DRAFT KWADUKUZA MUNICIPALITY: ALTERNATIVE AND RENEWABLE ENERGY BY-LAW, 2024

TO PROVIDE FOR ALTERNATIVE AND RENEWABLE ENERGY MANAGEMENT WITHIN THE MUNICIPALITY; AND FOR MATTERS INCIDENTAL THERETO.

PREAMBLE

WHEREAS the Municipality has competence in terms of section 156 (2) of the Constitution of the Republic of South Africa to make and administer By-laws for the effective administration of the matters which it has the right to administer;

WHEREAS the Municipality has competence in terms of Part B of Schedule 4 of the Constitution relating to electricity generation and reticulation;

WHEREAS section 156(2) of the Constitution provides that a municipality has the right to exercise any power concerning a matter reasonably necessary for, or incidental to, the effective performance of its functions;

WHEREAS the Municipality seeks to manage embedded generation units and other renewable energy generation sources erected within its area of jurisdiction to ensure that loadshedding is avoided, where it cannot be altogether avoided, is minimized and addressed through the implementation of an effective energy balance system.

AND WHEREAS *the Provision of electricity services is:*

1. *Only the Municipality may supply or contract for the supply of bulk and link electricity within its jurisdictional area.*
2. *The Municipality may permit the bulk or link supply or retail wheeling of electricity through its electrical grid by another electricity supplier which is permitted to supply electricity in terms of the Electricity Regulation Act.*
3. *The Municipality may permit the connection of an embedded generation system to its electrical grid in accordance with the requirements of this by-law and subject to:*

3.1 *Compliance with the relevant requirements of the Municipality pertaining to the generation of electricity and the safety thereof contained in any guideline or policy issued by the Municipality in respect thereof.*

4 *Registration with the Municipality of all fixed electrical installations where electricity is generated and compliance with the Municipality's safety and quality requirements contained in any guideline , by-law or policy issued by the Municipality in respect thereof.*

NOW THEREFORE the Municipal Council of the KwaDukuza Local Municipality, acting in terms of section 156 read with Schedule 4, Part B of the Constitution of the Republic of South Africa, and read with section 11 of the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000), hereby makes the following By-law:

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CHAPTER 1

INTERPRETATION AND OBJECTIVES

1. Definitions

In this By-law, unless the context indicates otherwise—

''adverse effect'' means any actual or potential impact on the environment that impairs or would impair the environment or any aspect of it to an extent that is more than trivial or insignificant;

"Anti-Islanding function" means a function in the inverter which allows for immediate disconnection when there is a general power outage.

"authorised official" means a person authorised to implement the provisions of this By-law, including but not limited to –

(a) peace officers as contemplated in section 334 of the Criminal Procedure Act, 1977 (Act No. 51 of 1977);

(b) municipal law enforcement officers, police officers as contemplated in the South African Police Service Act, 1995 (Act No. 68 of 1995); and

(c) such employees, agents, delegated nominees, representatives and service providers of the Municipality as are specifically authorised by the Municipality in this regard: Provided that for the purposes of search and seizure, where such person is not a peace officer, such person must be accompanied by a peace officer;

"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.

"Customer" In the context of this document, customers who also generate renewable energy will be referred to as "customers" although in actual fact they are "consumer/generators".

''electric vehicle'' means any motor car, motor carriage, motorcycle, bus, motor lorry or other conveyance propelled wholly or partly by renewable battery or electrical connection other than diesel or petroleum energy.

''environment'' means the surroundings within which humans exist and that are made up of—

(a) the land, water and atmosphere of the earth;

(b) micro-organisms, plant and animal life;
(c) any part or combination of (a) and (b) and the interrelationships among and between them; and
(d) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being;

"Embedded Generator" (EG) An entity that either operates one or more Unit or Units that is connected to the distribution system, or that desires to connect one or more Unit or Units to the distribution system; It includes an SSEG, MSEG and LSEG Unit which includes energy conversion device(s), static power converter(s), if applicable and the control and protection gear within customer's network that operates in synchronism with the utility's network;

"ERA" means the Electricity Regulation Act 4 of 2006 and Regulations published thereunder as amended;

"Export tariff" means a payment for every kilowatt-hour (kWh) of surplus electricity a customer system exports (feed-in) to the electricity grid.

"Import tariff" means a payment for every kilowatt-hour (kWh) of electricity imported to a customer from the electricity grid.

"LSEG" means Large Scale Embedded Generation. For the purpose of this by-law; this means an embedded generator with a generation capacity above 5000 kVA (5MW) Medium-scale embedded generation refers to power generation up to 5 MW peak output capacity for MSEG, such as PV systems or small wind turbines which are located on residential, and non-residential land uses where electricity is consumed.

"Municipality" means the KwaDukuza Local Municipality.

"Renewable energy" means energy that is derived from natural sources that can be replenished at a higher rate then its consumption and includes energy from the following non-exhaustive energy sources: solar energy, wind energy, bioenergy, hydropower, ocean energy and geothermal energy.

"Reverse power flow" means 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.

"SSEG" means Embedded Generation. For the purpose of this by-law; means an embedded generator with a generation capacity of up to 1000kVA (1MW) Embedded Generation refers to power generation up to 1MW peak output capacity for EG such as PV systems or small wind turbines which are located on residential, and non-residential land uses where electricity is consumed.

“MSEG” means Medium Scale Embedded Generation. For the purpose of this by-law; an embedded generator with a generation capacity above 1MW and up to 5000kVA (5MW). Medium-scale embedded generation refers to power generation up to 5 MW peak output capacity for MSEG, such as PV systems or small wind turbines which are located on residential, and non-residential land uses where electricity is consumed.

“Tariff” means A combination of charging parameters applied to recover measured quantities such as consumption and capacity costs as well as service costs.

“Wheeling” means Wheeling is the transportation of electric energy from generator to a consumer, through the KwaDukuza Municipality Grid infrastructure.

“Municipal council” or **“council”** means the KwaDukuza municipal council, a municipal council referred to in section 157(1) of the Constitution;

“Municipality” means the KwaDukuza Local Municipality, a category B Municipality as envisaged in terms of section 155(1) of the Constitution of South Africa and established in terms of PN343 of 2000 (KZN);

"Municipal Manager" means the official of the Municipality appointed as contemplated in section 54A of the Municipal Systems Act;

‘‘Municipal Systems Act’’ means the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000);

‘‘person’’ means a natural person or a juristic person;

‘‘premises’’ includes—

(a) any building or other structure;

(b) any adjoining land occupied or used in connection with any activities carried on in that building or structure;

(c) any vacant land;

(d) any locomotive, ship, boat or other vessel which operates in the precincts of any harbour,

within the area of the jurisdiction of the Municipality;

‘‘proclaimed township’’ means any land unit zoned and utilized for residential purposes;

''specialist study'' means any scientifically based study relating to renewable energy conducted by an expert or recognized specialist with appropriate qualifications and competency in the discipline of renewable energy management including grid impact studies.

2. Interpretation of By-law

(1) If there is a conflict of interpretation between the English version of this By-law and a translated version, the English version prevails.

(2) In the event of any conflict between this By-law and any other By-law or policy which directly or indirectly, within the jurisdiction of the Municipality, regulates renewable energy generation, then the provisions of this By-law shall prevail to the extent of the inconsistency.

3. Objects of By-law

The objects of this By-law are to –

(a) give effect to renewable energy generation within the area of the Municipality's jurisdiction;

(b) provide, in conjunction with any other applicable law, an effective legal and administrative framework within which the Municipality can manage and regulate activities that relate to renewable energy generation; and

(c) ensure that all applications for embedded generation units are dealt with in accordance with the Municipality's Renewable Energy Policy.

4. Application of By-law

(1) This By-law applies to all properties or premises within the area of jurisdiction of the Municipality.

(2) This By-law does not remove the need for any other permit, consent or authorisation in respect of any embedded generation unit that may be required under any other applicable legislation.

5. Compliance monitoring

(1) An authorised official must, for the purposes of ensuring compliance in terms of this By-law, exercise the powers of a law enforcement officer as set out in the By-law to ensure compliance with the provisions of this By-law.

CHAPTER 2

REGISTRATION AND APPLICATION PROCESS

Applications for Medium and Large-Scale Embedded Generation Units and other renewable energy projects

6. Registration

(1) Any person who has an SSEG, MSEG or LSEG unit installed at any property within the jurisdiction of the Municipality must within 6 months of the promulgation of these by-laws register their embedded generation unit with the energy office of the Municipality and submit a certificate of compliance from an accredited electrical engineer that the embedded generation unit is compliant with the relevant electrical installation regulations and the Standards for embedded generators.

(2) A person who fails to register their embedded generation unit within the prescribed period may be liable to a fine and or disconnection of their embedded generation unit.

7. Applications

(1) A person wishing to install an embedded generation unit must obtain a connection application form from the energy office of the Municipality or download it online and fill in all the relevant information including the capacity generation, intended maximum export capacity where applicable, and whether storage will be installed as part of the generation facility, and if charging will be required from the grid.

(2) The application should indicate the generator technology, rating (size) and the proposed connection point to the grid.

(3) The customer may require prior approval of the proposed embedded generation unit installation from other departments as stipulated in the form (e.g. building control department). All such approvals must be reflected in or submitted with the application form.

(4) The Municipality shall within 30 days of submission of the application evaluate such application according to the criteria set out in the NRS097-2-3 Standard and other criteria as set out in the NERSA guidelines for embedded generation units, and inform the applicant of the success or otherwise of the application within 7 days of the expiry of the 30-day evaluation period.

(5) In the event of the application not being successful, the Applicant may request a reconsideration of the application by the head of the energy office or in their absence the head of the electrical department. The head of the energy office must consider and make a decision on the re-evaluation application within 14 days of submission. In the event that the decision of the head of the energy unit does not approve the application, the Applicant may submit a formal notice of appeal to the accounting officer as prescribed in the appeal section of this by-law.

(6) All other applications for renewable energy projects must be submitted to the Municipality's energy office or online by completing the information on the form for small, medium or large installations.

(7) Applications for the installation of charging stations for electric vehicles must be submitted through the Municipality's energy office and the same time period for processing embedded generation unit applications will apply, including any requests for reconsideration of the application.

(8) Should the embedded generator system being applied for exceed the parameters in the NRS097-2-3 (Simplified Connection Criteria Standard), the customer will be required to complete grid impact studies before the application can be assessed. The Content and coverage of such a study may vary depending on the capacity availability on the network.

(9) Should such impact studies be required by the municipality, the customer should discuss the details of method, data and payment requirements with the municipality's energy office.

(10) The Municipality may stipulate a connection cost to be paid by embedded generator customers prior to system generation approval. This will be reflected in the currently applicable tariff schedule.

(11) All embedded generator installations that did not apply formerly for consideration by the municipality are deemed illegal and penalties will be in force against all property owners that have such installations in place.

8. Off-Grid Embedded Generator Systems

(1) Any stand-alone generators not connected to the municipal electrical network in anyway do not need any permission from the Municipality energy office. However, approvals from other Departments such as planning and building control may still be necessary, and it is the responsibility of the owner to comply with any such requirements.

CHAPTER 3

COMMISSIONING

9. Commissioning of Embedded Generation Units and Generation Licence

(1) No person may install and commission an embedded generation unit without first applying to the Municipality for approval to erect such a unit. No person may continue the operation of an existing embedded generation unit without registering the unit with the Municipality's energy office in accordance with sub-regulation 6(1).

(2) If a generation license is required in terms of the Electricity Regulation Act 2006 (ERA) then it is the customer's responsibility to interact with NERSA to obtain such a license. The Municipality is obliged to report to NERSA on a regular basis regarding all generators connected to the municipal electrical network and if a generator has not complied with any provision of the ERA or any NERSA conditions, the Municipality is obliged to disconnect such generators.

(3) In the event that the owner or operator of a generation unit is exempt from the obligation to obtain a generation licence, if required by the ERA or NERSA they must still register the generation facility according to NERSA requirements as published from time to time.

10. Net Consumption of Embedded Generators

(1) All Embedded Generation installations shall consume more energy than they produce over a consecutive 12-month period.

11. Use of Inverters

(1) The customer shall ensure that it uses inverters which have been certified to comply with the NRS097-2-1 standard and the NRS097-2-2 standard when it is published and to produce proof of certification of the inverter by a SANAS accredited certification body, or by the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.

(2) IP65 rated inverters and auxiliary systems are a requirement for properties 1km from the shoreline

(3) The use of inverters which do not comply with the certification requirements listed in sub-regulation (1) is not permitted, both in new and existing installations.

(4) The installation of reverse feed blocking does not exempt the customer from providing the NRS097-2-1 certification.

(5) All embedded generator installations must have an anti-islanding function as stipulated in the NRS 097-2-1 Standard. Should the inverter or embedded generation installation have the facility to both comply with the NRS 097-2-1 requirements for grid-connected systems, including anti-islanding requirements, and operate in "islanded mode" where the EG installation supplies power to a portion of the customer's electrical grid during a general power outage, the islanded system must be effectively isolated from the municipal electrical network during the islanded mode operation.

(6) If an embedded generator installation is to be configured as a standby supply after isolating from the municipal electrical network (in which case it becomes an 'alternative supply', not an embedded generator any longer) using a break-before-make changeover switch, a registered person in terms of the Electrical Installation Regulations (2009) shall issue a Certificate of Compliance to the owner if the generator is to be connected to the existing internal wiring of the property. In which case the requirements of SANS 10142-1 shall apply once published.

12. Battery or other Energy Storage

(1) Where a battery storage or another energy storage mechanism is used as part of the embedded generator's configuration and is connected in standby power supply mode, then the provisions for 'island mode' generators in Sub-paragraph 10(4) above in respect of Islanding / Anti-Islanding installations shall apply.

(2) Where battery storage is connected in such a manner that it can provide power onto the network, through a hybrid inverter, the storage/battery inverter shall be NRS097-2-1 certified, and a certificate of compliance must be provided to the municipality, or a suitable anti-islanding device shall be installed between the embedded generator and the point of supply of the municipality. This arrangement must be checked and tested upon system commissioning.

(3) IP65 rated batteries and auxiliary systems are a requirement for properties 1km from the shoreline

13. Safety Measures

(1) Any Emergency disconnection switching shall be in accordance with NRS 097-2-1 or its successor.

(2) The Dead Grid Safety Lock shall be in accordance with SANS10142-1-2 as amended from time to time once published.

14. Standards

(1) All embedded generators are to comply with the following standards:

(a) NRS 097-2-1: *Grid interconnection of embedded generation: Part 2 Embedded Generation, Section 1: Utility interface*

(b) NRS 097-2-3: *Grid interconnection of embedded generation: Part 2 Embedded Generation, Section 3: Simplified utility connection criteria for low voltage connected generators*

(2) In addition, EG installations are to comply with the following standards, legislation and regulations:

a) South African Renewable Power Plant Grid Code (although the NRS 097-2 series cover most issues relevant to EG)

b) NRS 048: Electricity Supply – Quality of Supply

c) SANS 10142-1, including SANS 10142-1-2: The wiring of premises (as amended and published)

d) SANS 474 / NRS 057 : Code of Practice for Electricity Metering

e) Municipality Electricity Supply by-law (as periodically amended)

f) The Occupational Health and Safety Act 85 of 1993 and its Regulations

15. Commissioning Sign-off

(1) Customers must use industry accredited installers under a third-party quality assurance such as PV Green Card or a SAPVIA (South African Photovoltaic Association) endorsed programme to ensure the quality and safety of PV installations.

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

(a) Up to 30kVA:

(i) Must be a PV Industry Accredited Green Card Installer sign-off or an ECSA registered Pr Engineer or Pr Tech Engineer sign-off

(b) Over 30kVA:

(ii) Must be an ECSA registered Pr Engineer or Pr Tech Engineer sign-off

16. Decommissioning of Embedded Generator

(1) The generator must within 30 days of decommissioning of any embedded generator installation notify the Municipality. The installation must, at the owners' cost, be disconnected from the municipal electrical network by the removal of the wiring that connects the embedded generator with the municipal electrical network and a decommissioning report filed with the energy office, including the provision of a Certificate of Compliance to confirm disconnection.

(2) Any materials that were used in the embedded generator installation must be disposed of in an environmentally responsible manner to avoid any adverse impacts on the environment.

CHAPTER 4

METERING

17. Metering Installation and Reverse Power Flow/Feed-in to the Municipal Electrical Network

(1) All embedded generator systems must have bi-directional meters which have been approved by the Municipality' energy office. The customer shall provide and install the requisite meters at its own cost.

(2) Until the municipality has a specific tariff in place which is approved by NERSA, reversed feed will not be allowed to the municipal network and will not be compensated.

(3) Conventional credit or pre-paid meters are not allowed to reverse feed. These type of meters will need to be replaced with meters appropriate for embedded generator systems and tariffs. Where a customer changes their pre-paid meter to the embedded generator system and tariff and has an appropriate meter installed refunds will not be given. Any electricity units that were purchased on the pre-paid meters will be forfeited.

