of multiple forms of useful energy (usually mechanical and thermal) in a single, integrated system.
Customer	In the context of this document, customers who also generate shall be referred to as "customers", although in effect they are "customer/generators".
Distributor	A legal entity that owns or operates/distributes electricity through a distribution network.
Generating capacity	The maximum amount of electricity, measured in kilovolt Amperes (kVA), which can flow out of the generation equipment into the customer"s alternating current wiring system. This is therefore the maximum alternating current power flow which can be generated.
Grid-tied	An EG that is connected to the municipal electrical grid either directly or through a customer"s internal wiring is said to be "grid-tied". The export of energy onto the municipal electrical grid is possible when generation exceeds consumption at any point in time. EG that is connected through a reverse power flow blocking relay is also considered to be a grid-tied.
Grid-tied hybrid EG	Grid-tied EG that islands after interruption of the distributor supply or when the applicable electrical service conditions are outside stated limits or out of required tolerances and then supplies the load from the inverter, operating in the stored-energy mode via a suitably interlocked change-over switch.
Inverter	A power device that converts direct current to alternating current at a voltage and frequency which enables the generator to be connected to the municipal electrical grid.
Isolated	A section of an electrical grid wiring or equipment which is disconnected from all possible sources of electrical potential is said to be isolated
Load profile	The variation of the customers rate of electricity consumption (or demand) over time.
Low-voltage	Voltage levels up to and including 1 kV. (1kV= 1000 Volts)
Medium-voltage	Voltage levels greater than 1 kV up to and including 33 kV.
Net customer	A net customer is someone who purchases (imports) consumes more kWh of electricity than they export (sell) over any 12 month period.
ECSA registered professional	This refers to a professional engineer(Pr.Eng), professional engineering technologist(Pr.Tech.Eng), professional engineering technician(Pr.Techni.Eng) or Professional Certified Engineer(Pr.Cert.Eng) who is registered with the Engineering Council of South Africa (ECSA).
Reverse power flow	The flow of energy from the customer electricity installation onto the municipal electrical grid (i.e. export) as a result of the instantaneous generation exceeding the instantaneous consumption at the generation site in question.

Reverse power flow blocking	A device which prevents power flowing from an embedded generator back onto the municipal electrical grid.
Standby EG	EG as an alternative supply system that provides a switched alternative supply to the grid supply to supply the electrical installation and is interconnected with the electrical installation by means of a change-over switch for alternative supply and passive standby UPS systems.
Passive standby UPS utilised as standby hybrid EG	Applies to any UPS operation functioning according to the following principle: (a) The normal mode of operation consists of supplying the load from the grid as the primary power source. (b) When the grid is outside stated limits, the load is supplied from the UPS inverter, operating in stored energy mode. Such a system will only be regarded as standby provided that it is equipped with a suitably interlocked change-over switch, selectable as follows: I. Charger/rectifier mode(normal): Batteries are charged by the EG installation or if required, by the grid. The grid is the primary power source for all loads. II. Inverter mode: when the grid supply is interrupted or applicable electrical services conditions are outside stated limits or required tolerances or switched by the customer between grid and storage. The grid supply is disconnected and elected loads are supplied from the inverter, within the rating of the energy storage and/or EG(also known as grid- assisted EG.)
Conditional approval letter	A signed letter from the Municipality approving giving permission to the applicant to commence with the EG installation.
Final approval letter	A letter signed by the Director: Infrastructure Services giving permission to connect the EG installation after the installer has completed the EG installation and final inspection has been done by the municipal official(s).
Process and Information pack	Collective name given to documents to be sent to the applicant together with a conditional approval letter after application has been successful. These documents are; • Stellenbosch Municipal's guidelines for embedded generation • EG commissioning Report • Supplemental contract to install embedded generation • Stellenbosch Municipality's list of approved inverters.
Shared network	A section of the distribution grid that supplies more than one customer.
Stand-alone generator/ off-grid EG	An EG that is physically separated, electrically isolated and not interconnected with the electrical installation or the distribution network – either directly or through a customer's internal wiring. A generator that is not in any way connected to the municipal electrical grid. Export of energy onto the municipal electrical grid by the generator is therefore not possible.

iii. Abbreviations

AMI	Advanced Metering Infrastructure
ECSA	Engineering Council of South Africa
kVA	kilo-Volt Ampere (unit of electrical power, often similar in magnitude to kW)
kW	kilo-Watt (unit of electrical power)
kWp	kilo-Watt peak (the rated peak output of solar PV panels)
LV	Low voltage
MV	Medium voltage
MVA	Mega-Volt Amperes (1000 kVA)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
PV	Photovoltaic
EG	Embedded Generation/Generator
VAT	Value added tax
PPM	Prepayment meter

1. Introduction

Since early 2008 when South Africa experienced serious load shedding, because of inadequate generating capacity, the energy landscape has changed considerably.