(4) The Municipality may in writing request customers moving onto an embedded generator system and tariff to adapt their electrical installations in such a way that the metering is located in a conspicuous area within the customer's property which will be easily accessible, or at the kiosk in the road reserve.

CHAPTER 5

CONTRACTUAL AGREEMENTS

18. General Terms and Conditions for Connection into Grid

(1) All new embedded generator customers must agree to the Municipality's GENERAL TERMS AND CONDITIONS: CONTRACT FOR CONNECTION OF AN EMBEDDED GENERATOR before any generation may commence. This contract clarifies the legal responsibilities of both the customer and the Municipality and can be found on the Municipality's website.

CHAPTER 6

ELECTRICITY WHEELING

19. Wheeling into the Municipal Grid

(1) Wheeling is the financial transaction representing the transportation of third-party electrical energy (kWh) over the Municipality's distribution network which allows for the third-party supplier to sell this electrical energy to a Municipality customer or a different off-taker.

(2) Consumers are not allowed to wheel to the municipal grid without the written consent of the Municipality.

(3) If the electricity producers wheeling electricity to off-takers are connected onto the municipal electricity network, relevant studies will have to be produced by the wheelers to the municipality to assess the impact of such systems on the municipal electricity grid.

(4) Consumers who wish to undertake a wheeling contract are required to consult with the Municipality's Energy Office and to submit an application which will be assessed in consultation with NERSA.

(5) The Municipality may implement wheeling tariffs which both cover fixed and variable municipal costs in different tariff categories. These tariffs will be determined as per NERSA's final Cost of Supply Framework which will give guidance on how electricity distributors can develop Use of System charges for wheeling.

(6) The wheeling tariff will be implemented only once NERSA has approved such a tariff.

(7) The maximum capacity allocated to wheeling on the Municipal network will be determined in consultation with NERSA and Eskom.

20. Resale of Electricity

(1) Unless authorised by the ….., no person may sell or supply electricity supplied to his or her premises or generated by him or her under an agreement with the Municipality, to any other person or persons for use on any other premises or permit or allow such resale or supply to take place.

(2) If electricity is resold for use on the same premises, the provisions of the Electricity Regulation Act, No 4 of 2006 shall apply, as specified in Schedule 2 to the Electricity Regulation Act, No 4 of 2006.

(3) If electricity is resold for use upon the same premises, the electricity resold shall be measured by a submeter of a type which has been approved by the South African Bureau of Standards and supplied, installed and programmed in accordance with the standards of the Service Provider.

(4) The tariff, rates and charges at which and the conditions of sale under which electricity is thus resold shall not be less favourable to the purchaser than those that would have been payable and applicable had the purchaser been supplied directly with electricity by the Service Provider.

(5) Every reseller shall furnish the purchaser with monthly accounts that are at least as detailed as the relevant billing information details provided by the Service Provider to its electricity consumers.

CHAPTER 7

INDEPENDENT POWER PRODUCERS

21. Power Generation by Independent Power Producers

(1) Independent Power Producers are similar to embedded generators but are entities with the sole objective to generate power on a commercial basis and differ from embedded generators in that they feed-into the network more power than what they consume.

(2) Independent Power Producers are not allowed to connect any generation to the municipal grid without the written consent of the Municipality and in consultation with NERSA.

(3) Independent Power Producers are not allowed to build and operate a generation facility within the Municipality's boundaries until such time that the Municipality's holistic energy masterplan is concluded and adopted by council.

(4) The Municipality must assess and facilitate the integration of Independent Power Producers onto its electricity distribution network once Municipality's holistic energy masterplan is concluded and adopted by council. Due to the magnitude of these systems, advanced Grid Impact and Power Quality Apportionment studies will be a requirement. The process and the relevant studies to be conducted will be made available to the public after the completion of the holistic energy masterplan.

(5) The Municipality must consider safer methods to connect Independent Power Producers to the electricity network and provide energy in a safe and acceptable manner pending the conclusion of any required studies.

CHAPTER 8

OFFENCES AND PENALITIES

22. Offences and Penalties

(1) A person commits an offence if he or she–

(a) contravenes any provision of this By-law;

(b) contravenes any conditions, restrictions or prohibitions imposed in terms of this By-law;

(c) fails to comply with the terms of any notice given or signage displayed in terms of this By-law;

(d) obstructs, hinders, or in any manner interferes with an authorised official who is acting or entitled to act in terms of this By-law; or

(e) furnishes false information to an authorised official in respect of any issue pertaining to this By-law;

(f) fails to obey any lawful instruction or direction given to him or her in terms of this By-law.

(2) Any person who is convicted of an offence under this By-law shall be liable to a fine of an amount not exceeding R300 000.00 or to a period of imprisonment, or to both such fine and imprisonment.

(3) In the case of a continuing offence, an additional fine of an amount not exceeding R100 000.00 or imprisonment for a period not exceeding 10 days, for each day on which such offence continues or both such fine and imprisonment, will be imposed.

(4) In addition to imposing a fine or imprisonment, a court may order any person convicted of an offence under this By-law to

(a) remedy the harm caused; and
(b) pay damages for harm caused to another person or to property, which order shall have the force and effect of a civil judgment;

(5) In addition to any other penalty the court may impose, it may order a person convicted of an offence under this By-law to take such steps the court considers necessary within a period determined by the court in order to prevent a recurrence of the contravention.

CHAPTER 9

SOLAR GLARE

23. Solar PV Glare and air-traffic safety

(1) Should the installation of a Solar PV linked EG be required and is in a designated flight path for approach, landing and take-off for air traffic, the applicant is required to get authority from ACSA to install solar PV in those designated areas.

CHAPTER 10

SOLAR PV DISCARDING

24. Solar PV discarding

(1) Solar PV panels may contain heavy metals, all discarding of solar PV's must be done in a manner which is environmentally safe for all

CHAPTER 11

GENERAL MATTERS

25. Exemptions

(1) Any person may, in writing, apply to the Municipality for exemption from the application of a provision of this By-law.

(2) An application in terms of subsection (1) must be accompanied by substantive reasons.

(3) The Municipality may require an applicant applying for exemption to take appropriate steps to bring the application to the attention of relevant interested and affected persons and the public.

(4) The steps contemplated in subsection (3) must include the publication of a notice in at least two newspapers, one circulating provincially and one circulating within the jurisdiction of the Municipality—

(a) giving reasons for the application; and

(b) containing such other particulars concerning the application as the Municipality may require.

(5) The Municipality may—

(a) impose conditions it deems necessary when granting an application for exemption;

(b) from time to time review any exemption granted in terms of this section, and may impose such conditions as it may determine; and

(c) on good grounds withdraw any exemption.

(6) The Municipality may not grant an exemption under subsection (1) until it has—

(a) taken reasonable measures to ensure that all persons whose rights may be significantly or detrimentally affected by the granting of the exemption, including adjacent landowners or occupiers, are aware of the application for exemption and how to obtain a copy of it;

(b) provided interested and affected persons with a reasonable opportunity to object to the application; and

(c) have duly considered and taken into account any objections raised.

~~**26. Appeals**~~

~~(1) A person whose rights are affected by a decision taken by the Municipality in terms of this by-law may appeal against that decision in terms of the Appeals provision contained in the Local Government: Municipal Systems~~

~~Act, 2000 (Act No. 32 of 2000) by giving written notice of the appeal and reasons to the municipal manager within 21 days of the date of the notification of the decision.~~

~~(2) The municipal managers delegate must promptly submit the appeal to the appropriate appeal authority.~~

~~(3) The appeal authority must commence with an appeal within six weeks and decide the appeal within 14 days of the hearing.~~

~~(4) The appeal authority must confirm, vary or revoke the decision made by the Energy Office, but no such variation or revocation of a decision may detract from any rights which may have accrued as a result of the decision.~~

~~(5) The appeal authority must furnish written reasons for its decision on all appeal matters.~~

~~(6) All appeals lodged are done so in terms of the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000) and not in terms of this By-law.~~

~~(7) Where a conviction has been affirmed by a court of law and the accused wishes to appeal such conviction, the appeal must take place in terms of the court's appeal process and not in terms of subsections (1) to (7).~~

27. Change in property ownership or tenure

The change in ownership and tenure for any property which may be land or improved land is subject to

28. Indemnity

(1) The Municipality and its employees are not liable for any loss or harm suffered by any person, or any damage caused to any property or premises, as a result of the Municipality acting in terms of this By-law: Provided that the Municipality and its employees must, when exercising such function or performing such duty, take reasonable steps to prevent any harm, loss or damage from occurring.

29. Short title and Commencement

(1) This By-law is called the KwaDukuza Municipality: Alternative and Renewable Energy By-law, 2024 and takes effect from the date of publication thereof in the *Provincial Gazette* or on such earlier date as may be determined by the publication of a commencement notice in the *Provincial Gazette*

CIRCULAR TO SOLAR PV INDUSTRY AND CUSTOMERS OF KWADUKUZA MUNICIPALITY CONCERNING THE INSTALLATION OF SOLAR PV OR OTHER EMBEDDED (GRID-CONNECTED) GENERATION

In keeping with national move to promote embedded generation, the Municipality of KwaDukuza Municipality is aligning their policies and by-laws for Embedded Generation (EG).

What is an Embedded Generator?

An Embedded Generator is a generator connected to the distribution network, either directly, of behind the customer's meter. If such a connection is on the customer's side of the meter, it is still 'Embedded' as it is linked to the distribution network. A solar PV system connected to the customer's distribution board via an inverter is a common example. EG refers mostly to solar PV generation, although it also includes other forms of generation (e.g. wind, diesel).

How to install an EG which the municipality may accept

While municipal policies and by-laws are being finalised, customers wishing to install EG are to comply with the SALGA and AMEU endorsed approach, which is laid out in the document ***Requirements for Embedded Generation: Conditions and application process to become an embedded generator in the Municipality of KwaDukuza.*** The relevant Application Form is to be completed and submitted to the Energy Office before commencing installation. This enables the municipality to check that the system safety and power quality characteristics are adequate, amongst other checks. Upon receiving written approval from the municipality, installation followed by Commissioning may take place. More information is provided in the abovementioned "Requirements" document, including regarding the installation of a bi-directional meter.

Consequences of non-compliance

Where EG systems do not comply as per requirements, these customers will be disconnected in due course, as the municipality cannot allow such systems on their network for safety and other reasons.

Where to obtain the necessary documents and forms

The ***Requirements for Embedded Generation*** document as well as all other information and ***Application Forms*** and ***Commissioning Report*** are available from the municipality:

Any queries may be directed to:

Mr. Chimene Pereira
Director: Special Projects – Energy Office
KwaDukuza Municipality
14 Chief Albert Luthuli Street
KwaDukuza
4450
KwaZulu-Natal
South Africa

Telephone: +27 (32) 437 5297 or **Email:** chimenep@kwadukuza.gov.za

Your sincerely,

_____

KwaDukuza Municipality

PUBLIC NOTICE

Application and Registration of Embedded Generators

The KwaDukuza Municipality supports Embedded Generation and would like to thank you for contributing to the growth of green energy by installing a Photovoltaic (PV) system.

All EG systems must be registered and authorised by the Municipality as per the Alternative and Renewable Energy by-law[1]. This includes the following system types:

- Grid-tied with feed in (including hybrid):
  - Excess electricity generated by the PV system is fed back onto the grid.
- Grid-tied with reverse power flow blocking:
  - The output is connected to the household wiring which is simultaneously connected to the municipal grid through the meter. Excess electricity generated by the PV system is blocked from feeding back into the grid.
- Grid-tied inverters which can operate in "islanded mode":
  - Used during general power outages.
  - Must meet SANS 10142-1 requirements

Emergency equipment such as standby generators do not need to be registered.

Grace period for registration

Customers may not be aware of the requirement to apply, register and obtain authorisation for their EG. The Municipality is allowing a grace period for existing systems to be registered and authorised. In order to benefit from this grace period, property owners must apply for authorisation of their EG systems with the Municipality by….. After the grace period, the Municipality will be implementing a R……. service fee for the disconnection of unauthorised EG connections which will be included as part of the monthly bill. The supply of electricity to the property in question may be disconnected and only reconnected once the Municipality is satisfied that the EG system is either disconnected, decommissioned or authorised and that the service fee has been paid.

Customers registering their system during the grace period may continue to operate the system[2]. This is based on the assumption that the system is compliant with the municipal requirements. If during the registration and authorisation process, your system is found to be non-compliant, your system will need to be disconnected until such time as it is deemed compliant and has received written authorisation from the Municipality.

Systems that have registered for authorisation during the grace period have until (date – 6 months after expiry of registration grace period) to receive written authorisation from the Municipality. If these systems are not authorised by this time, they may be liable for the service fee for the removal of unauthorised EG supply.

The Municipality is legally required to ensure that the electricity distributed to all its consumers complies with set quality standards and that its employees are protected from inadvertent electrical shocks when working on the grid and that costs associated with maintaining the grid infrastructure maintenance are recovered from its consumers.

The Municipality has accordingly developed technical specifications for grid-connected generation equipment and associated metering configurations and tariffs. National wiring codes (ensuring public safety) have also been

[1] Under the municipal Electricity Supply By-Law (as promulgated), no generation equipment may be connected to the grid without the written consent of the Electricity Department.

[2] As per the Electricity Installation Regulations of the Occupational Health and Safety Act (clause 2), the property owner carries the responsibility for the safety of the electrical installation on the property. This includes everything related to the EG installation on the property.

established. To enable the Municipality to ensure compliance with the abovementioned requirements, all grid-tied electricity generators in the area supplied directly by the Municipality must be authorised in writing.

Connecting generators to the grid without obtaining the necessary authorisation can result in systems endangering the municipal staff and members of the public, interfere with the quality of supply and result in the Municipality not fully recovering costs that are due from the consumer. Unauthorised generators which are grid-tied are therefore considered to be a form of tampering and will be dealt with accordingly.

The Municipality looks forward to working with you to ensure that your PV system is safe and legal.

The application form to start the EG registration process, and documentation clarifying the requirements for EG, are available from www.kwadukuza.gov.za or from the Energy Office at energy.office@kwadukuza.gov.za. Convenient online applications process is also available at: www.apply.sseg.org.za.

Yours sincerely,

NJ Mdakane

Municipal Manager, KwaDukuza Municipality

EG APPLICATION CONTROL DOCUMENT

This Control Document is to be attached to each EG application.

Application from (name):		**Date:**
Check	☑	**Comments/Notes**
GENERAL CHECKS		
RECEIVE APPLICATION FORM		
1. All information completed?		
2. Other Departmental permissions obtained? (as necessary)		
3. Installer accreditation? (if required)		
4. NERSA registration needed?		
5. Attachments supplied:		
5.1. NRS097-2-1 Test Certificate?		
5.2. Preliminary circuit diagram (if >100kVA)		
Notes/comments		**Initial**
EVALUATION OF APPLICATION AS PER NRS097-2-1 and NRS097-2-3 (Note: consult these standards where necessary or for queries)		
1. Basic compliance with NRS097-2-1:		
1.1. Earthing arrangements adequate?		
1.2. Test Certificate according to NRS097-2-1 adequate, from accredited test house? **OR** 1.3. On approved inverter list? **OR** 1.4. Other adequate protection information provided?		
1.5. If **storage** connected in parallel to EG via separate storage inverter: separate inverter NRS097-2-1 certification?		
Notes/comments		**Initial**
2. Basic compliance with NRS097-2-3 (if not compliant, specialist grid impact studies may be required):		
2.1. System is linked to LV network (not MV or HV)		
2.2. LV fault level at customer point of supply greater than 210A? *(fault current checks only relevant for synchronous or asynchronous generators >13.8kVA. Fault current issues are not anticipated for inverter-based generators)*		
Notes/comments		**Initial**

If on **a shared LV feeder**:

2.2.1. EG kVA <= NMD / circuit breaker capacity (see relevant table in NRS097-2-3)		
2.2.3. EG max export kVA <= 25% of NMD / circuit breaker capacity (see relevant table in NRS097-2-3)		
2.2.4. EG storage: Max charging current <= 25% of NMD / circuit breaker capacity (see relevant table in NRS097-2-3)		
2.2.5. If max export>4.6kVA, is it balanced acro phases?		
Notes/comments		**Initial**
If on a **dedicated LV feeder**		
2.2.6. EG kVA <= NMD (see relevant table in NRS097-2-3)		
2.2.7. EG max export kVA <= 75% of NMD (see relevant table in NRS097-2-3)		
2.2.8. EG storage: Max charging current <= 25% of NMD (see relevant table in NRS097-2-3)		
2.2.9. Feeder cable limits voltage rise to 1% (see graphs and tables in Annex to estimate)		
2.2.10. If max export >4.6kVA, is it balanced acro phases? (if connection only single phase, can connect 100% of NMD – see NR097-2-3 section 4.3.5)		
Notes/comments		**Initial**
NETWORK CHECKS		
NETWORK CAPACITY CHECK		
3. **Shared feeder ONLY**: Total of all EG max exports on all shared feeders <25% of MV/LV transformer rating?		
4. Total EG max export on ALL LV feeders (shared and dedicated) <75% of MV/LV transformer rating?		
5. Total EG max export on MV feeder <15% of MV feeder peak load? (under all transformers supplied by the MV feeder)		
Notes/comments		**Initial**
6. If above checks OK, notify customer to proceed		
7. If above checks **not OK**, either:		
7.1. Request further information from customer, **OR** 7.2. Advise customer on EG system that would be acceptable (e.g. smaller system), **OR** 7.3. Inform customer that grid impact study required (and request meeting to discuss requirements)		
Notes/comments		**Initial**
NETWORK PLANNING CHECK		
8. Grid impact study indicate that generator installation can proceed?		
Notes/comments		**Initial**

9. Customer notified accordingly		
Notes/comments		**Initial**
If installation to proceed, install METER, update records:		
METERING		
10. Request meter payment		
Notes/comments		**Initial**
11. Install bi-directional meter (**once payment received**)		
Notes/comments		**Initial**
RECORD KEEPING		
12. Capture EG on database		
Notes/comments		**Initial**

Installation takes place. Customer submits completed Commissioning Form			
COMMIIONING			
Commissioning form assessment:			
13. All required information completed?			
14. kVA and key component make and model same as Application Form?			
15. Lo of mains test performed?			
16. Safety labels checked in accordance with NRS097-2-1			
17. Controls/settings to limit maximum export capacity adequate?			
18. Controls/settings to limit maximum storage charging current adequate?			
19. Signoff adequate?			
20. Attachments all present:			
20.1. Final circuit diagram			
20.2. NRS097-2-1 Test Certificate (if required)			
20.3. Storage inverter NRS097-2-1 Test Certificate (if installed)			
20.4. Electrical CoC and number		Number:	
Notes/comments			**Initial**
If all OK: Activate TARIFF, Notify Customer, Update Records			
RECORD KEEPING			
21. Update generator info on database			
Notes/comments			**Initial**
TARIFFS/BILLING			
22. Activate EG tariff for customer			
Notes/comments			**Initial**
FINALISATION			
23. Check that meter installed			
24. Check that EG tariff activated			
25. Inform customer that generation may proceed			
26. Close off process, archive			
Notes/comments			**Initial**
End			

Annex: Cable voltage rise estimation

The below graphs and tables can be used to estimate voltage rise in cables as a function of generator size, cable types and lengths. The 'Gen (kW)' shows the maximum generator size that can be connected while still limiting voltage rise to 1% (Source: 2014 version of NRS097-2-3).

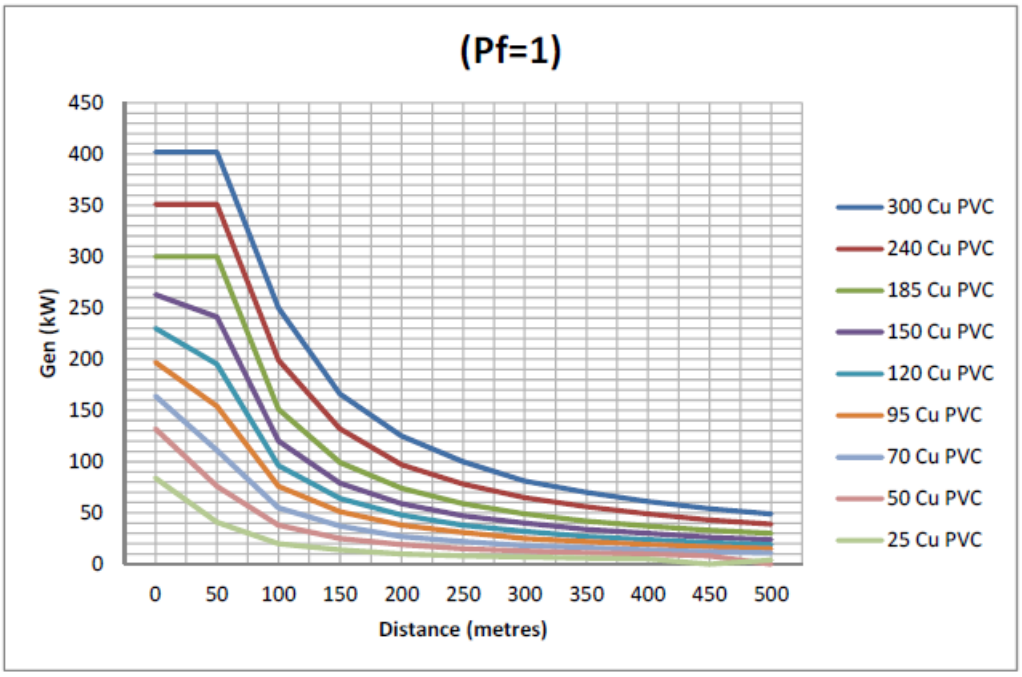

Figure 3 — Dedicated LV feeder maximum generator sizes as a function of PVC copper cable size and distance

Table 2 — Look-up values for a dedicated LV feeder maximum generator sizes (kVA) as a function of PVC copper cable size and distance

1	2	3	4	5	6	7	8	9	10
	Size mm^2								
	300 Cu PVC	240 Cu PVC	185 Cu PVC	150 Cu PVC	120 Cu PVC	95 Cu PVC	70 Cu PVC	50 Cu PVC	25 Cu PVC
Distance m	Generator sizes kVA								
0	402	351	300	263	230	197	164	132	84
50	402	351	300	241	195	154	111	76	41
100	250	199	151	120	96	76	55	38	20
150	166	132	99	79	64	51	37	25	14
200	125	97	74	59	48	38	27	19	10
250	100	78	59	47	38	31	22	15	8
300	81	65	49	40	32	25	18	13	7
350	70	56	42	34	27	22	16	11	6
400	61	49	37	30	24	19	14	10	5
450	54	43	33	26	21	17	12	8	4,5
500	49	39	30	24	19	15	11	7,5	4

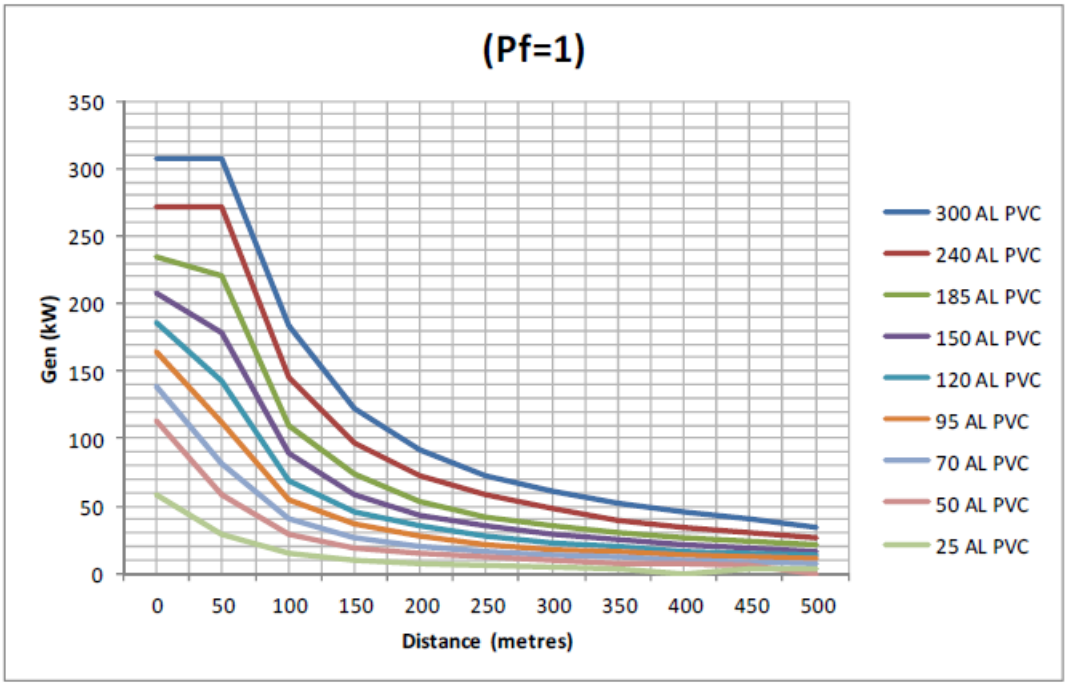

Figure 4 — Dedicated LV feeder maximum generator sizes as a function of aluminium PVC cable size and distance

Table 3 — Look-up values for a dedicated LV feeder maximum generator sizes (kVA) as a function of aluminium (AL) PVC cable size and distance

1	2	3	4	5	6	7	8	9	10
	Sizes mm^2								
	300 AL	240 AL	185 AL	150 AL	120 AL	95 AL	70 AL	50 AL	25 AL
Distance m	Generator sizes kVA								
0	307	271	234	208	186	164	139	113	59
50	307	271	221	179	143	112	81	58	29
100	184	145	110	89	69	55	41	29	15
150	122	97	74	58	46	37	27	19	10
200	92	73	53	43	35	28	20	15	7
250	73	58	42	35	28	22	16	12	6
300	61	48	35	29	23	18	14	10	5
350	52	39	30	25	20	16	12	8	4
400	46	34	26	22	17	14	10	7	3,5
450	41	30	24	19	15	12	9	6	3
500	34	27	21	17	14	11	8	5,5	3

APPLICATION FOR THE CONNECTION OF EMBEDDED GENERATION LESS THAN 1MW

GENERAL INFORMATION

NB: Online application is also available at: www.apply.sseg.org.za.

This application form is for the connection embedded generation to the electricity network of KwaDukuza Municipality. The *Requirements for Embedded Generation* document of the municipality provides important background regarding the municipality's conditions for generators.

This is application form is for:	This application form is NOT for:
• All generator power sources (solar, wind, hydro, diesel etc) • Embedded generators up to 1MVA • Generators with self-consumption • All customer categories (residential, commercial etc)	• Generators >1MVA • 'Pure' generators / IPPs (no self-consumption) • Generators wanting to wheel power • Generators in Eskom network areas • Off-grid generators

Applications that fall within the 'Simplified Connection Criteria' as specified in the NRS097-2-3 are likely to be approved by the municipality. Applicants should familiarise themselves with these criteria to avoid delays (refer to the municipality's 'Requirements' document). Systems that exceed these criteria may require grid impact studies before their approval is considered. The municipality will advise if such studies are required after this application form is submitted. For systems not covered by this form, engage with the Municipality separately for more information. In addition, some systems may need to be registered with NERSA (refer to the Requirements document).

It is recommended that this form is filled in by personnel familiar with the technical details of the intended generation technology. 'Competent person' sign-off of the Commissioning Report is mandatory, but such sign-off is not required at the Application stage.

If the applicant does not yet have an electricity connection, an application for a new connection will need to be submitted together with this application form.

PLEASE NOTE: FAILURE TO PROVIDE ALL RELEVANT INFORMATION AS REQUIRED BELOW MAY LEAD TO DELAYS IN THE APPLICATION PROCESS

Project Name:						
Nominal AC capacity of generator (kVA):						
System type:	Solar PV:		Other generator (specify):			
If solar PV (tick):	Rooftop		Ground mounted		Building integrated	

SECTION A: APPLICANT, PROPERTY AND INSTALLER INFORMATION

Property ERF No:	
Physical address:	Postal code:

Site GPS coordinates	Latitude (dd mm ss)	S ° ‘ ‘’
	Longitude (dd mm ss)	E ° ‘ ‘’

Account Holder/Customer Details*

Name: Electricity Account No:		
Meter No: Telephone Number: Email Address:	Landline:	Mobile:

** - if the applicant does not yet have an electricity connection, this should be stated above and an application for a new connection will need to be submitted together with this application form.*

Installer Details

Company Name: Dept of Labour and Employment registration no:[1] List any professional memberships, certifications:		Reg Number:
Physical address:	Postal code:	
Postal address:	Postal code:	
Website:		

Contact Person: Telephone Number:	Landline:		Mobile:
Email Address:			

Construction Schedule*

Anticipated Construction Start Date:		Anticipated Commissioning Date:	

- *- if system already installed (i.e. a retrospective application) – state 'existing system' under start date*

Existing Connection

Existing main switch:	Current (A):		Phases (tick):	Single		Three		
NMD (kVA) (non-residential):								
Customer supply voltage (tick):	LV (230 or 400V):		MV:		Other:			

SECTION B: Embedded Generator Technical Information

Embedded Generator (EG) System Details

Total AC capacity of EG (kVA and PF) (inverter capacity if solar PV): Type of energy conversion[4]: Manufacturer (if PV, fill in for inverter): Model (if PV, fill in for inverter):	kVA[2]: PF[3]:		If solar PV: Total PV panel (nameplate) capacity (kWp): Quantity:	
Number of Phases[5] (tick):	Single Phase		Three Phase	

[1] Note that installations need to be done or supervised by registered persons

[2] *Note that if storage is included in the EG configuration and is set up in such a way that it can contribute additional export onto the grid, such output must be included in this figure.*

[3] *This will mainly apply to systems that make use of rotating machines and/or transformer type power converters e.g. wind power, hydro, battery connected inverters or diesel generators. For transformer-less static power converters (e.g. inverters with a solar PV system), the power factor is generally unity and the kW of the system will be the same as the kVA.*

[4] *e.g. synchronous generator, induction generator, static inverter, fuel-cell, dyno set. Will typically be an inverter for residential EGs.*

[5] *see NRS097-2-3 for phase balancing requirements*

Voltage of generator connection into customer's network:	
Earthing arrangements e.g. TN-C-S:	
Grid Connection mode (tick appropriate):	Energy from generator to be used solely within the consumers electricity network and **no excess power to be exported** to Municipal electricity network at any time (i.e. reverse power blocking to be installed) Energy from generator to be used within consumers electricity network and excess power to be exported to Municipal electricity network Other (specify)
Export power (if exporting): Maximum export capacity (kVA):	
Method of control of max export power (e.g. hardware, software settings etc):	

Embedded Generator (EG) Protection Details

EITHER: NRS097-2-1 certification must be produced (inverters **must** have such certification)	
NRS097-2-1 test certificate is attached to this application (tick) :	
OR: fill in the below -	
Method of synchronising (auto/manual, make and type of relay, etc.)	
Method of anti-islanding (details of scheme, relays used, etc.)	
Method of generator control (AVR, speed, power, PF, excitation system requirements etc. relays to be used)	
Other main protection to be applied (O/C, E/F, over/under voltage, over/under frequency, reverse power flow, back-up impedance, generator transformer back-up earth fault, HV breaker fail, HV breaker pole disagreement, etc.)	

Storage (e.g battery)

Does the EG include storage capabilities? (tick appropriate):	✓

No storage	
Yes *(but only as standby power – cannot operate in parallel and feed onto the grid)*	
Yes *(connected in parallel to EG – can feed onto the grid)*	
Storage capacity (kWh):	Maximum AC charging current (Amps)[6]:
Method of control of max charging current (e.g. hardware, software settings etc):	
If connected in parallel via separate storage inverter - Specify anti-islanding arrangements (e.g. NRS097-2-1 certificate)[7]:	

Preliminary design details (for systems >100kVA only):

Attach a preliminary circuit diagram and design showing major components, proposed point of common coupling, isolating and interfacing devices with the municipal electrical network, protection schemes, customer electrical installation, earthing arrangements, etc.

Estimated Consumption and Generation Levels

Current electricity consumption/month (average kWh/mth)	
Estimated average output of generator/month (average kWh/mth)	

SECTION C: Regulatory Requirements and Standards

List of regulatory approvals, requirements and references that the installation will comply with:
(note that the latest version of all of the below standards are applicable) ✓

NRS 097-2 : Grid interconnection of embedded generation: Part 2: Embedded generation (NRS097-2-1 and NRS097-2-3)	
SANS 10142-1 and SANS 10142-1-2: The wiring of premises (as amended and published)	

NERSA registration/license

Does the system need to be **registered** with NERSA? (tick)	Yes		No	
Does the system require a **license** from NERSA? (tick)	Yes		No	

6 Per phase - Measured on the AC terminals of the power conversion equipment
7 See 'Requirements' document for anti-islanding requirements regarding storage

Clearance by other Municipal departments (only if needed – see 'Requirements' document)

Section	Comments	Name	Signature	Date
Buildings/Planning department				
Environment (noise pollution)				
Health (air pollution – burning fuels)				

Notes:

1. *Electricity department will require **prior** approval from this department if necessary (see 'Requirements' document to determine if necessary). Applications to connect to the municipal electrical grid will not be considered until necessary approval has been obtained.*
2. *Photovoltaic (PV) EG applications require approval from Planning and Building Development Management if:*
   a) *Roof top installations: PV panel(s) in its installed position projects more than 1.5m, measured perpendicularly, above the roof and/or projects more than 600mm above the highest point of the roof;*
   b) *Installations on the ground: PV panel(s) in its installed position projects more than 2.1 metres above the natural/finished ground level.*

SECTION D: DECLARATION

I request the Municipality to proceed with a preliminary review of this embedded generation interconnection application and I agree to pay the cost associated with completing this review and obtaining written consent of the Municipality (see costs listed in the Municipal tariff/charge schedule), though such costs are unlikely except if grid studies or a new meter are required. Should such grid studies be required, a quotation for such work will be provided beforehand, giving me the opportunity to cancel or modify the application should I wish to do so.