In addition to the need for more generation capacity the global commitments to carbon mitigation accelerated the increasing interest in alternative energy. Various wind farms and solar energy plants have been built since and are feeding into the Eskom grid.

Along with this there is also high interests in Embedded Generation (EG) in South Africa and also in Stellenbosch.

This mainly focus on energy from the sun which includes hot water solar and Photo Voltaic (P.V.) panels. The National Energy Regulator of SA (NERSA) started with a process to develop standard guidelines and regulations to be used by Municipalities, however this is not fort coming and Municipalities like Cape Town developed their own guidelines and regulations.

Because of the demand experienced in Stellenbosch the Electrical Services Department drew up guidelines and regulations using the City of Cape Town document as a guide.

These guidelines are designed to assist all relevant stakeholders involved in the installation, commissioning, management and ownership of an EG system, with any generation capacity.

It is intended to provide guidance in this regard to:

* EG Project developers
* Residential and commercial property owners
* EG installers
* Energy Consultants commissioned to design EG systems
* Registered professional engineers, professional technologists, professional engineering technicians who are involved in EG design and commissioning.
* Municipal officials involved in EG

The document is broken down into three main sections (in addition to this introduction). The first section details legal requirements and rights that the Municipality has in terms of EG. Section two covers important general considerations in terms of the Municipalities EG rules and regulations that apply for all customers including residential, commercial and Industrial customers respectively. Sections three detail specific considerations for residential and commercial and industrial customers.

This document will be charged as and when required to adapt to the NERSA document when available or with new future trends and developments.

2. Indemnity, Legal Requirements & Curtailment

2.1. Illegal Connections to the Municipal Electrical Grid

Section 3(3) of Stellenbosch Municipality's Electricity Supply By-Law, PN 8497 of 28 September 2021 states that no person may generate electricity by way of a fixed installation and into a municipal network unless an agreement has been concluded with the municipality, and such agreement together with the provisions of this by-law, as well as any other legislation governing the licensing of generators, shall govern such generation of electricity.

Failure to enter into an agreement with the municipality may constitute an offence which could lead to a fine and/or imprisonment. Furthermore, the installation may also be in contravention of the Occupational Health and Safety Act, for which punitive sanctions also apply.

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

Should the customer fail to have the EG disconnected from the municipal electrical grid, the Municipal Electrical Services Department shall disconnect the electricity supply to the property.

Customers wishing to connect EG legally to the municipal electrical grid shall be required to follow the normal application procedure as detailed in these guidelines. No exemption from any of the Municipality's requirements shall be granted for "retrospective applications".

In addition, customers wishing to connect EG legally to the municipal electrical grid shall be required to ensure that illegal wiring forming part of the electrical installation is disconnected and that the installation is safe.

2.2. Generation Curtailment

In the event of operating conditions resulting in municipal electrical grid parameters not meeting statutory minimum quality-of-supply standards it may become necessary to impose peak generation limits on embedded generator installations. It is expected that these limitations would be of a temporary nature, applied only during abnormal system conditions or low load periods.

2.3. Right to Adapt Rules & Regulations

In the event of provincial or national changes in the energy landscape, relevant rules, regulations, policies, laws and standards it may become necessary to implement changes to this guideline and the rules, regulations, bylaws and policies that it references.

2.4. Right to Deny Access

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

3. General Guidelines - Embedded Generators

Although the EG rules and regulations for residential and commercial and industrial customers are different, certain sections of the Municipality's rules and regulations are overarching. This section covers important considerations in terms of the Municipality's EG rules and regulations that apply for all customers including residential, commercial and industrial customers who wish to connect an EG system of any capacity to the municipal electrical grid.

3.1. Registered Professional Sign off

Until SANS 10142-Part 3: *The Wiring of Premises – Embedded Generators* and SANS 10142-Part 4: *The Wiring of Premises – Direct Current and PV* are published all EG projects shall be signed off by a registered professional engineer and a certificate of compliance shall be issued.

3.2. Testing of Inverters

Until such time as a SABS mark is issued for inverters, the Municipality shall require proof in the form of test certificates, of type tests having been successfully carried out by a third party testing authority certifying compliance of the inverters with the requirements of the Municipality and NRS097-2-2 .

3.3. All Generators shall be Nett Customers (net consumers of electricity)

All EG installations shall consume more energy than they produce on a consecutive 12-month period. This stipulation is in response to the National Energy Regulator of South Africa (NERSA) requiring customers to consume more energy than they produce on a consecutive 12-month period.

3.4. Generating License

Existing legislation requires that anyone generating electricity "not for own use" shall obtain a generating license from the National Energy Regulator of South Africa. A 1MW EG installation feeding back onto the municipal electrical grid while continuing to purchase more energy from the municipality than it feeds back onto the grid in a consecutive 12-month period is classified as electricity generation "for own use" and does not require a generating license from the NERSA.