I further consent to the Municipality providing this information to the National Electricity Regulator of SA (NERSA) and other Distributors as required.

I declare that this installation has been designed such that it complies with the requirements laid out in the latest version of the Municipality's *Requirements for Embedded Generation* document. I agree not to interconnect and operate this proposed EG system without written approval from the Municipality to do this.

Acceptance of Terms and Conditions

I, the Customer (Account Holder), acknowledge that I have read and understood the General Terms and Conditions: Contract for Connection of Embedded Generator and that by signing this application form, I agree to be bound by the General Terms and Conditions: Contract for Connection of Embedded Generator, should approval for the Embedded Generator be granted by the municipality. A copy of the General Terms and Conditions: Contract for Connection of Embedded Generator can be found on the Municipal website or is obtainable from the Electricity Department offices on request. Any amended

terms and conditions found on the aforementioned website will form part of the terms and conditions of the General Terms and Conditions: Contract for Connection of Embedded Generator, to which terms I, the Customer, agree to be bound. The information provided in this Application Form also will form part of the General Terms and Conditions: Contract for Connection of Embedded Generator.

Customer (Account Holder) Sign-off:

Name or Entity

Date

Signature (If entity, authority to sign on behalf of entity is required)

Installer Sign-off:

Name

Date

Signature

RETURN COMPLETED FORM TO THE RELEVANT OFFICE, OR E-MAIL ADDRESS:

Office Name		
E-mail:		
Telephone Number:	Landline:	Mobile:
Physical address:		
		Postal code:

Attachment of this application checklist (tick)

Preliminary circuit diagram (if >100kVA)	
Type test Certificate of Compliance and Test Report according to NRS 097-2-1, issued by accredited 3rd party test house (all inverters must have this) Competent person signed report confirming system compliant with NRS 097-2-1	

APPLICATION FOR EMBEDDED GENERATOR GREATER THAN 1MW

General information

This application form is for the connection embedded generation greater than 1MW to the electricity network of KwaDukuza Municipality.

- technical compliance
- applicable standards
- environmental and other authorisations
- NERSA registration/licensing requirements.

This is application form is for:

- All generator power sources (solar, wind, hydro, diesel etc)
- Embedded generators 1MW and larger
- Generators with or without self-consumption
- Generators intending to wheel power
- All customer categories (residential, commercial etc)

This application form is NOT for:

- Embedded generators of less than 1MW
- Generators in Eskom network areas
- Off-grid generators (where there is no point of supply)

Applications for generators under 1MW should use the EG application form.

It is recommended that this form is filled in by personnel familiar with the technical details of the intended generation technology.

There are two main parts in the application process prior to implementation permission:

1. The Applicant submits this application form and pays applicable application fees to enable the Municipality to assess the proposal, including undertaking any grid impact studies necessary (the Applicant may be asked to undertake these according to municipal specifications). The Municipality then submits a Cost Estimate Letter to the Applicant, which provides a non-binding estimate of the cost of connection and associated work, including any network strengthening necessary.
2. If the Applicant accepts this and pays the Budget Quote Fee, the Municipality then undertakes detailed studies necessary to provide a more accurate Budget Quote. On acceptance of the Budget Quote by the Applicant, contractual arrangements can proceed and design and construction work can begin.

If the applicant does not yet have an electricity connection from the municipality, or requires an **increase in connection capacity**, a separate application for the new or increased capacity connection will need to be submitted together with this application form.

Fees:
Cost Estimate and Budget Quote Fees schedule should be requested from the municipality.

Summary of the application and project implementation process[1]

[1] Further details are available in the *Guideline for Municipalities on Processing Embedded Generator Applications 1MW and Larger*

PLEASE NOTE: FAILURE TO PROVIDE ALL RELEVANT INFORMATION AS REQUIRED BELOW MAY LEAD TO DELAYS IN THE APPLICATION PROCESS

Generator overview information

Project Name:			Date:	
Nominal AC capacity of new generator (MW):				
If extension of existing generator (or N/A):	Existing AC capacity (MW):		New total (MW): (existing+new)	
System type:	Solar PV:		Other generator (specify):	
Grid Connection mode (Tick appropriate):	Energy from generator to be used solely within the consumers electricity network and **no excess power to be exported** to Municipal electricity network at any time (i.e. reverse power blocking to be installed)			
	Energy from generator to be used within consumers electricity network and **excess power to be exported** to Municipal electricity network			
	All energy generated to be exported to the Municipal network (e,g, wheeling to a separate customer)			
	Other:			
Generation project description:	Provide details in 1 paragraph to give assessors a picture of the generator and site characteristics e.g. rooftop PV, ground mounted, land area, energy source, current use of land etc			
Site / Property Erf/farm/portion No:			Zoning:	
Physical address:			Postal code:	
Site GPS coordinates	Latitude (dd mm ss)	S ° ‘ ‘‘		
	Longitude (dd mm ss)	E ° ‘ ‘‘		
Land use permission: Indicate whether permission to use the land for generation purposes is in place (e.g. letter of consent from owner) – or state why not relevant				

Applicant and Property Information

Account Holder/Customer Details*

Name: Electricity Account No:		
Telephone Number: Email Address:	Landline:	Mobile:

** - if the applicant does not yet have an electricity connection, this should be stated above and an application for a new connection will need to be submitted together with this application form. Off grid systems where there is no point of supply from the municipality, do not need to apply for Municipal approval.*

Applicant Details

Company Name:		
Relationship to customer:	(developer/consultant/installer/other…)	
Physical address:	Postal code:	
Postal address:	Postal code:	
Website:		
Contact Person: Telephone Number: Email Address:	Landline:	Mobile:

Construction Schedule*

Anticipated Construction Start Date:		Anticipated Commissioning Date:**	

** - if system already installed (i.e. a retrospective application) – state 'existing system' under start date*
*** - if the generator is to be commissioning in phases, state date and kW for each phase*

Existing Connection

NMD (MVA):	
Customer supply voltage:	

Embedded Generator Technical Information

Voltage of generator connection into customer's network (as relevant):	
Estimated fault contribution from total generator installation (any existing + new):	

Embedded Generator Specifications

(Note that some information may not be relevant to generator in question. Indicate NA if not applicable)

Manufacturer:	
Energy source:	
Rated MVA (e.g. Inverter/generator):	
Rated MW (e.g. Inverter/generator):	
Rated MWp (for solar):	
Rated Voltage AC:	
Max expected Voltage DC:	
Rated Power Factor:	
Inertial Constant:	
Maximum MVAR Limit:	
Neutral to Earth Resistance in Ohms:	
Xd – Synchronous reactance in p.u:	
X'd - Direct Axis transient reactance in p.u:	
X"d – Direct axis sub-transient reactance in p.u:	
X2 – Negative sequence reactance in p.u:	
X0 – Zero sequence reactance in p.u	

Embedded Generator and Unit Transformer Specifications

Voltage and power ratings:	
Windings configuration:	
Neutral earth resistors or reactors:	
Positive and zero sequence impedances in p.u:	
R1:	
X1:	
R0:	
X0:	

Estimated Consumption and Generation Levels

Current electricity consumption from the municipality (average MWh/month)*	
Estimated output of generator (average MWh/month)	
Estimated future consumption from the municipality (average MWh/month)**	
Maximum export capacity (MVA)***	
Plant operating characteristics, operating and maintenance philosophy (generation profile – daily, weekly, annual, other relevant information regarding operating times, operating activities, outputs, import/export, downtime, maintenance regime etc)	

* - relevant to current customers
** - relevant to customers/generators with self-consumption
*** - this will be the same as the generator capacity for generators without self-consumption

Storage/hybrid technical information

Does the EG include storage capabilities? (tick appropriate):	✓
1) No storage	
2) Yes - *but only as standby power – cannot operate in parallel and feed onto the grid*	
3) Yes - *connected in parallel to EG – can feed onto the grid*	
4) Yes – *stand-alone energy storage installation (no EG)*	

For 3) and 4) above, complete the following:

1) Size (Power/Energy) and technology of Energy Storage *(e.g. 5MW/20MWh L-Ion Battery)*	Max Charging:	MW	
	Max Discharging:	MW	
	Installed Storage Capacity:	MWh	
	Storage technology:		
2) Combined Facility Maximum Export Capacity (MEC) *(e.g. 75 MW PV and 40 MW BESS might result in max export of 50 MW and not the sum)*	MW	To be used for network thermal capacity check – Generation Scenario	
3) BESS[2] application/use description *(What function will be played by the Storage? How will it be used? What is the charge-discharge philosophy?)*			
4) Energy Storage charging *(NB: to determine applicable criteria for capacity check when storage operates as a load)*	RE Generator only	**Y/N**	BESS load to be assumed = 0MW
	Grid only	**Y/N**	Maximum charging load of the BESS to be assumed for load scenario capacity check
	From both Renewable Energy Generator and Grid when required	**Y/N**	Maximum charging load of the BESS to be assumed for load scenario capacity check

Layout and Preliminary design details:

1: Attach a **map of the facility** showing the generator location on the property, boundaries, immediate surrounds to the property/location, existing PoC and key electrical infrastructure, and other relevant details.

2: Attach a **preliminary circuit diagram and design** showing major components, proposed point of common coupling, isolating and interfacing devices with the municipal electrical network, protection schemes, customer electrical installation, earthing arrangements, etc.

[2] BESS - Battery Energy Storage System

If **storage is included in the facility**, this is to be included in the diagrams and design information provided.

Regulatory Requirements and Standards

(The *Guideline for Processing Embedded Generator Applications 1MW and Larger* document of the municipality provides further information of relevance)

The key standards, regulatory approvals, requirements and references that the installation needs to comply with are: *	✓
NRS 097-2 and NRS097-1 series (as published)	
South African Grid Codes	
South African Grid Code Requirements for Renewable Power Plants	
SANS 10142 Parts 1 to 4: The Wiring of Premises (as published)	
NRS 048: Electricity Supply: Quality of Supply	
NRS 047: Electricity Supply: Quality of Service	
NRS 057/SANS 474: Code of Practice for Electricity Metering	
Eskom standard 240-61268576 for generator design	

* - note that the latest versions of all of the above standards are applicable

NERSA registration/license

Does the system need to be **registered** with NERSA? (tick)	Yes		No	
Does the system require a **license** from NERSA? (tick)	Yes		No	

Other authorisations, clearances and approvals

In the stages prior to construction, various environmental, water, heritage or other authorisations may be necessary. Land rezoning may also be necessary. These are the responsibility of the customer and should be pursued timeously so as not to delay the process.

The *Guideline for Municipalities on Processing Embedded Generator Applications 1MW and Larger* document of the municipality provides further information in this regard.

Declaration

I request the Municipality to proceed with a preliminary review of this embedded generation interconnection application and I agree to pay the cost associated with completing this review, including costs to cover any studies necessary for such assessment. Upon receipt of a response and a Cost Estimate Letter from the Municipality I will have the opportunity to cancel or modify the application, or proceed to Budget Quote stage, which involves my paying a Budget Quote Fee.

I further consent to the Municipality providing this information to the National Electricity Regulator of SA (NERSA) and other Distributors as required.

I declare that this installation has been designed such that it complies with the regulatory requirements and standards applicable, and I acknowledge the conditions and processes outlines in the *Guideline for Municipalities on Processing Embedded Generator Applications 1MW and Larger* document.

Customer Sign-off:

_____	_____	_____
Name	Date	Signature

Applicant Sign-off:

_____	_____	_____
Name	Date	Signature

Return completed form to the relevant office, or e-mail address:

Office Name		
E-mail:		
Telephone Number:	Landline:	Mobile:
Physical address:		
		Postal code:

Attachment of this application checklist (tick)

Preliminary circuit diagram	
Map of the facility	

KWADUKUZA MUNICIPALITY

EMBEDDED GENERATOR COMMISSIONING REPORT

PROJECT NAME:	

Notes:_(e.g. new system / existing system being expanded etc)

ACCOUNT HOLDER DETAILS

NAME:			
ELECTRICITY ACCOUNT NO:			
METER NO:			
ERF NO:			
TELEPHONE NUMBER:	LANDLINE:	MOBILE:	
EMAIL ADDRESS:			
PHYSICAL ADDRESS:			
		POSTAL CODE:	

INSTALLER DETAILS

COMPANY NAME:			
CONTACT PERSON:			
TELEPHONE NUMBER:	Landline:	Mobile:	
EMAIL ADDRESS:			
PHYSICAL ADDRESS:			
		Postal code:	

EG DETAILS

KEY EQUIPMENT MANUFACTURER/S AND MODEL/S:	
TOTAL AC RATING (KVA):	
SINGLE OR THREE PHASE:	

SERIAL NUMBER/S OF KEY EQUIPMENT (SPECIFY EQUIPMENT E.G. INVERTER/S):	

Attachments Checklist	✓
Final as-built circuit diagram: *NOTE: The diagram is to clearly indicate point of connection to municipal network, the location of all protection devices, location of all breakers/isolators/disconnectors, measurement location for all protection and control devices, connection point of EG to the total system*	
Energy Conversion type test Certificate of Compliance according to NRS 097-2-1, issued by accredited 3rd party test house (mandatory for inverters):	
(If storage inverter in parallel:) Separate NRS097-2-1 certificate for storage inverter:	
Electrical installation Certificate of Compliance according to SANS 10142-1 (and SANS10142-1-2 when published):	
Competent person signed report confirming system compliant with NRS 097-2-1:	

COMPULSORY DECLARATION, TEST AND SIGN-OFF

The EG installation complies with the relevant sections of NRS 097-2-1 and NRS 097-2-3:	Y/N
	Tick chosen option
The loss of mains protection (anti-islanding) has been checked to be functional in test carried out on-site – i.e. a momentary disconnection of the mains supply to the site:	Y/N
	Tick chosen option
1. Anti-islanding test: (multi-meter required) With the system running (main breaker closed and EG producing power), OPEN the main breaker to the EG installation. - Does the EG activate anti-islanding mode? Measure the voltage at the AC output terminals of the EG or at the connection point to the AC mains board.	YES/NO ……..V
2. EG Re-connection test: ***(stop watch required)*** With the main breaker OPEN and the EG in island mode, reconnect the mains (close main breaker). Measure the time the EG takes to reconnect to the network/grid.(minimum must be 60 sec)	……..s
(Own text)	*Tick chosen option*
Safety labels have been fitted in accordance with NRS 097-2-1 (distribution board and metering point):	
The EG installation complies with the relevant sections of SANS 10142-1 and SANS 10142-1-2 '*The wiring of premises; Specific requirements for embedded generation installations connected to the low voltage distribution Network in South Africa*' standard (as published), and an installation Certificate of Compliance is attached:	
The EG complies with **licensing/registration** requirements of NERSA (if relevant)	
The EG installation complies with any reverse feed/export limitations in the Municipality's 'Requirements for Embedded Generation' document (if applicable), including being set up to comply with **maximum export capacity** limits:	
If **storage** is included, the installation is set up to comply with **maximum charging current** limits:	
Comments/notes:	

SIGN-OFF OPTION 1: Up to 30kVA - ~~(for PV) Industry Accredited Installer* signoff~~ OR ECSA registered Pr Eng or Pr Tech Eng Over 30kVA – ECSA registered Pr Eng or Pr Tech Eng	*Tick chosen option*
SIGN-OFF OPTION 2: Up to 100kVA - ~~(for PV) Industry Accredited Installer* signoff~~ OR ECSA registered Pr Eng or Pr Tech Eng Over 100kVA – ECSA registered Pr Eng or Pr Tech Eng	*Tick chosen option*
SIGN-OFF OPTION 3: Up to 1MVA (all EG) ~~(for PV) Industry Accredited Installer* signoff~~ OR ECSA registered Pr Eng or Pr Tech Eng on all systems	*Tick chosen option*
SIGN-OFF OPTION 4: Up to 1MVA (all EG) ECSA registered Pr Eng or Pr Tech Eng on all systems	*Tick chosen option*
SIGN-OFF OPTION 5: (own text)	*Tick chosen option*
Note: once SANS10142-1-2 is published and electricians are qualified to issue CoCs according to this, such a CoC is all that will be needed - the Industry Accredited Installer and PR Eng etc signoff will fall away. Date Signature	

FULL NAME OF SIGNATORY:				
SIGNATORY REGISTRATION DETAILS (TICK IF APPLICABLE):	INDUSTRY ACCREDITED INSTALLER*		ECSA (E.G.PR ENG/TECH ENG)	
REGISTRATION NO. (ECSA / INDUSTRY ACCREDITATION*)				
COMPANY NAME:				
TELEPHONE NUMBER:	LANDLINE:	MOBILE:		
EMAIL ADDRESS:				
PHYSICAL ADDRESS:				
		POSTAL CODE:		

KwaDukuza Municipality Witness of Commissioning		
Commissioning Witness By:	**Name:**	**Designation:**
	Signature	**Date:**

*eg PV GreenCard, P4

KWADUKUZA MUNICIPALITY

EMBEDDED GENERATOR DECOMMISSIONING REPORT

ACCOUNT HOLDER DETAILS

Name:			
Electricity Account No:			
ERF No:			
Telephone Number:	Landline:	Mobile:	
Email Address:			
Physical address:			
		Postal code:	

EG DETAILS

Manufacturer/s and model/s:	
AC rating (kVA) (total):	
Serial number/s of key equipment (e.g. inverter):	

DECOMMISSIONING AGENT DETAILS AND DECLARATION

I declare that the EG has been disconnected effectively from the municipal electrical distribution grid.		
Name:		
Accreditation/qualification:		
Address (incl. post code):		
Certificate of Compliance number (provide certified copy of the CoC which confirms that the EG has been disconnected effectively from the municipal electrical distribution grid):		
Telephone Number:	Landline:	Mobile:
Email Address:		

Name Date Signature

**Should any information contained in this document be found to be false, the property owner and the decommissioning agent will be liable to a fine or any legal process that may ensue as a result of false*

representation. Should any municipal infrastructure be damaged as a result of false representation, the owner and the decommissioning agent will be liable for the full cost of replacement of infrastructure damaged.

Bi-directional Metering for EG Checklist

This checklist provides guidance on the minimum as well as key metering requirements when it comes to implementing bi-directional metering for EG customers. The checklist has been populated from the NRS 049, Annexure B: Guidance to Purchases: Table B:4

The type of functionality required will depend on the Municipal approach of doing EG metering which could be influenced by the level of resources available for doing metering. This checklist is to provide some guidance depending on the applicable approach.

NOTE: This checklist does not cover general Metering requirements when it comes to standard metering functions, like import values, meter interfaces, mounting, IP rating, accuracy class etc.

Nr	Bi-directional Metering functionality and Register requirement	Entry level approach	Intermediate to Advance level approach (AMR, AMI or Smart Metering Systems)	Comments/ Notes
1	***Separate Import and Export Active Energy Registers (+A, -A)***			
2	***4 Quadrant Measuring capabilities***			Only for large basic customers (>100Amp)
3	***Separate Import and Export Reactive Energy Registers (+Q, -Q)***			
4	***Separate import and export power registers (+P, -P)***			
5	***On site communication interface like Optic probe***			
6	***Customer interface & meter's display has direction indicators (+P, -P)***			
7	***Prepayment Meters Charge registers for import and export energy for the prepayment account***			
8	***STS functionality***			
9	***Net Energy register***			
10	***Time of Import and Export for Time of Use Tariffs***			(Intermediate level) If ToU implemented or to be implemented soon. (Advance level) Only for customers on Time of Use tariff

11	***Tamper Protection (Needs to stipulate what the meter needs to do and what it should display when going into tamper.)***			(Entry Level) Meter must indicate clearly when it's in tamper mode. Must also specify why it is in tamper mode.
12	***Consider the physical design of meter (footprint) to match those being replaced***			
13	***Customer interface & meter's display can be configured to display EG registers (import and export energy and power)***		(Optional)	Selective – could be cost-based option for customers
14	***Import and Export Load Profiles (30min)***			
15	***Minimum of 6 channels to upload from the Meter to the AMR or AMI system***			
16	***Clock Synchronisation capability***			If ToU implemented
17	***Apparent power import and export (+S, -S)***		(Optional)	Not needed for residential. Can be calculated from other measurements.
18	***Register for Quality of Supply (QS) measurement***		(Optional)	Future – if more metering parameters are available
Metering specifications to be future ready for AMI application				
19	***Ability to remotely read all applicable registers, instantaneous values, monitor import and export generation and STS prepayment information***			
20	***Remote communication interface like GPRS, Wi-Fi, Radio Frequency (RF), Power Line Carrier (PLC), RS 485, etc.***			
21	***Remotely monitor and audit for improved revenue protection***			
22	***DLMS/COSEM gateway capabilities and compliant***			
23	***Load Management Capabilities***		(Optional)	

24	***Remotely disconnect and reconnect the meters supply control switch***		(Optional)	Only when AMI is in place
25	***Other?***			

Other Considerations for EG Metering

- Meter has sufficient local content (50-70%) according to DTI requirements
- Local support (Ideally Local manufacturing and R&D) for proposed meter
- Licensing software to program/communicate with meters should be free or included and not expire
- Going out on RFP should include a live demonstration before going out on tender for RFQ
- If number of installed bi-directional meters for EG becomes too much to operate offline; taking measurements on site, consider realising an AMR system for remote access and readings.
- Outsourcing the complete smart metering service; smart meter, AMR or AMI system and/or automatic billing.
- Make budget provision for integration of meters with billing system and handover
- When specifying requirements, state standards or functionality that can be tested and independently verified; similar to the calibration certification
- Include training for Municipal staff for the procured meters
- Once an AMR or AMI system is set up, ensure relevant human resources is available and has sufficient technical capacity to be able to process and use the data captured and be able to deal with the system if there is a failure

Bi-directional Metering for EG Specifications

Here is proposed text that could be used for the tender specification when procuring bi-directional meters. Note that the text number corresponds with the relevant meter functionality and/or register requirement as listed in the check list.

1, 2, 3, 4, & 17: Measurements and direction of power flow

- The meter is required to meter and register active energy, reactive energy and active and apparent demand as a minimum and as specified in NRS 071 and IEC 61968-2.
- Meter shall be capable to measure forward, reverse, and net active energy.
- Measures 4-Quadrant kVArh when demand metering is required.

- The meters shall be capable of measuring and displaying active, reactive and apparent energy consumption in both import and export modes.
- The principal unit for the measurement of active energy shall be the kilowatt-hour (kWh).
- The meters shall measure energy correctly even when the phase rotation/ sequence is incorrect.
- The meters shall be capable of recording of active and reactive energy in all four (4) quadrants with up to four (4) tariffs.
- Meters shall have a facility to indicate reverse energy consumption.
- The meters shall have capability of closing end of billing period on any selected date of the month selectable by software.
- The meter's billing registers shall NOT be re-settable to zero readings.

- The meters shall have at least twelve (12) billing historical data stored in memory and retrievable by software.
- Total import and total export quantities shall be registered separately. The measurement discrimination must be such that, as the power factor of any load from 0.05Ib to Imax is varied over 360°, the import and export registers will never advance together. The resolution of registration is 1mWh.

Demand Measurements:

- The meters shall be capable of measuring and displaying active, reactive and apparent demand consumption in both import and export modes.
- The meters shall display demand values and their time and date stamps.

5: On site communication Interfaces

All meters shall have an optical port compliant with SANS 62056-21. This port shall support direct configuration of the meter through the meters configuration software and the manual downloading of meter information.

7: Charge Register for Prepayment Meters

The meter must have a Charge register for both Import and export energy for the prepayment account.

8: STS

Prepayment meter must be IEC 62055 STS certified and compliant.

9: Net Energy measurement

Net value between import and export energy to be calculated and stored on register.

10: Time of Use (TOU) metering

Remotely configurable time-of-use metering are required that may lead to peak load reduction. Meter to support at least 4 tariff periods with up to 10 tier switches per day and at least over 2 seasons (winter months Jun – Aug and summer month Sept - May).

14: Load profile (mass memory)

The meter shall cater for at least six (6) channels of load profiling memory (import and export active and reactive energy) for a period of at least 100 days over a 30 min integration period. These channels shall be user configurable depending on the needs of the installation.

The integration period shall be user configurable to cater for typical intervals of 60 min, 30 min and 15 min. The integration periods will be of block type.

The following non-interval data shall also be stored on the meter and it shall be possible to retrieve this data through remote communications:

- Energy registers (active and reactive – import and export), and
- Status alarms to verify the integrity of the data.

6 + 13: Local display

In addition to the local display requirements in NRS 071, meters shall fulfil the following requirements:

- The meter shall display registers locally for use as a check by customers and for maintenance purposes.
- It shall be possible to display the contents of all relevant registers in a user defined sequence which will be flexible to cater for local tariff structures.

- The meter shall support the display of various engineering data (minimum required):
    - Import and export energy
    - voltages per phase;
    - currents per phase;
    - angle between voltage and current per phase;
    - instantaneous apparent demand;
    - number of power outages; and
    - history of configurations (time and date of last configuration).

18: Quality of Supply

Long and short outage detection (Sustained and momentary <5minutes)

Voltage dip or swell detection with configurable voltage threshold and duration.

THD event detection with analysis up to 10th harmonic to reveal unusual conditions.

11: Tamper Protection

The meter shall have a tamper switch capable of detecting and reporting the opening of the terminal cover.

16: Real time clock

The metering system shall have a real time clock that will not drift by more than 60sec every 30 days. This clock may be synchronized to line frequency or to a crystal oscillator circuit. The crystal shall be within accuracy limits for the total temperature range specification of the meter.

A facility shall exist to synchronize the clock using an external source either via an input pulse or through remote interrogation or both. When the time on the meter is being corrected, it shall be possible to do so without resetting any other parameters in the meter. The synchronization shall be indicated in the load profile if the period is longer or shorter to facilitate consumption validation.

During any loss of supply, the time of the clock shall be maintained by, for example, a crystal oscillator circuit and a back-up battery for a period of 10 days.

15. Number of Channels for remote Communications

The meter shall have a minimum of 6 channels for uploading data to the AMR or AMI system.

19, 20 & 21: Remote communication Interfaces

Meters shall support modular industry standard ports for meter reading via remote methods namely and not limited to RS232, RS485, TCP/IP, and GSM, and shall support the cascading of multiple devices to one communication media.

Note: All Direct Electronic Meters and all Electronic meters shall be equipped with at least a RS232 port fitted included, in the tendered price.

24: Integrated Disconnect/Reconnect switch

The meter shall be equipped with a suitably rated switch that can be locally or remotely be controlled.

22: Communication protocols

The protocol for use with meters could be DLMS/COSEM as a result this specification shall not be limited in itself only to DLMS/COSEM compliant meters but at the very least the meter must comply with SANS 62056 Part 21.

Communication protocols shall be freely available to all third-party users and it is the meter manufacturers' responsibility to ensure that the AMR or AMI master station (DAS) can communicate with the meter. The management system must be able to communicate to all AMR/AMI meters stipulated by the user.

23: Load Management

The meter shall be equipped with a suitably rated switch that can be locally or remotely be controlled to manage large loads on the customer side.

GENERAL TERMS AND CONDITIONS: CONTRACT FOR CONNECTION OF AN EMBEDDED GENERATOR

Entered into between KwaDukuza Municipality (hereinafter referred to as the "Municipality")

and

_____

_____

_____

_____

(hereinafter referred to as the "Customer")

1. INTRODUCTION

WHEREAS the Customer has applied to the Municipality for the connection of an Embedded Generator to the Distribution Network and the Municipality is prepared to approve the connection in accordance with the terms and conditions of this Contract.

AND WHEREAS the Parties wish to record their agreement in respect of the terms and conditions governing: (i) physical connection of the Embedded Generator to the Distribution Network; (ii) access to and use by the Customer of the Distribution Network in connection with its generation undertaking at the Embedded Generator; and (iii) the operational interface between the Embedded Generator and the Distribution Network.

2. DEFINITIONS

In this Contract the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires:

1.1. "**Anti-Islanding**" means the ability of the Embedded Generator to instantly automatically disconnect the generator from connection to the Distribution Network whenever the Distribution Network has lost the supply of power from the national electricity grid, thus preventing the export of electricity to the Distribution Network from the Embedded Generator. This is done primarily to protect municipal workers who may be working on the municipal electrical grid and who may be unaware that the municipal electrical grid is still being energized by the Embedded Generator.

1.2. "**Certificate of Compliance**" means a certificate of compliance issued in terms of the Electrical Installation Regulations, 2009, issued in terms of the Occupation Health and Safety Act (Act 85 of 1993).

1.3. "**Claims**" means with respect to any person, any and all suits, sanctions, legal proceedings, claims, assessments, judgments, damages, penalties, fines, liabilities, demands, reasonable out-of-pocket expenses of whatever kind (including reasonable attorneys' fees and expenses) and losses incurred or sustained by or against such person but excluding any lost profits or other special, incidental, indirect, punitive or consequential damages suffered by such person.

1.4. **"Codes**" means the Distribution Code, the South African Grid Code, the Grid Connection Code for Renewable Power Plants or any other code, published by NERSA, as applicable and as amended, modified, extended, replaced or re-enacted from time to time.

1.5. "**Commissioning**" means in relation to the Embedded Generator, the process of testing to demonstrate whether the plant and equipment meets the applicable requirements and specifications of the Code(s) and the Municipality's Technical Requirements for the commencement of commercial operation.

1.6. "**Competent Authority**" means the Government of the Republic of South Africa, or any local government, ministry, department, political subdivision or regulating entity and any person under the direct or indirect control of any such government exercising executive, legislative, judicial, regulatory or administrative functions of or pertaining to government or any other governmental entity, instrumentality, agency, authority, corporation, committee or commission, or any independent regulatory authority, in each case within South Africa, and any successor to or any assignee of any of the foregoing.

1.7. "**Connection Charge**" means the charge(s) recouped or to be recouped by the Municipality from the Customer for the cost of connecting the Embedded Generator to the Distribution Network, as per the currently applicable official municipal tariffs.

1.8. "**Consents**" means all approvals, planning approvals, consents, authorisations, notifications, concessions, decrees, waivers, privileges, acknowledgements, agreements, licenses, permits, decisions, clearances or similar items issued by and obtained from any Competent Authority in favour of the Customer, including for the purposes of clarity the Codes.

1.9. "**Contract**" means this contract together with the requisite provision of the supplemental contract that have been incorporated and the Schedules attached hereto.

1.10. "**Distribution Network**" means the Municipality's network infrastructure consisting of assets operated at a nominal voltage below 132 kV.

1.11. "**Effective Date**'' means the first business day following the date of signature this Contract by the Customer.

1.12. "**Electrical installation**" means any machinery, in or on any Premises, used for the transmission of electricity from a point of control to a point of consumption anywhere on the Premises, including any article forming part of such an Electrical Installation irrespective of whether or not it is part of the electrical circuit.

1.13. "**Embedded Generator**" means the electricity generating device that is connected to the distribution network directly or via the Customer's Electrical Installation beyond the Point of Control.

1.14. "**Law**" means the provisions of the Local Government: Municipal Systems Act (Act No. 32 of 2000), the Electricity Regulation Act, (Act No. 4 of 2006), the Municipality Electricity

1.15. "**Main Supply Contract**" shall mean the existing contract in place between the Municipality and the Customer for the supply of electrical power at the Premises, as contained in the documentation signed at the time of applying for an electrical connection, read together with the Municipality Electricity By-Law.

1.16. "**Maximum AC Charging Current**" means the maximum per phase AC charging current setting of a system equipped with an energy storage system.

1.17. "**Maximum Export Capacity**" means the maximum electrical power that can be transmitted by the Embedded Generator to the Distribution Network at the Point of Control, measured at the AC output of the Embedded Generator.

1.18. "**Municipality**" means [insert Municipality] established in terms of the Local Government: Municipal Structures Act 1998.

1.19. "**Municipality Electricity By-Law**" means the Municipality by law governing the supply of electricity and connection of generation facilities, to the Distribution Network;

1.20. "**Municipality's Technical Requirements**" means the Municipality's technical requirements in relation to the connection of Embedded Generators as detailed in the document entitled "Requirements for Scale Embedded Generation: Conditions and application process to become an embedded generator in the Municipality" to be made available by the Municipality.

1.21. "**NERSA**" means the National Energy Regulator of South Africa established in terms of the National Energy Regulator Act, (Act No. 4 of 2004), or its legal successor.

1.22. "**Parties**" shall mean the Municipality and the Customer and their successors in title.

1.23. "**Point of Control**" means the point at which the Customer's Electrical Installation on or in the Premises can be switched off from the electricity supplied from the Point of Supply.

1.24. "**Point of Supply**" means the actual supply point on the Distribution Network as described in Schedule 1.

1.25. "**Premises**" means the premises of the Customer where the Embedded Generator is located as described in Schedule 1.

1.26. " **Embedded Generator**" means an Embedded Generator no larger than 1MVA.

1.27. "**Total AC Capacity**" means the aggregated maximum nameplate AC power rating of the power conversion equipment (e.g., inverters, synchronous machines, or asynchronous machines)

3. INTERPRETATION

3.1 Unless inconsistent with the context, an expression which denotes:

3.1.1 any gender includes the other genders;

3.1.2 a natural person includes a juristic person and vice versa;

3.1.3 the singular includes the plural and vice versa.

3.2 The headings of the clauses of this Contract shall not be deemed part of or affect the interpretation or construction thereof.

3.3 If any provision in a definition is a substantive provision conferring rights or imposing obligations on any party, notwithstanding that it only appears in a definitions clause, effect shall be given to it as if it were a substantive provision in the body of this Contract.

3.4 Any reference in this Contract to "days" shall be construed as calendar days unless qualified by the word "business", in which instance a "business day" will be any day other than a Saturday, Sunday or public holiday as gazetted by the government of the Republic of South Africa from time to time.