If a NERSA generation license is required then it is the customer's responsibility to interact with NERSA. The Municipality is obliged to report to NERSA on a regular basis regarding all municipal electrical grid connected generation and disconnect generators that are not adhering to regulations.

3.5. Eskom Grid Connection

Customers residing within the municipal boundaries, but located in Eskom's area of supply, need to apply to Eskom for consent to connect EG to the Eskom electrical grid.

3.6. Decommission of an EG System and Transfer/change of Ownership

The Municipality requires notice of any EG system which has been decommissioned. The system shall be removed at the owner's cost and a decommissioning report filed. If transfer/change of

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[1] Anyone wanting to connect 1 MW or greater shall not be able to connect under the conditions of these guidelines.

ownership takes place, a certificate of compliance is required, and a new Supplemental Contract shall be signed or alternatively the EG system shall be decommissioned.

3.7. Islanding / Anti-Islanding Installations

Grid-tied inverters are generally not designed to operate in “islanded mode” where the EG installation supplies power to a portion of the customer’s electrical grid during a general power outage. Should the inverter have this facility, it shall be effectively isolated from the municipal electrical grid during operation (as is legally required of any standby generator). Break before make switch.

If the EG installation is to be configured as a standby supply after islanding from the municipal electrical grid, the EG installation shall be connected to the existing internal wiring of the property. A registered person in terms of the Electrical Installation Regulations (2009) shall 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, Installations, etc.) apply. A fire safety and emergency shut off switch shall be installed where the EG installation is to be configured as a standby supply after islanding.

3.8. Types of EG Systems

3.8.1. Grid-tied system

As defined

(a) Grid-tied with no exports

- The customer needs to install reverse power flow blocking protection to ensure that no excess energy is exported into the municipality’s electrical network.
- No EG size limitation applicable. Customer can install a system bigger than service connection circuit breaker or NMD.
- If the EG has back-up batteries directly **connected in parallel** with the inverter with no manual change over switch, then a fireman switch must be installed.
- Fireman switch to disconnect the EG output power in case of emergency must be installed. Specification and the position of the firemen switch will be determined by the municipality’s Fire Department.
- All circuits from the distribution board fed from the grid tied EG system should be clearly labelled “Alternative supply”.
- Sign off by an ECSA registered professional is required.

(b) Grid-tied with exports

- The customer is allowed to export excess energy into the municipality’s electrical distribution network.
- No EG size limitations applicable. Customers are allowed to generate to the maximum of their service circuit breaker or NMD and what the service cable can take. Should the customer require an EG installation that exceeds the maximum service circuit breaker then the excess kW/kVA must be for customer’s own consumption.
- Fireman switch to disconnect the EG output power in case of emergency must be installed. Specification and the position of the firemen switch will be determined by the municipality’s Fire Department.
- Credit or prepaid meter must be replaced with a bi-directional meter at an expense of the customer or applicant.
- All circuits from the distribution board fed from the grid tied EG system should be clearly labelled “Alternative supply”.
- Sign off by an ECSA registered professional is required.

3.8.2. Grid-tied Hybrid system

- As defined
- No EG size limitation applicable. Customer can install a system bigger than service connection circuit breaker or NMD.
- Fireman switch to disconnect the EG output power in case of emergency must be installed.

Specification and the position of the firemen switch will be determined by the municipality's Fire Department.
- Compulsory external automatic change-over switch between network supply and the storage supply must be installed.
- All circuits from the distribution board fed from the grid-tied hybrid EG system should be clearly labelled "Alternative supply".
- Sign off by an ECSA registered professional is required.

3.8.3. Standby system

- As defined for two types
  (a) Passive standby UPS utilised as standby hybrid EG
  (b) Alternative supply
- Compulsory external automatic change-over switch between network supply and the storage supply must be installed.
- Geyser electrical heating element supplied by both solar PV and local network with an automatic switching between AC and DC is considered an alternative supply to the geyser heating element.
- All circuits from the distribution board fed from the standby system should be clearly labelled "Alternative supply".
- No Sign off by an ECSA registered professional is required.

3.8.4. Off-grid system

Standalone generators (not connected to the municipal electrical grid in any way) do not need permission from the Electrical Services Department. However, approvals from other departments are still necessary (health, building, fire). If the EG system shall never be grid-tied to an electrical installation connected to the municipal electrical grid, a registered person in terms of the Electrical Installation Regulations (2009) shall install the EG system and issue a Certificate of Compliance issued to the owner in terms of South African National Standard - The wiring of premises (SANS 10142-1 – Low-voltage installations), which confirms that the EG system is not grid-tied to the municipal electrical grid and that it only supplies an off-grid electrical installation. The Municipality shall require a copy of the Certificate of Compliance. Geyser electrical heating element supplied from a solar PV generation source directly to a separate geyser heating element is considered off-grid. There is no need for a sign-off by an ECSA registered professional

3.9. Break-before-make switch with an appropriate change-over switch interlock

Approval by the Municipality's Electrical Services Department is required if the EG installation is connected to the customer's electrical grid via a break-before-make switch with an appropriate change-over switch interlock.