3.5 Unless specifically otherwise provided, any number of days prescribed shall be determined by excluding the first and including the last day or, where the last day falls on a day that is not a business day, the next succeeding business day.

4. DURATION OF CONTRACT

This Contract shall commence on the Effective Date and shall continue indefinitely unless terminated in terms of Clause **Error! Reference source not found.**.

5. CONNECTION OF EMBEDDED GENERATOR

5.1 Subject to clause 5.2, the Customer shall not connect the Embedded Generator to the Distribution Network without the prior written consent of the Municipality. The permission by the

Municipality shall not be unreasonably withheld or delayed, provided that such permission shall only be granted upon successful completion of the pre-commissioning tests and compliance with the Municipality's Technical Requirements.

5.2 The Customer is entitled to connect to the Distribution Network temporarily for the purpose of carrying out Commissioning.

6. CAPACITY OF EMBEDDED GENERATOR

6.1 The Total AC Capacity, Maximum Export Capacity and Maximum AC Charging Current of the Embedded Generator are as specified in Schedule 1.

6.2 The Customer shall not exceed these parameters without the prior written consent of the Municipality.

6.3 If these parameters are exceeded without the prior written consent of the Municipality, the Municipality may give notice to the Customer setting out details and requesting the Customer to remedy the situation within twenty (20) business days of receipt of the notice, failing which the Municipality reserves the right to disconnect the Embedded Generator from the Distribution Network and shall not re-connect until such time as the Customer satisfies the Municipality that the parameters will not be exceeded when the connection is renewed or arrangements have been made for an alteration or modification of this Contract.

6.4 If the Customer proposes increasing the Total AC Capacity, Maximum Export Capacity or Maximum AC Charging Current of the Embedded Generator, the Customer must give prior written notice to the Municipality of such a request and any change shall be subject to the Municipality approving the change, which approval shall not be granted until such time as –

6.4.1 the Customer has submitted an additional Embedded Generator application (available on request from the Municipality) for an upgrade of an Embedded Generator and the connection to the Distribution Network to the Municipality;

6.4.2 an amendment to this Contract to account for the increase in Total AC Capacity, Maximum Export Capacity and Maximum AC Charging Current; and

6.4.3 any work required to the Parties electricity networks have been completed, to the satisfaction of the Municipality.

7. Electricity Feed-in Compensation

7.1 If the Customer is permitted to feed electricity back into the Distribution Network, the Customer's electricity account with the Municipality shall be credited for electricity generated by the Embedded Generator and exported to the Distribution Network in the amounts reflected in the Municipality's annual tariff relating to the import and export of electricity for embedded generation.

7.2 At the time that the Customer ceases to be on the embedded generation tariff, any remaining credit balance will be reflected on the Customer's municipal electricity account. Municipal tariffs applicable to embedded generation will be updated annually, and any changes regarding quantum and structure are applicable to all existing and new embedded generation. The Municipality reserves the right to make amendments to the tariff as stated and does not warrant the financial viability of the Customer's embedded generation installation.

7.3 The Municipality shall not grant credit to the Customer for any energy not exported onto the Distribution Network due to unavailability of the Distribution Network for any reason.

7.4 A schedule of the tariffs relating to the import and export of electricity for embedded generation set by the Municipality shall be furnished to the Customer upon written request to the Municipality.

8. Metering

8.1 In order to accept reverse feed onto the Distribution Network from the Embedded Generator, the metering installation shall be of the bi-directional type, in accordance with NRS097-2 and NRS 057, and be approved by the Municipality.

8.2 The metering installation will measure the imported and exported electricity at the point of common coupling. The metering installation will be specified by the Municipality.

8.3 Any upgrade to the meter, or future amendments to applicable metering requirements or the applicable standards, will be for the Customer's account.

8.4 In the event that either Party has grounds for believing that the meter is operating outside the relevant accuracy class in [NRS 057], the Municipality may test the metering installation at any time or the Customer shall be entitled to request such a test to be conducted. The Customer shall be entitled to nominate representatives to attend such test. The Municipality shall be liable for its costs undertaking such test, only to the extent that the metering is operating within the relevant accuracy class.

9. BILLING

9.1 The Customer shall pay the Connection Charge (plus VAT), if applicable, to the Municipality for the connection of the Facility to the Distribution Network in terms of this Contract. To the extent that a Connection Charge is payable according to the applicable municipal tariff, the Customer shall not be entitled to connect to the Distribution Network without paying the Connection Charge.

9.2 The Customer shall be liable for all charges as per the Municipality's schedule of electricity tariffs applicable to the Customer and the performance under this Contract, as amended from time to time. All charges shall be due and payable by no later than 7 days after date of invoice.

9.3 Customers who have had a bi-directional meter installed and are on a NERSA approved embedded generation tariff for the import and export of electricity will be billed as follows:

9.3.1 The daily service charge and all energy and maximum demand charges, as applicable, will be billed on the Customer's monthly electricity account.

9.3.2 Compensation for the export of electricity will be carried out monthly against the Customer's normal monthly electricity account.

9.3.3 Export credits will only be offset against energy purchase amounts, not fixed, service, demand or other applicable charges.

9.3.4 The Customer will not be paid out if the relevant monthly energy account goes into credit (i.e. Rand compensation for kWh exported exceeds Rand amount for kWh purchased), and the credit balance will be carried forward to the following month.

9.3.5 Any credit in the energy account (i.e. Rand amount for kWh exported exceeding Rand amount for kWh purchased) remaining at the end of the municipal financial year will be zero'd, as it may not be paid to the Customer in terms of existing Municipal financial legislation.

9.4 VAT will only be payable by the Municipality on exported energy where the Customer is registered with the South African Revenue Service (SARS) as a VAT vendor.

10. NO SUPPLY TO THIRD PARTY

The Customer shall not supply any electricity generated on the Premises under this Contract to any third party on any other Premises.[1]

11. COMPLIANCE WITH QUALITY OF SUPPLY, SAFETY AND OTHER TECHNICAL REQUIREMENTS

11.1 The Customer shall comply with the requirements of the Codes and the Municipality's Technical Requirements with respect to the connection of the Embedded Generator to the Distribution Network.

11.2 The Municipality reserves the right, acting reasonably, to alter the Municipality's Technical Requirements from time to time. The Municipality will provide written notification to the Customer of any such change required of existing approved Embedded Generators. Such changes will be justified by the Municipality. The Customer will be obliged to ensure, at its cost, that the Customer's connection equipment complies with any such additional or amended requirements.

11.3 The Customer shall, at its own expense, provide, install, maintain and operate a protection system on the Embedded Generator side of the Point of Control which:

11.3.1 shall be compatible with the Distribution Network protection system; and

11.3.2 shall safeguard the Customer’s connection equipment from any fault condition on the Distribution Network, including but not limited to (i) phase faults, (ii) earth faults, (iii) under or over voltage, (iv) under or over frequency and (vi) open-phase conditions.

11.4 The Customer shall ensure that the protection settings of the Embedded Generator are coordinated with the Municipality’s protection settings from time to time.

11.5 The Municipality may instruct the Customer to disconnect the whole or part of the Embedded Generator from the Distribution Network OR may switch off the Grid Supply. If the Customer is in breach of any provision of this Contract, the Municipality shall be entitled to switch off the Grid Supply to the Customer until it can be proven that the EG is physically and electrically disconnected from the electrical installation.

11.6 In accordance with the Electricity Regulation Act (No 4 of 2006), the Customer shall be responsible for maintaining the quality of supply from the Embedded Generator within the limits set out in the NRS 048 Quality of Supply and NRS 097 Grid Interconnection of Embedded Generation specification, with which the Customer acknowledges himself/herself/itself to be acquainted.

11.7 The Customer shall ensure that the Anti-Islanding functionality of the Embedded Generator is in good operational order at all times to ensure the safety of the Municipality’s personnel.

[1] Drafting Note: No provision is made for wheeling in terms of this Contract and use of system charges. To the extent that a Customer intended to wheel electricity , amendments will be required to this Contract.

12. INTERRUPTION OF SUPPLY

The Customer acknowledges and agrees that nothing in this Contract shall be construed so as to impose on the Municipality any guarantee, commitment or undertaking of or as to the

KWADUKUZA MUNICIPALITY REQUIREMENTS FOR **EMBEDDED GENERATION**

Conditions and application process for embedded generation in the KwaDukuza Municipality

2024

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Contents

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Disclaimer and Indemnity

The information contained in this document is for information purposes only and to guide stakeholders regarding the requirements and application process of the Municipality of KwaDukuza in connecting embedded generation to the municipal electricity network. The opinions expressed are in good faith and while every care has been taken in preparing this document, and the authors make no representations and give no warranties of whatever nature in respect of these documents, including but not limited to the accuracy or completeness of any information, facts and/or opinions contained therein.

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i. Information on this document

Purpose of the document	This document primarily sets out the requirements and application process of the Municipality in connecting all forms of Embedded Generation (EG) to the municipal electricity network. The focus is on Small-Scale Embedded Generation (SSEG), but information is also provided for the connection of larger generators.
Defining small scale embedded generation	Small-scale embedded generation (SSEG) refers to power generation installations **less than or equal to 1MVA/1000kVA** which are typically located on residential, commercial or industrial sites, and generated power is mainly for **self-consumption**. SSEG is in contrast to large-scale generation units that generate large amounts of power, typically in the multi-Megawatt range, and are often pure generators (not for self-consumption)
The need for this document	The parallel connection of any generator to the municipal electrical network, however powered, has numerous implications for the Municipality. It therefore needs to be regulated and managed. This document serves to: ● Ensure the safety of the municipal staff, the public and the user of the EG installation. ● Uphold the power quality of the municipal electricity network ● Clarify metering and billing requirements and options In addition, municipalities are faced with low carbon development imperatives and economic growth challenges. EG can play a role in both of these areas, and the document therefore also serves to: ● Promote the development of the EG industry by creating a conducive environment for growth.
Scope	This document covers: ● The connection SSEG installations to the municipal electrical network ● Installations up to and above 1MVA ● Installations connected to low voltage networks ● Installations with self-consumption This document does not provide detail on: ● Systems with a generation capacity above 1MVA, including the necessary hardware, monitoring and control functionality (anyone wanting to connect a system greater than 1MVA should engage with the municipality before commencing with any application). ● Wheeling of electricity ● The connection of EG to the Eskom electrical grid. ● Systems connecting to MV and HV networks (although the NRS 097-1 standards covering MV and HV connections are not complete, such systems may be approved by the Municipality, but are likely to require further grid studies and should be discussed separately with the municipality)

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Who this document is for	This document will assist all relevant stakeholders involved in the commissioning, installation, management and ownership of an EG system, with generation capacity less than, equal to or above 1 MVA (1000 kVA), including: ● EG project developers ● Residential and commercial property owners ● EG installers ● Energy consultants commissioned to design EG systems ● Municipal officials involved in EG generation ● Registered technical personnel who are involved in EG commissioning

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ii. Glossary & Definitions

Alternating current	The flow of electrical energy that follows a sine wave and changes direction at a fixed frequency (i.e. it 'alternates'). Most residential and commercial uses of electricity require alternating current.
Anti-Islanding	The ability of an EG installation to instantly and automatically disconnect the EG installation from the municipal electrical network whenever there is a power outage in the municipal electrical network, thus preventing the export of electricity to the municipal electrical network from the EG installation. This is done primarily to protect municipal electrical network workers who may be working on the electrical network and who may be unaware that the electrical network is still being energized by the EG.
Bi-directional meter	A meter that separately measures electricity flow in both directions (import and export)
Certificate of Compliance	a) a certificate with a unique number obtainable from the chief inspector, or a person appointed by the chief inspector, in the form of Annexure 1 of the Electrical Installation Regulations and issued by a registered person in respect of an electrical installation or part of an electrical installation; or (b) a certificate of compliance issued under the Electrical Installation Regulations, 1992;
Customer	In the context of this document, customers who also generate shall be referred to as "customers", although in effect they are generators.
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.
Electrical Contractor	A person who undertakes to perform electrical installation work on behalf of any other person, but excludes an employee of such first-mentioned person;
Installation Electrician	A person who has been registered as an installation electrician in terms of regulation 11 (2) of the EIR 2009 for the verification and certification of the construction, testing and inspection of any electrical installation, excluding specialised electrical installations;
Inverter	A power device that converts direct current to alternating current at a voltage and frequency which enables the EG installation to be connected to the municipal electrical network.
Isolated	A section of a municipal electrical network which is disconnected from all other possible sources of electrical potential is said to be isolated
Load profile	The profile or curve showing the variation of the customer's rate of electricity consumption (or demand) over time.
Low-voltage	Voltage levels up to and including 1 kV (1kV= 1000 Volts)
Master Installation Electrician	A a person who has been registered as a master installation electrician in terms of regulation 11 (2) of the EIR 2009 for the

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	verification and certification of the construction, testing and inspection of any electrical installation;
Reverse power flow	The flow of energy from the customer electricity installation onto the municipal electrical network (i.e. export) as a result of the instantaneous generation exceeding the instantaneous consumption at the generation site in question.
EG Connection Contract	The terms and conditions governing the connection of the EG installation to the municipal electrical network accepted by the customer
Small Scale embedded generator or SSEG	A small-scale embedded generator for the purposes of these guidelines is an embedded generator with a generation capacity of less than or equal to 1000 kVA (1MVA).
Stand-alone generator/ off-grid generator	A generator that is not in any way connected to the municipal electrical network. Export of energy onto the municipal electrical network by the generator is therefore not possible.

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iii. Types of systems

DESCRIPTIONS OF SYSTEM TYPES	Do they need to comply with Municipal Requirements doc?
Grid Tied Solar PV Systems Solar PV systems that connect to and run in parallel with the grid and don't include any form of energy storage. These systems need the grid supply to synchronize and supply power simultaneously with the utility network. When installed on the customer side of the utility meter, they are mainly installed for self-consumption to reduce the customers' electricity bill. They cannot supply back-up power during a power failure.	These systems **must comply** with all Municipal embedded generation requirements.
Off Grid or Stand-Alone solar PV systems Off grid solar PV systems, are systems that supply power from both solar and/or batteries through an off-grid inverter that has no electrical connection to the utility grid. These systems can be supported with a back-up generator to charge batteries and/or supply loads when there is insufficient solar PV and/or battery energy available. NOTE: Inverters labelled as Off Grid inverters shall not be used for grid connected solar PV systems.	Because these systems cannot generate in parallel with the grid, they **do not need to comply** with Municipal embedded generation requirements.
Back-up or standby (UPS) systems Back-up or standby uninterruptable power supply (UPS) systems store energy in batteries through a charger and then only supplies power to the loads from these charged batteries via an inverter during a power outage. Fuel generators can also be used as back-up or stand by power supply. These systems require a suitable change over switch to select power supply between the utility and the back-up power supply, as the two supplies shall never be supplied simultaneously.	Because these systems cannot generate in parallel with the grid, they **do not need to comply** with Municipal embedded generation requirements[1].
Hybrid Grid Tied Solar PV systems Grid tied/connected hybrid systems are those that combine two or more energy sources like solar PV, batteries, diesel generator or wind, which are connected to and runs in parallel with the utility network. **The most common and most relevant hybrid system for Municipal Distributors is a solar PV - battery hybrid.** These systems mainly run from the solar PV and battery power, and only use the utility to supplement the supply when there is insufficient from the PV or batteries. These systems can also operate during a power outage – hence their increasing popularity.	These systems **must comply** with all Municipal embedded generator requirements.

[1] Note that if the system is configured so it can provide power in parallel to the network, it does need to comply with embedded generation requirements

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iv. Abbreviations

AC	Alternating current
AMI	Advanced Metering Infrastructure
DC	Direct current
ECSA	Engineering Council of South Africa
EG	Embedded Generation/Generator
HV	High Voltage
kVA	kilo-Volt Ampere (unit of apparent electrical power, often similar in magnitude to kW)
kW	kilo-Watt (unit of electrical power)
kWp	kilo-Watt peak (the rated peak output of solar PV panels)
LV	Low Voltage
MFMA	Municipal Finance Management Act
MV	Medium Voltage
MVA	Mega-Volt Amperes (1000 kVA)
MW	Mega-Watt (1000 kW)
NERSA	National Energy Regulator of South Africa
NMD	Notified Maximum Demand
PV	Photovoltaic
SSEG	Small Scale Embedded Generation/Generator
VAT	Value Added Tax

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1. Introduction

Embedded generators (EG) are increasingly being installed by businesses and residences across South Africa, and this trend is expected to continue. It is therefore important that approval procedures and standards are established by municipal distributors to regularise the growing number of such generators connected to their networks.

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

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

This document outlines the municipal requirements and processes for prospective EG installations to connect to the municipal electrical network such that the above factors are balanced. The focus is on EG, although broad guidance is provided for larger generators.

1.1. Connecting larger generators to the distribution grid

This document covers small-scale embedded generators, with a detailed focus on generators falling under the simplified connection criteria assessment method (see Table 1). Larger generators typically require Grid Impact and/or Grid Code compliance assessments.