3.10. Adaption of Electrical Installation

All customers wishing to participate in the EG tariff shall adapt their electrical installations in such a way that the metering is accommodated in a meter kiosk in the road reserve. This does not apply where an acceptable meter box or meter room already exists on the street-front property boundary. If there is no kiosk or there is no room for the meter in an existing kiosk, a meter kiosk shall be installed in the road reserve at the Municipality's cost. Only in cases where there are extremely narrow or no footways, thereby precluding the installation of a meter kiosk, shall customers be required to provide metering accommodation on the street-front property boundary. Such a meter box shall face outwards and be locked with a standard Electrical Services Department lock.

Refund of Prepayment meter (PPM) units when a customer changes to the EG tariff and has an AMI (credit) meter installed:

- PPM vending unit tokens already loaded on the PPM:
  - The customer may delay the installation of an AMI meter
  - Alternatively, the customer may elect to forfeit the units on the PPM.

- PPM vending unit tokens not yet loaded onto the meter
  - The customer may request a refund. The token shall be validated to confirm that it has not been used after which the customer shall be refunded at the original tariff rate at which the token was purchased. The refund shall be credited to the customer's municipal account and shall not be paid out in cash.

3.11. Load Profile Management

The EG tariff has been structured in such a way that customers shall 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.

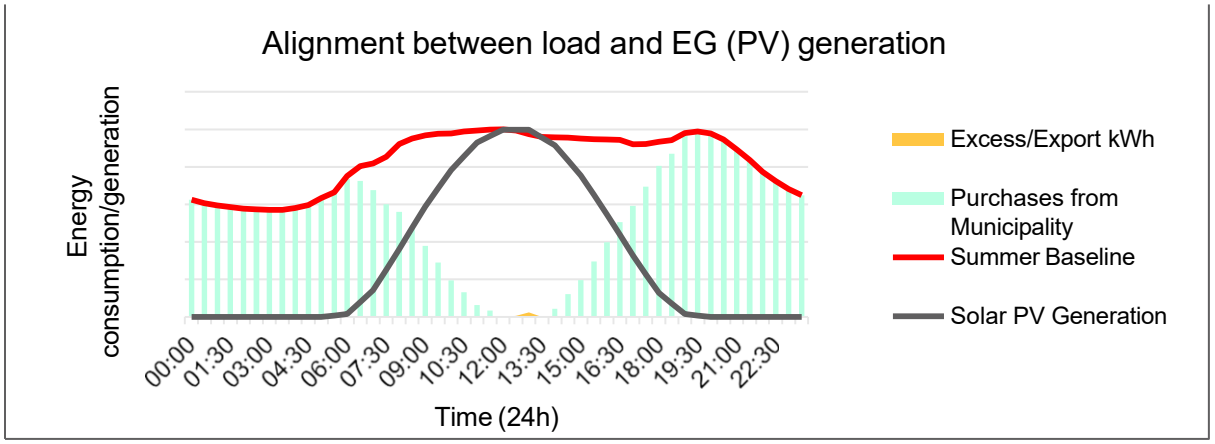


Figure 1: Load profile management - alignment between load profile and EG (PV) generation.

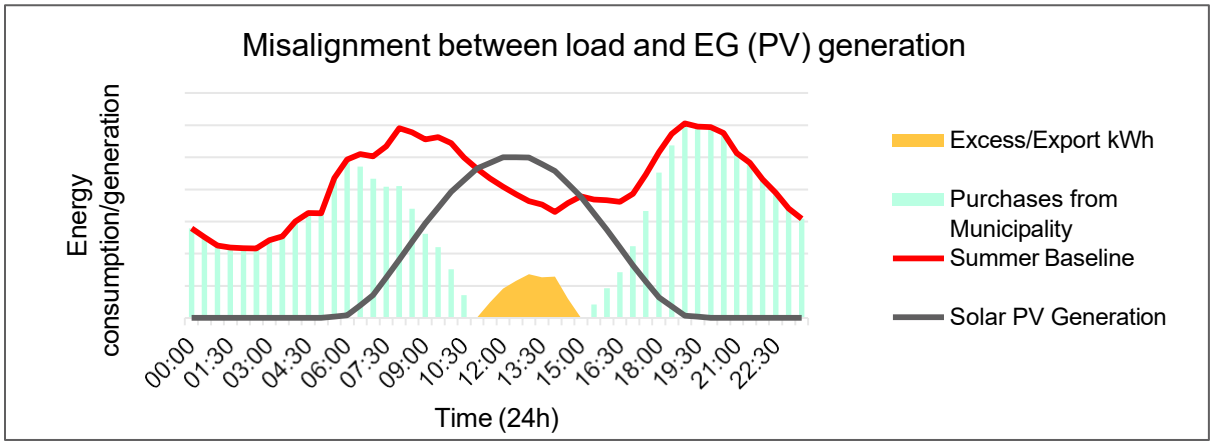


Figure 2: Load profile management - Misalignment between load profile and EG (PV) generation.

3.12. Grid Studies

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

While the NRS097 guideline stipulates that a grid impact study is required for systems exceeding 1MVA, Stellenbosch has opted to adopt a more conservative approach, setting the threshold at 350kVA and above, for which a grid impact study is mandatory. This precautionary measure ensures a comprehensive assessment of the potential impact that EG systems, based on their location and configuration, may have on the local distribution network.

3.13. Applicable Technical Standards

Most of the technical requirements for EG are covered in the following standards and guidelines (note that these do not necessarily cover all requirements for embedded generation):

1. NRS 097-2: *Grid interconnection of embedded generation: Part 2 EG*

In addition, the EG installations are to comply with the following standards, legislation, and regulations.

1. *South African Renewable Power Plant Grid Code (although the NRS 097-2 series cover most issues relevant to SSEG)*
2. *NRS 048: Electricity Supply – Quality of Supply*
3. *SANS 10142-Parts 1 to 4: The wiring of premises (as amended and published)*
4. *SANS 474/ NRS 057: Code of Practice for Electricity Metering*
5. *Stellenbosch Municipality's Electricity Supply by-law*

3.14. Approvals required from other municipal departments

3.14.1. Planning and Building Development Management

No building plans are required to be submitted provided the EG installation does not project more than 1.5 m, measured perpendicularly, above the roof and/or not more than 600mm above the highest point of the roof. If the above statement does not apply then full building plans, including an engineer's endorsement, are required. Relaxation in terms of the Zoning Scheme Regulations is also required under either one or both of the above circumstances[2].

3.14.2. Air Quality and Noise Control Approvals

The Air Quality and Mechanical Engineering (Noise) Units do not need to be consulted with EG applications where diesel fuelled mechanical engine generator are not part of the installation. Should a mechanical engine which burns fuel or generates noise be incorporated in the installation, a written approval from the Municipality's Community Services Department is required.

[2] PV systems installed on the ground - no building plans are required to be submitted provided the panel(s) in its installed position does not project more than 2.1 metres above the natural/finished ground level. Full building plans are required where any part of the installation projects more than 2.1 metres above the ground level. Other installations clearance required for other embedded generation such as wind.

3.14.3. Environmental Approvals

A residential EG installation does not require Environmental Approval unless it exceeds the electricity generation threshold mentioned in the section pertaining to *Planning and Building Development Management*[3].

3.15. Who pays for what?

The customer is responsible for paying for the following:

- The supply and installation of meters (in accordance with the municipality's requirements to install metering)
- Specialist municipal electrical grid studies (if required)
- Any changes required to the municipal electrical grid upstream of the connection point as a result of the EG installation (subject to the clause mentioned in section 3.10)
- Specialist test that are required, e.g. Inverter testing
- All costs related to the purchase and installation of the system

4. Residential Guidelines - Embedded Generators

4.1. Generation Size Limitations

NRS 097-2-3 specifies that the maximum individual generation limit in a shared LV feeder (which applies to most small commercial and residential situations) shall not exceed 25% of the customer's Notified Maximum Demand (NMD) and be up to a maximum of 20kVA. The NRS 097-2-3 also specifies that the generation limit in a dedicated LV feeder (which applies to mostly bigger commercial and industrial situations) must not exceed 75% of Notified Maximum Demand (NMD).

Stellenbosch Municipality has decided not to have EG size limitation as derived from NRS 097-2- 3 for both shared and dedicated LV connections but to rather allow customers to generate to the maximum of their service circuit breaker or NMD and what the service cable can take. Should the customer require an EG installation that exceeds the maximum service circuit breaker then the excess kW/kVA must be for customer's own consumption.

The following are Stellenbosch Municipality's EG generation capacity for LV shared connections

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

Table 1: EG generation capacity for Shared LV connections

Service connection		
No. of Phases	**Service Circuit Breaker Size (A)**	**Maximum Total Generation Capacity of EG (kVA)**
1	40	9.2
1	60	13.8
1	80	18.4
3	40	27.68
3	60	41.52
3	80	55.36
3	100	69.2

The generation capacity in Table 1 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 shall consult with the Electrical Services Department before commencing. If EG generation capacity is 4.6 kVA or less, a single-phase inverter can be installed even if the customer has a three-phase connection. However, it is the responsibility of the customer to ensure that their load is balanced across all three phases. A registered professional should be consulted.