Table 1: Summary of connection assessment requirements for small- and large-scale generators

Generator characteristics			Connection assessment method	
Scale	Size	LV or MV connected generator	Simplified criteria (NRS097-2-3)	Grid studies
Small-scale (up to 1MVA)	0-1MVA	LV connected	✓	✗ (if complies with NRS097-2-3)
		MV connected	✗	✓
Large-scale (>1MVA)	>1MVA	LV or MV	✗	✓

Large generators and others requiring further grid studies, including all Independent Power Producers (IPPs), should obtain guidance from the municipality, such as:

- Guide for Municipalities on Processing Embedded Generator Applications 1 MW and Larger
- Grid Impact Study Specification Guide

Generic versions of the above guidance documentation is available at www.sseg.org.za.

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2. Indemnity, Legal Requirements & Curtailment

2.1. Legal and Illegal Connections to the municipal electrical network

Customers wishing to connect EGs to the municipal electrical network are required to follow the normal application procedure as detailed in this document and comply with the regulations, specifications and standards listed herein.

No electrical installation may be connected without being inspected and tested by a registered electrician and a Certificate of Compliance issued by such person[2]. Express consent of the Municipal Electricity Distributor for the connection of EGs to the network is also required.

Failure to obtain this consent constitutes an offence which could lead to a fine and/or imprisonment. Furthermore, the installation may also be in contravention of the Occupational Health and Safety Act (1993), for which punitive sanctions also apply.

Customers found to have illegally connected an EG installation to the municipal electrical network shall be instructed to have the installation disconnected from the municipal electrical network. Should the customer fail to have the EG disconnected from the municipal electrical network, the Municipality will disconnect the electricity supply to the property.

In cases where unauthorised reverse feed-in takes place which results in the meter reversing to the benefit of the customer, the municipality may institute action to recover lost revenue and relevant punitive fines will be applicable.

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

2.2. Generation Curtailment

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

2.3. Right to adapt rules & regulations

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

2.4. Right to deny access

On receipt of a complete application for an EG installation, the Municipality needs to check that, amongst other considerations, the EG installation can be accommodated on the municipal electrical network and that the total EG capacity of the municipal electrical network has not been exceeded,

[2] Occupational Health and Safety Act EIR Regulation 8(2). Also note that notification of electrical work should be given prior to commencement according to EIR 2009 Regulation 8(1): No person shall commence installation work which requires a new supply or an increase in electricity supply capacity unless the supplier has been notified thereof in the form of Annexure 4: Provided that the supplier may waive this requirement in respect of such types of work as it may specify.

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considering parameters in the NRS097-2-3 and other applicable standards. Equipment should not be purchased prior to obtaining written approval from the Municipality to commence, as approval of the EG as proposed by the applicant is not guaranteed and the Municipality shall not be held liable for equipment expenses in such cases.

2.5. Unsuccessful applications

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

2.6. Application processing timeframes

The Municipality will aim to assess applications for EG submitted and respond to applicants within 30 to 90 working days, depending on whether the existing infrastructure is adequate to accommodate the EG. Where applications are more complex leading to delays or require further studies, customers will be notified accordingly within this timeframe.

2.7. Recourse for the customer

Where the Customer feels they have been unfairly dealt with by the Municipality, they should address their complaint to the Municipality in writing, or failing a suitable response, they may submit their complaint to NERSA in writing.

2.8. Contract with the municipality

All EG customers are required to enter into an EG contract with the municipality. The document *General Terms and Conditions: Contract for Connection of an Embedded Generator* is available on the municipal website or from municipal Energy Office, and on the Online SSEG Application Portal, through which the municipality accepts applications. In completing an EG Application Form the customer agrees to be bound by the terms and conditions in this document.

2.9. Transfer/change of ownership

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

Alternatively the EG installation shall be decommissioned as set out in paragraph 3.14.

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3. General Guidelines - Small Scale Embedded Generators

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

3.1. Registration or Generation licence

In terms of the Electricity Regulation Act (2006), any person that owns or operates a generation facility is required to obtain a generation licence to be issued by NERSA unless otherwise exempt as per Schedule 2 of the Act. Table 2 clarifies NERSA license and registration requirements.

Table 2: NERSA Requirements for different size systems (January 2023 revision of ERA Schedule 2)[3]

System size*	NERSA license?	NERSA registration?
Any size EG with self-consumption (can also export, but no wheeling)	✘	✘
EG for wheeling up to 100kW	✘	✘
EG for wheeling over 100kW	✘	✓

* - applies whether the EG has storage or not

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

3.2. Self-consumption vs IPPs (pure generators).

This document focuses on embedded generators which are largely for self-consumption. Independent Power Producers (IPPs) or 'pure generators' (where there is no self-consumption) generally will automatically require grid impact studies, and, if they intend to wheel power, will fall under any wheeling policies or regulations of the municipality. Pure generators not wheeling power but receiving export credits from the municipality will also be subject to MFMA conditions[4].

3.3. Exporting electricity

Municipal requirements regarding embedded generators exporting power back onto the network are as follows:

Export freely, but remain a net consumer in RAND terms:	*Tick chosen option*

[3] Since the wording in the Schedule 2 is open to interpretation in places, a meeting was organised by SALGA with the Department of Mineral Resources and Energy on 19 Dec 2022 to clarify their interpretation. The information here is based on this meeting. NERSA may still issue clarifying notes of this matter.

[4] In such cases the generator effectively becomes an electricity 'vendor' to the Municipal Distributor, for which a transparent and competitive procurement process is needed in terms of the MFMA.

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There is no technical limit to exporting electricity, but the export credit Rand amount may not result in a net payment to the customer in the energy account (i.e. excluding fixed, demand charges). The customer is advised to size their system appropriately. NOTE: in terms of the MFMA, the export credit Rand amount granted to the customer may not be greater than the Rand amount for kWh purchased by the customer over a municipal financial year. Any exports above such limit will not be credited to the customer or will be deducted on year-end reconciliation.	
Export no electricity: Export at any time is not permitted, and reverse-feed blocking must be installed to ensure this.	*Tick chosen option*
OTHER OPTION:	*Tick chosen option*

3.4. Wheeling.

All generators wishing to connect to the municipal network must obtain permission to connect as described in this document, whether wheeling or not. For generators wishing to wheel electricity, the municipality should be approached regarding whether a process for this is in place, and contractual and other arrangements to be complied with.

Generators will not fall under both embedded generator export tariffs and wheeling financial arrangements.

3.5. Applicable technical standards

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

1. NRS 097-2 series: Grid interconnection of embedded generation: Part 2 Small Scale Embedded Generators, in particular[5]:
    a. *NRS097-2-1: Utility interface*
    b. *NRS097-2-3: Simplified utility connection criteria for low-voltage connected generators*

In addition, 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 EG)
2. NRS 048: Electricity Supply – Quality of Supply
3. SANS 10142-1 and 10142-1-2: The wiring of premises (as amended and published)

[5] Note that the Grid Code is the overarching technical regulatory framework applicable to all generators, however the NRS097 series covers the aspects of the Grid Code relevant to SSEG, and therefore the Grid Code does not need to be directly referred to for generators covered by the NRS097 specifications listed here.

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4. SANS 474 / NRS 057 : Code of Practice for Electricity Metering
5. Municipal Electricity Supply by-law
6. Electrical Installation Regulations of 2009
7. Electrical Machinery Regulations of 2011
8. General Machinery Regulations
9. SANS 10400 series

3.6. Testing of Inverters.

Until such time as a SABS mark is issued for inverters, the Municipality shall require proof in the form of test certificates, of type tests having been successfully carried out by a third-party testing authority certifying compliance of the inverters with NRS097-2-1 (and NRS097-2-2 when published). The use of inverters without such certification is not permitted, both in new and existing installations. The installation of reverse feed blocking does not exempt the customer from providing the NRS097-2-1 certification. Non certified inverters with NRS097-2-1 certified external anti-islanding devices do not address power quality concerns of the inverter, and the municipality reserves the right not to accept such systems.

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

The certification body must be SANAS accredited or be recognised by the International Laboratory Accreditation Co-operation (ILAC) or the International Accreditation Forum (IAF) in terms of ISO/IEC 17025:2005 for photovoltaic systems. The accreditation bodies must provide accreditation documentation for the specific test location.

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

3.7. Islanding / Anti-Islanding installations

All EG installations are required to have an anti-islanding function (immediate disconnection when there is a general power outage) as stipulated in the NRS 097-2-1. Certification to this effect is required of inverters (see 3.6 Testing of Inverters).

Should the inverter or EG installation have the facility to both comply with the NRS 097-2-1 requirements for grid-connected systems (including anti-islanding requirements) AND operate in "islanded mode" (or "off grid" mode) where the EG installation supplies power to a portion of the customer's electrical grid during a general power outage, the islanded system shall be effectively isolated from the municipal electrical network during islanded mode operation.

If the EG installation is to be configured as a standby supply after isolating from the municipal electrical network (in which case it becomes an 'alternative supply', not an embedded generator any longer) using a break-before-make changeover switch, a registered person in terms of the Electrical Installation Regulations (2009) shall 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 apply.

3.8. Storage.

Battery or other storage may be included in the EG configuration. Where it is connected in standby power supply mode (i.e. it is not configured to provide power in parallel to the EG but only to operate in islanded mode) the provisions for 'island mode' generators in Section 3.7 Islanding / Anti-Islanding installations apply.

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

Battery charging current limits are applicable to reduce cold load pickup, and are covered in the NRS097-2-3.

Compliance regarding battery storage installation location is the customer's responsibility (see section 3.18.3).

3.9. Hybrid grid-tied inverters operating in islanded (off-grid) mode.

Hybrid grid-tied inverters which can be operated in grid-tied or islanded (off-grid) mode, but where physical wiring connections with the grid exist (e.g. via the distribution board), are considered grid-tied EG systems and require municipal permission as described in this document. This applies even if they are being operated in off-grid (islanded) mode. Only where there is no physical wiring connection to the grid, direct or indirect, is it not considered an embedded generator.

3.10. Fire safety and emergency shut-off switch

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

3.11. Dead Grid safety Lock

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

3.12. Qualified installers.

The municipality recommends that customers installing solar PV EG use industry accredited installers under a third party quality assurance, together with the mandatory CoC from a registered electrician. Industry accreditations include PV Green Card: A SAPVIA (South African Photovoltaic Industries Association) endorsed programme to ensure the quality and safety of PV installations (www.pvgreencard.co.za), or P4 quality assurance certification (https://pqrs.co.za/the-pv-quality-assurance-program/). There are also other industry accredited programs such as those being implemented by the ECASA[6]. **(NB: Note for public participation process – this is being tested specifically for the PV greencard vs the ECSA registered engineers)**

3.13. EG Sign-off on Commissioning

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

SIGN-OFF OPTION 1: Up to 30kVA - (for PV) Industry Accredited Installer* signoff OR ECSA registered professional** Over 30kVA – ECSA registered professional**	*Tick chosen option*

[6] Electrical Contractors Association of South Africa

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SIGN-OFF OPTION 2: Up to 100kVA - (for PV) Industry Accredited Installer* signoff OR ECSA registered professional** Over 100kVA – ECSA registered professional**	*Tick chosen option*
SIGN-OFF OPTION 3: Up to 1MVA (all SSEG) (for PV) Industry Accredited Installer* holder signoff OR ECSA registered professional** on all systems	*Tick chosen option*
SIGN-OFF OPTION 4: Up to 1MVA (all SSEG) ECSA registered professional** on all systems	*Tick chosen option*
SIGN-OFF OPTION 5: Above 1MVA (all EG) ECSA registered professional** on all systems	*Tick chosen option*

** - such as PV Green Card*
*** - ESCA registered professional engineer, professional engineering technologist, professional technician or certified engineer*

Until the SANS10142-1-2 is published, all installations require a Certificate of Compliance in terms of the SANS10142-1 **in addition** to the above signoff. Upon the publishing of the SANS10142-1-2, a registered person in terms of the Electrical Installation Regulations (2009) with appropriate knowledge acceptable to the Municipality will issue a Certificate of Compliance in terms of the SANS10142-1-2, and ECSA registered professional or other signoff will not be necessary.

Note that in all cases a Certificate of Compliance according to the SANS10142-1 and SANS10142-1-2 may only be issued by an Installation Electrician or Master Installation Electrician, not a single phase tester.

3.14. Decommission of EG system.

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

3.15. 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 the EG installation to the Eskom electrical grid. The municipality will not be involved in this process apart from elements required for building plan submissions or any other form of a land development application such as relaxation applications.

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3.16. EG applications from sub-tenants, complex residents or other non-municipal customers.

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

3.17. Off-grid system

Stand-alone generators (not connected to the municipal electrical network in any way) do not need permission from the Municipal Electricity authority. However, approvals from other Departments may still be necessary (e.g. Building Dept), and it is the responsibility of the owner to comply with any such requirements.
Customers and installers should note that in future the municipality may require all inverters to be NRS097-2-1 certified, whether off-grid or grid-tied.

3.18. Advice for the customer

3.18.1. Load profile management to maximise benefit to the customer

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

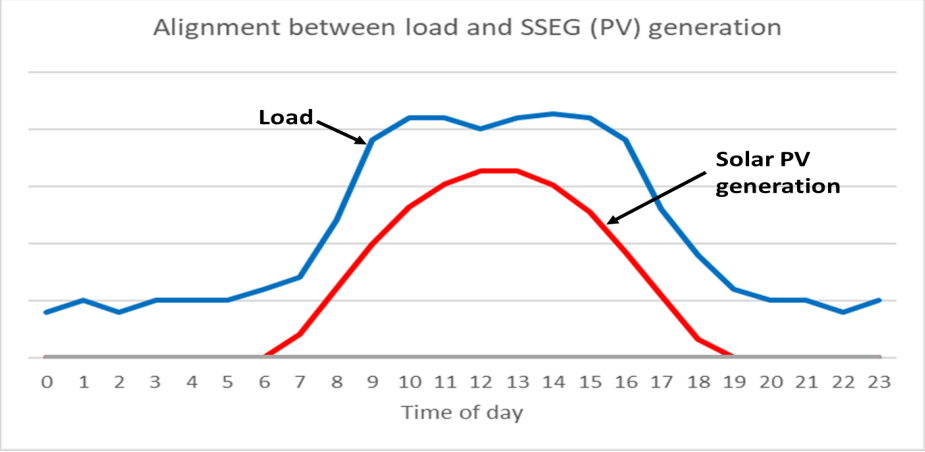

Figure 1: Good alignment between load profile and EG (PV) generation

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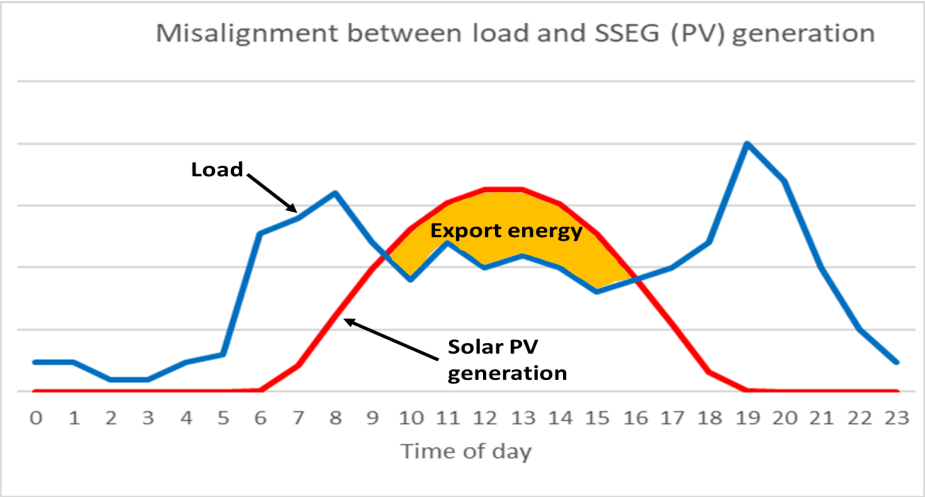

Figure 2: Poor alignment between load profile and EG (PV) generation).

3.18.2. Battery charge-discharge regime choice

Battery-charge-discharge regimes can be set differently. Commonly they are set to 'maximise self-consumption', which minimises export to the network. This is beneficial for customers but does not maximise benefit to the network. Customers on Time-of-Use tariffs may consider a 'peak-shaving' setting rather, where battery discharge is set to coincide with peak periods when electricity is most expensive, thereby increasing their resulting savings. This setting is also beneficial for the network. In addition, while the national electricity crisis persists, batteries should have a minimum discharge setting that reserves adequate energy for the duration of scheduled outages.

3.18.3. Location of battery storage

There are no clear electrical or other regulations regarding the installation location of Lithium-Ion batteries. Where feasible, it is recommended the battery system is installed in an appropriate enclosed area with ventilation, outside of the building or inside the garage (which has the advantage of a firewall between the garage and the rest of the building). If lead-acid batteries are used, a separate battery room with adequate ventilation is particularly important. It is not recommended that lithium-ion batteries are installed in a living area or corridor, as this may change the SANS10400 hazard classification of the space, with fire resistance, escape route and fire extinguisher requirements applying. Compliance in this regard is the customer's responsibility.