4.2. Metering

4.2.1. Municipal electrical grid connection with reverse power flow blocking protection

Customers wanting to connect an EG system to the municipal electrical grid without being compensated for reverse power flow shall be required to install reverse power flow blocking protection to prevent reverse power flow onto the municipal electrical grid. If reverse power flow blocking protection is installed the applicant can remain on their current tariff and continue to use their current meter.

4.2.2. Municipal electrical grid connection with reverse power flow/ feed-in to the municipal electrical grid

Residential customers installing EG who wish to participate in the EG tariff shall have a bi- directional EG approved meter. The Municipality shall provide and install the requisite meters at the customer's cost. Conventional credit or prepayment meters are not allowed to run backwards. If for some reason the customer is moved off the EG tariff (either by their own doing or by municipal mandate) the customer shall be required, at their own cost, to install reverse power flow blocking protection and (if necessary) a prepayment meter. They shall also forfeit any expenditure incurred installation of the bi-directional EG approved meter. The meter stays the property of the Municipality.

4.3. Embedded Generation Tariff

In order to qualify for the EG tariff customers shall have excess generation to regularly require the facility to feed excess power back onto the municipal electrical grid. It shall be at the Electrical Services Department's discretion to decide whether customers shall be allowed on the residential EG tariff. Customers shall be moved off the tariff if they do not have sufficient regular excess generation capacity.

The applicable EG tariff is the Residential embedded generation tariff and comprises of:

- A daily service, network and meter reading charge
- Electricity consumption charges for kWh consumed
- A rate per kWh at which the Municipality shall purchase residential excess generation

4.3.1. Network cost (R/kVA – based on capacity)

It shall be ensured that the fixed costs associated with maintaining and operating the municipal electrical grid are recovered through appropriate charges. In the long term, these fixed costs may even increase due to EG as the municipal electrical grid needs to manage bi-directional flow.

4.3.2. Service charge

It shall be ensured that the fixed costs associated with providing a retail service network (metering, billing, customer call centre) are recovered through appropriate fixed charges.

4.3.3. Energy charge (c/kWh)

It shall be ensured that the variable cost associated with the volume of energy consumed is recovered through appropriate charges. This is billed on a per kWh basis and may be simple (Flat or Inclining Block Tariff) or complex (Time of Use or other).

4.3.4. Feed-in rate (c/kWh)

The EG system may avoid certain costs for a distributor and the customer should be fully compensated through an export credit rate for any measurable reduction of cost to the utility (energy cost/purchases and the network and line losses costs).

4.3.5. Billing period

The daily service charge along with charges for consumption and credits for feed-in shall be billed monthly (as is done for other Municipal services e.g. water and rates). Tariffs are determined annually by the Municipality and are subject to approval by NERSA. EG applicants should check the Stellenbosch Municipality's website for the latest tariffs.

4.3.6. Increased costs

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

5. Commercial and Industrial Guidelines – Embedded Generators

5.1. Generation Size Limitations

All LV commercial and industrial customers planning to install EG systems under 1MW do not need to comply with the size limitations as specified from NRS 097-2-3 for both shared and dedicated LV connections, but customers will be allowed to generate to the maximum of their service circuit breaker or NMD and what the service cable can take. Should the customer require an EG installation that exceeds the maximum service circuit breaker then the excess kW/kVA must be for customer's own consumption.

MV commercial and industrial customers planning to install EG systems under 1MW are allowed to generate to the maximum of their NMD and what the service cable and MV equipment can take. Should the customer require an EG installation that exceeds the NMD then the excess kW/kVA must be for customer's own consumption and such EG systems may require a bespoke engineering study to determine the impact of the proposed EG system size on the municipal electrical grid.

5.2. Metering

5.2.1. Municipal electrical grid connection with reverse power flow blocking protection

Customers wanting to connect an EG system to the municipal electrical grid without being compensated for reverse power flow shall be required to install reverse power flow blocking protection to prevent reverse power flow onto the municipal electrical grid. If reverse power flow blocking protection is installed the applicant can remain on their current tariff and continue to use their current meter.

5.2.2. Municipal electrical grid connection with reverse power flow/ feed-in to the municipal electrical grid

Residential customers installing EG who wish to participate in the EG tariff shall have a bi- directional EG approved meter. The Municipality shall provide and install the requisite meters at the customer's cost. Conventional credit or prepayment meters are not allowed to run backwards. If for some reason the customer is moved off the EG tariff (either by their own doing or by municipal mandate) the customer shall be required, at their own cost, to install reverse power flow blocking protection and (if necessary) a prepayment meter. The customer shall also forfeit any expenditure incurred installation of the bi-directional EG approved meter. The meter stays the property of the Municipality.

5.3. Embedded Generation Tariff

Customers on a tariff that does not include a daily service charge shall be changed to an appropriate tariff. Tariffs are determined annually by the Municipality and are subject to approval by NERSA. EG applicants should check the Municipality's website for the latest tariffs.

6. Installation of Power Quality Devices

All installations above 200 kVA will require installation of a power quality device by the municipality.

The installation of the device will be on the day of final inspection.

7. Residential, Commercial and Industrial Embedded Generation Application Process

The *application for the connection of embedded generation* form shall be completed for all forms of embedded electricity generation, including renewable energy and cogeneration. This form deals with applications for approval for all EG installations. Should tariff or metering changes be required for the EG installation, the general application form for new or modified connections shall also be completed. The forms are available on the Municipality's website as well as Municipal offices.

- **Step 1: Visit the Municipality website or offices**
  - Visit the Municipality's website https://stellenbosch.gov.za/download/application-for-the-connection-of-embedded-generation-stellenbosch-municipality-wc024/ and download the relevant application form/s as noted above.
  - Alternatively, the application form can be obtained at Infrastructure Services, 1st Floor, Eclessia Building, 71 Plein Street, Stellenbosch or requested via email on engineering.services@stellenbosch.gov.za

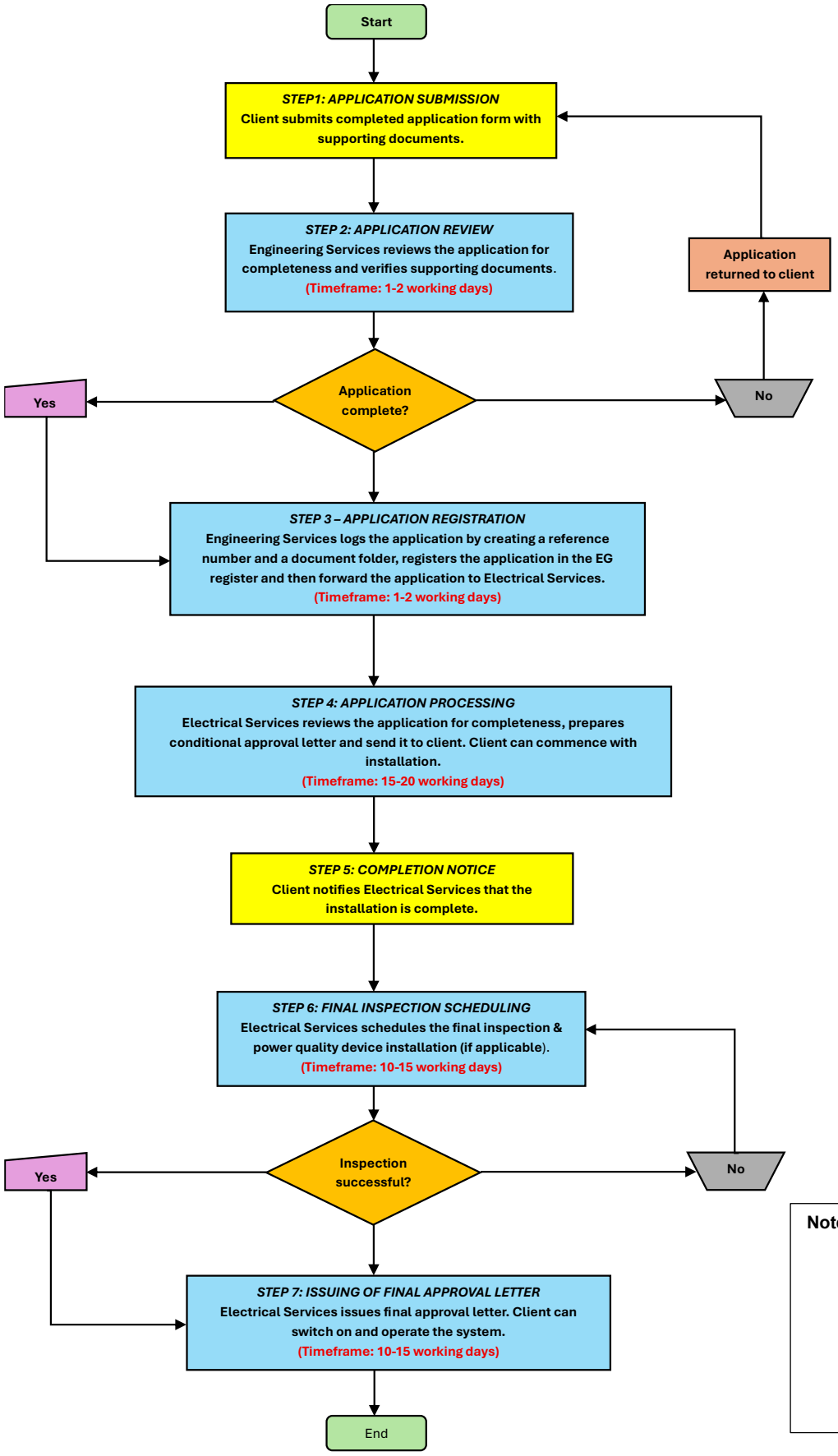
- **Step 2: Complete *application for the connection of embedded generation* form (EG form) and, if required, the general application form for new or modified connections**
  - The Municipality requires that the application form/s be signed by the property owner if not, an approved letter of proxy signed by the property owner giving permission to the applicant to complete and sign the application on his/her behalf must be attached to the application form.
  - Details of the proposed installer shall also be provided.
  - The property owner may need support from the proposed installer or a registered professional in completing the *generation and embedded generation application form*.
- **Step 3: Obtain permission from other Municipality departments**
  - The Electrical Services Department shall require prior approval of the proposed EG installation from other municipal departments such as Fire & Disaster Management.
- **Step 4: Submit completed application form/s and attachments**
  - Form/s shall be submitted via email to engineering.services@stellenbosch.gov.za or hand delivered to Infrastructure Services Directorate, Ecclesia Building, 1st Floor, 71 Plein Street, Stellenbosch.
  - The following documents must be attached to the application form:
    (a) Copy of the identity document of the property owner and that of the person completing the application on behalf of the property owner.
    (b) Proxy letter signed by the property owner or trustee, in case of a business, if the application is not completed by the property owner.
    (c) Copy of municipal rate account.
    (d) Detailed single line drawing of the EG to be installed.
- **Step 5: Installation commencement upon approval from the Municipality and signing of the Supplemental contract (where applicable) for embedded generation (Supplemental to the contract for the supply of electricity).**
  - After due consideration of the application, the applicant shall be informed in writing whether the application has been successful.
  - If the application is successful, a **conditional approval letter** and **the process and information pack** will be sent to the applicant for the applicant to commence with the installation.
  - Rejected applications may be modified and resubmitted.
- **Step 6: Commissioning and documentation to be submitted to the Electrical Services Department (a division within the Municipality).**
  - Commissioning of the system shall be undertaken by a registered professional, who shall complete and sign off the *EG Installation Commissioning Report*.
  - In addition to the Commissioning Report, the following documentation shall also be completed:
    - Final copy of circuit diagram signed by ECSA registered professional where needed.
    - Inverter Type Test - The inverter type test certification requirements are specified in the NRS 097-2-1. Type testing is to be undertaken by a 3rd party test house such as Bureau Veritas, KEMA or TÜV Rheinland. Inverter suppliers should be asked to provide the necessary certification before the equipment is purchased. A list of inverters which have been shown to comply with the municipality's requirements can be found on the municipality's website.
    - Factory setting sheet or other documentation showing that the inverter has been set according to NRS 097-2-1.
    - An electrical installation Certificate of Compliance as per SANS 10142-1.
    - A signed *Supplemental Contract for Embedded Generation*. This is a legally required contract that governs the relationship between the Municipality and the

customer. The contract is valid for as long as the project is in existence.

- Operation and Maintenance Procedure – installation responsibilities after commissioning.
- All completed documentation shall be submitted to the relevant Electrical Services office.

- **Step 7: Inspection of installation if necessary**
  - The Municipality shall do a final inspection of the installation when the installer is completed with the installation. For final inspections, the installer is to contact the officials indicated in the conditional approval letter.
- **Step 8: Approval granted to connect to the municipal electrical grid and generation commences**
  - If all of the above is satisfactory, the necessary meters will be installed at the customer's / property owner's expense.
  - Approval to connect EG (Final approval letter) to the municipal electrical grid shall be provided by the Electrical Services Department to the customer, in writing, together with any operation and decommissioning requirements deemed necessary.
  - Once this is done, the change to the tariff shall be implemented where applicable.
- **Step 9: Repeat the process in the case of EG capacity expansion**
  - Should an expansion or a change to the system be required, a new application shall be completed.

8. Application Process Flow Diagram



Notes:

1. If the application is returned after Step 2, resubmission will be treated as a new application and the standard stipulated timeframes will apply.
2. If the inspection fails, the customers must rectify the identified issues before requesting a new inspection date. The standard timeframe will apply when scheduling a new inspection date.

9. Final Inspection Requirements

9.1 Tests to be performed during final inspection

The installer should be ready to perform the following test on the day of final inspection:

1. Earth spike reading <10 Ohms
2. ELU Plug test
3. Earth/neutral bonding
4. Anti-islanding test
5. Fireman Switch test
6. General SLD overview

NOTE: The main breaker/supply will be switched off during inspection and power will be sourced exclusively from the inverter.

9.2 Signage and documentation required on final inspection day

The following signage and documents need to be in place:

1. The signage at the entrance (Alternative Supply on site)
2. The signage next to the fireman switch (Notice in case of emergency shutdown)
3. Electrical Certificate of Compliance (COC).
4. Final circuit diagram signed by the ECSA professional registered person.
5. EG commissioning report signed by professional registered engineer/technologist