3.18.4. Installer experience and accreditation

Customers are advised to check that the installer they intend to use has adequate competence and experience to undertake such projects. It is recommended that installers are asked to provide proof of Electrical Contractor registration, and that the installer is a member of a recognised industry body that can be contacted in the event of poor performance (e.g. ECASA, ECBSA, SAPVIA, AREP etc[7]). For solar PV EG third party quality assurances can be used, such as:

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

[7] Electrical Contractors Association of South Africa, Electrical Conformance Board of South Africa, South African Photovoltaic Industry Association, Association of Renewable Energy Practitioners.

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3.18.5. Roof strength for PV installations

Customers are responsible to ensure that their installer has checked the load (weight) bearing capacity of the roof on which the PV panel installation is to take place. This may involve obtaining an engineer's report on the roof strength. Note that in normal circumstances roof design strength is adequate to accommodate PV panels.
It is recommended that waterproofing requirements are completed before a rooftop installation commences.

3.18.6. Insurance

It is recommended that customers check any requirements that may be placed upon them by their building insurance company. It is advisable that the EG system is specifically covered by building or content insurance. The municipality bares no legal or financial liability to improperly installed EG systems which includes all ancillary hardware such as solar PV's.

3.18.7. Installation on Asbestos Rooftops

Installations are not permitted on asbestos rooftops.

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4. Metering

4.1. Metering installation and reverse power flow/ feed-in to the municipal electrical network

METERING OPTION 1 Customers installing SSEG with reverse flow blocking do not need to install bi-directional meters. However, a prepaid meter must be in place or installed. Customers installing EG with the ability to export power shall have an approved bi-directional meter. The Municipality, if stock is available may provide and install the requisite meter at the customer's cost.	*Tick chosen option*
METERING OPTION 2 All customers installing EG, whether with reverse feed blocking or not, shall have an approved bi-directional meter. The Municipality shall provide and install the requisite meter at the customer's cost.	*Tick chosen option*
METERING OPTION 3: (to be consistent with your municipal metering policy)	*Tick chosen option*

~~Where the municipality has not yet implemented tariffs with export credits, reversed feed will be allowed on systems so enabled and appropriately signed off, but will not be compensated for~~ (note that this is a temporary situation pending the operationalising of EG tariffs).

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

4.2. Adaption of electrical metering installation

The Municipality reserves the right to require customers moving onto an EG tariff to adapt their electrical installations in such a way that the metering is located in a kiosk in the road reserve. The municipality will inform prospective EG customers accordingly should this be required.

4.3. Refunds of electricity already pre-purchased

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

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5. EG connection criteria

Simplified SSEG connection criteria are specified in the NRS 097-2-3 (2023), and applications for systems that fall within these parameters are likely to be easily processed by the Municipality, and only in rare cases will require grid impact studies in their assessment. Such parameters include:

- Systems not larger than 1000kVA
- Connecting to a LV network

Applications to connect SSEG installations which exceed the parameters of the NRS097-2-3 may also be accepted by the Municipality, but may require specialist grid-impact studies in their assessment. The Municipality will advise the customer of such needs after the application form is received.

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

Note that the below is a summary of parts of the NRS097-2-3 (2023), and is provided for information purposes. The parameters and criteria in the latest version of the NRS097-2-3 may differ from the below and, where this is the case, they supersede the below information. It is therefore important to consult the latest version of the NRS097-2-3 as the criteria therein will be used to assess the SSEG application.

5.1. Shared LV feeders

The NRS 097-2-3 specifies that the maximum individual limit on a shared LV feeder (which applies to most small commercial and residential situations) is as follows:

- SSEG nameplate power rating shall not exceed the consumer's NMD (or UIC – Utility Installed Capacity)[8]
- SSEG maximum export capacity shall not exceed 25% of the customers NMD
- Maximum battery charging current shall not exceed 25% of the NMD[9]

The following SSEG size limitations are derived from NRS 097-2-3 for Shared LV connections.

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

Service connection			SSEG parameters		
No phases	Service circuit breaker (A)	Maximum demand (NMD) (kVA)	Max export capacity (kVA) (25%)	Max nameplate power rating (kVA) (100%)	Max battery charging current (per phase) (A) (25%)
1	40	9.2	2.3	9.2	10
1	60	14	3.5	13.8	15
1	80	18	4.6	18.4	20
3	40	28	7	28	10
3	60	41	10	41	15
3	80	55	14	55	20
3	100	69	17	69	25

[8] The NRS097-2-3 uses the term UIC (utility installed capacity) in place of NMD (notified maximum demand) which is used in this document. They can be regarded as the same for the purposes of this document.

[9] Measured on the AC terminals of the power conversion equipment

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Service connection			SSEG parameters		
No phases	Service circuit breaker (A)	Maximum demand (NMD) (kVA)	Max export capacity (kVA) (25%)	Max nameplate power rating (kVA) (100%)	Max battery charging current (per phase) (A) (25%)
3	125	86	22	86	31
3	150	104	26	104	38
3	175	121	30	121	44
3	200	138	35	138	50
3	225	155	39	155	56
3	250	173	43	173	63
3	275	190	47	190	69
3	300	207	52	207	75
3	325	224	56	224	81
3	350	242	60	242	88
3	375	259	65	259	94
3	400	276	69	276	100

Notes to table:

- *To determine if it is a single-phase or three-phase connection, check the main circuit-breaker on the distribution board. A single-phase supply will generally have a single main circuit-breaker, and a three-phase a triple main circuit-breaker. If in doubt consult an electrician.*
- *'**Maximum nameplate power rating'** 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.*

5.2. Dedicated LV feeders

The NRS 097-2-3 specifies that the maximum individual limit on a Dedicated LV feeder is as follows:

- SSEG nameplate power rating shall not exceed the consumer's NMD (or UIC – Utility Installed Capacity)[10]
- SSEG maximum export capacity shall not exceed 75% of the customers NMD
- Maximum battery/storage charging current shall not exceed 25% of the NMD[11]

The following SSEG size limitations are derived from NRS 097-2-3 for Dedicated LV connections.

Table 4: SSEG size limitations - NRS 097-2-3 for Dedicated LV connections

Service connection			SSEG parameters		
No phases	Service circuit breaker (A)	Maximum demand (NMD) (kVA)	Max export capacity (kVA) (75%)	Max nameplate power rating (kVA) (100%)	Max battery charging current (per phase) (A) (25%)
3	125	86	65	86	31
3	150	104	78	104	38
3	175	121	91	121	44
3	200	138	104	138	50

[10] The NRS097-2-3 uses the term UIC (utility installed capacity) in place of NMD (notified maximum demand) which is used in this document. They can be regarded as the same for the purposes on this document.

[11] Measured on the AC terminals of the power conversion equipment

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Service connection			SSEG parameters		
No phases	Service circuit breaker (A)	Maximum demand (NMD) (kVA)	Max export capacity (kVA) (75%)	Max nameplate power rating (kVA) (100%)	Max battery charging current (per phase) (A) (25%)
3	225	155	116	155	56
3	250	173	129	173	63
3	275	190	142	190	69
3	300	207	155	207	75
3	325	224	168	224	81
3	350	242	181	242	88
3	375	259	194	259	94
3	400	276	207	276	100
3	500	345	259	345	125
3	630	435	326	435	158
3	800	552	414	552	200
3	1000	690	518	690	250
3	1250	863	647	863	313
3	1500	1035	776	999	375

Notes to table:

- *'**Maximum nameplate power rating'** 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.*

5.3. Phase balancing

If SSEG maximum export capacity is 4.6 kVA or less, a single-phase inverter can be installed even if the customer has a three-phase connection. Systems with max export above 4.6 kVA are required to be balanced across the phases[12]. In general phase unbalance should not exceed 4.6kVA, including consideration of load distribution between phases.

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

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

5.5. Grid impact studies

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

[12] See NRS097-2-3 in the case of dedicated single-phase supplies.

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

Where network hardware upgrades are found to be necessary in order to accommodate the proposed SSEG, costs may be for the customer's account. This should be discussed with the municipality.

Further information on Grid Impact Studies is given in Annex A.

6. EG Tariffs

The Municipal EG tariffs, once approved by NERSA and Council as appropriate, will be available on the municipal website or from the Energy Office on request. Tariffs are updated annually. Where tariffs with export credits have not yet been implemented by the municipality, reverse feed will not be allowed or accepted and will not be compensated for (note that this is a temporary situation pending the operationalising of EG tariffs and Grid impact study required).

General information on EG tariffs is given below:

6.1. Residential EG Tariff

The Residential EG tariff comprises the following parts:

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

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

Export (Feed-in) credit (c/kWh): The compensation to the customer for energy provided back onto the network.

6.2. Commercial and Industrial EG Tariff

Commercial and industrial customers that are on tariffs which already have a fixed service charge and network demand charge will retain a similar tariff structure, and an export (feed-in) generation tariff credit will be added for reimbursement for energy exported onto the municipal electrical network. Customers on a tariff that does not include fixed service/network charge and demand charge will be changed to an appropriate tariff.

Commercial and Industrial customers should note that the demand charge component of the tariff is unlikely to change after the installation of the EG because the monthly maximum demand is unlikely to reduce due to the regular occurrence of cloudy weather[13].

[13] However, if batteries are included and the system operation is explicitly configured to limit maximum demand, such demand may be reliably reduced.

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6.3. Connection Costs

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

6.4. Increased Costs

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

7. Approvals required from other municipal departments

Where relevant, approvals required of other municipal departments are to be obtained prior to submission of the EG application form, and reflected on the form.

7.1. Buildings/Planning department

Building plans are required to be submitted in order to conform to safety of loading and whether any Solar PV's are properly installed in case of high winds blowing off the panels as an example. A relaxation in terms of the Land Use Scheme may also be required under either one or both of the above circumstances. Should there be any damage to property or injuries or loss of life due to Solar PV's, it is the owner of the property or tenant of that property who will be solely responsible for any damages.

7.2. Other Approvals

EG installations covered by this document generally do not require Environmental Impact Assessments.[14]

For generators that produce noise or air pollutants (e.g. diesel generators), approval from Municipal departments is required (e.g. Health, Environment).

8. What payments may be due by the customer?

The customer is responsible to pay for the following:

- The supply and installation of meters (in accordance with the Municipality's metering policy)
- Connection charges (if applicable)
- Specialist municipal electrical network impact studies – if required (details of payment amounts are to be discussed with the municipality)
- Any changes required to the municipal electrical network upstream of the connection point as a result of the EG installation.
- Specialist tests that are required, e.g. Inverter testing
- Any other costs associated with obtaining approval for the EG connection to the municipal grid

9. EG application process

The *Application for the Connection of Embedded Generation* form shall be completed for all applications to connect an EG installation to the municipal electrical network. The forms are available on the Municipality's website or from the Energy Office.

[14] See EIA GUIDELINE FOR RENEWABLE ENERGY PROJECTS, Dept of Environmental Affairs, 2013, and associated Activity Listings GNR 544, GNR545 and GNR546 for a complete set of criteria.

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Alternatively, an application may be submitted via the municipality's link on the Online EG Application Portal – www.apply.sseg.org.za. After registering as an applicant (a simple process), an application may be submitted to this municipality by following the steps indicated. This Online Platform is the preferred means of submission, as it undertakes some error checking, communicates automatically with the applicant and the municipality, and speeds up the assessment process.

9.1. The hardcopy Application Form submission process is as follows:

- Step 1: Obtain the Application Form
  - Visit the Municipality's website and download the relevant application form/s or request the forms from the Energy Office.
- Step 2: Complete application form for the connection of EG
  - The Municipality requires that the application form/s be signed by the current electricity customer/account holder.
  - Details of the proposed installer shall also be provided.
  - The customer may need support from the proposed installer or registered personnel in completing the application form.
  - By signing the application form the customer agrees to the *General Terms and Conditions: Contract for Connection of an Embedded Generator* (or similarly named) (this document is available on the municipal website or on request from the Energy Office).
- Step 3: Obtain permission from other Municipality departments
  - The Energy Office may require prior approval of the proposed EG installation from other departments as stipulated in the form (e.g. buildings department) if relevant. All relevant approvals must be reflected in or submitted with the application form.
- Step 4: Submit completed application form/s and attachments
  - Form/s shall be submitted to the relevant contacts at the Energy Office.
  - Attachments to the application include an initial design circuit diagram[15] (for >100kVA systems) and inverter NRS097-2-1 certification.
- Step 5: Installation commencement upon approval from the municipality
  - After due consideration of the application, the applicant will be informed in writing whether the application has been successful or not.
  - If further information or grid studies are required by the municipality, the applicant will be notified thereof.
  - Once notified in writing of a successful application, the applicant may commence installation (it is advised that the applicant does not pay for any equipment until municipal approval to install is granted in writing, as such approval is not guaranteed).
- Step 6: Commissioning and documentation to be submitted to the Energy Office.
  - Once installation is complete, commissioning of the EG installation shall be undertaken by a competent person, who shall complete and sign off the EG Installation Commissioning Report.

[15] Single Line Diagram templates can be found at: https://www.sseg.org.za/embedded-generator-single-line-diagram-templates/

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- In addition to the SEG Installation Commissioning Report, there is a list of other documentation specified on the Commissioning Report for submission with the Report, including:
  - Final as-built circuit diagram
  - Inverter type test certificate according to NRS 097-2-1.
  - An electrical installation Certificate of Compliance as per SANS 10142-1 (and SANS 10142-1-2 when published).
- All completed documentation shall be submitted to the relevant Energy Office office.

- Step 7: Inspection of installation if necessary
  - The Municipality shall inspect the EG installation if they deem it necessary.

- Step 8: Approval granted to connect to the municipal electrical network and generation commences
  - If all of the above is satisfactory shall check that such meter is installed.
  - Approval to connect the EG installation to the municipal electrical network shall be provided by the Energy Office to the customer, in writing, together with any operation and other requirements deemed necessary.
  - Once this is done, the change to the EG tariff shall be implemented if applicable and only when the set tariff as approved by NERSA is available. Should the application be approved prior to NERSA approved tariffs are available, the tariff will automatically be raised to the account holder.

9.2. The Online Application process is as follows:

An application may be submitted via the municipality's link on the Online EG Application Portal – www.apply.sseg.org.za. This is the preferred means of applying to connect an EG.

- Step 1: Register as an applicant at www.apply.sseg.org.za
  - If not done already, complete the simple registration process and log in as an applicant
  - Visit the Municipality's website and download the relevant application form/s or request the forms from the Energy Office.

- Step 2: 'Create a New Application'
  - Once logged in, click the 'Create a New Application' button
  - Select this municipality, and follow the steps in each tab, completing all the information requested
  - The municipal 'Requirements' document plus Contract can be examined throughout (left of screen)
  - Approvals from other municipal departments may be necessary in some circumstances. You will be guided in this regard.
  - Relevant document uploads are requested during the process (ID copies, electrical diagrams etc)
  - After completing the 'Declaration' tab and submitting the application to the municipality, both the municipality and the applicant will receive an email notifying them of the submission

- Step 3: Installation commencement upon approval from the municipality

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- After assessing the application, the municipality will issue a Permission to Install letter via email, or request revisions, grid studies or further information
- Automated emails will notify the applicant
- Once notified of a successful application, the applicant may commence installation (it is advised that the applicant does not pay for any equipment until municipal approval to install is granted in writing, as such approval is not guaranteed).

- Step 4: Commissioning and documentation to be submitted to the Energy Office.
  - Once installation is complete, commissioning of the EG installation shall be undertaken by a competent person, and the online Commissioning Report completed.
  - The report includes a declaration by the competent person
  - Electrical diagrams[16], a Certificate of Compliance as per SANS 10142-1 (and SANS 10142-1-2 when published) are amongst the documents to be uploaded
  - After submitting the Commissioning Report, both the municipality and the applicant will receive an email notifying them of submission

- Step 5: Permission to Generate issued and generation commences
  - If the municipality approves the Commissioning Report, the Municipality shall install the necessary meter, or check that such is installed.
  - Permission to Generate will be issued to the customer via email, upon which the EG installation may be connected to the municipal electrical network.
  - Once this is done, the change to the EG tariff shall be implemented if applicable.

10. Changes to existing approved systems

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

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

- An expansion in the EG capacity
- A change in the EG configuration (e.g. adding storage)

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

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

[16] Single Line Diagram templates can be found at: https://www.sseg.org.za/embedded-generator-single-line-diagram-templates/

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11. ANNEX A: Grid Impact Study Overview

In cases where an EG or larger EG application falls outside the simplified connection criteria in NRS097-2-3, it may be necessary to conduct grid impact studies. These studies will assess whether the grid or electrical network remains within prescribed technical limits[17] after the connection of the EG. The municipality will provide specific requirements in this regard. Some general information is below.

○ General grid impact studies

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

○ Requirements for more complex Grid Impact Studies

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

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

Table 5: Grid impact studies to be conducted

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

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

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

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Grid Impact Study Specification Guide

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

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12. ANNEX B: New Owner/Account Holder Declaration

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

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

Acceptance of Terms and Conditions

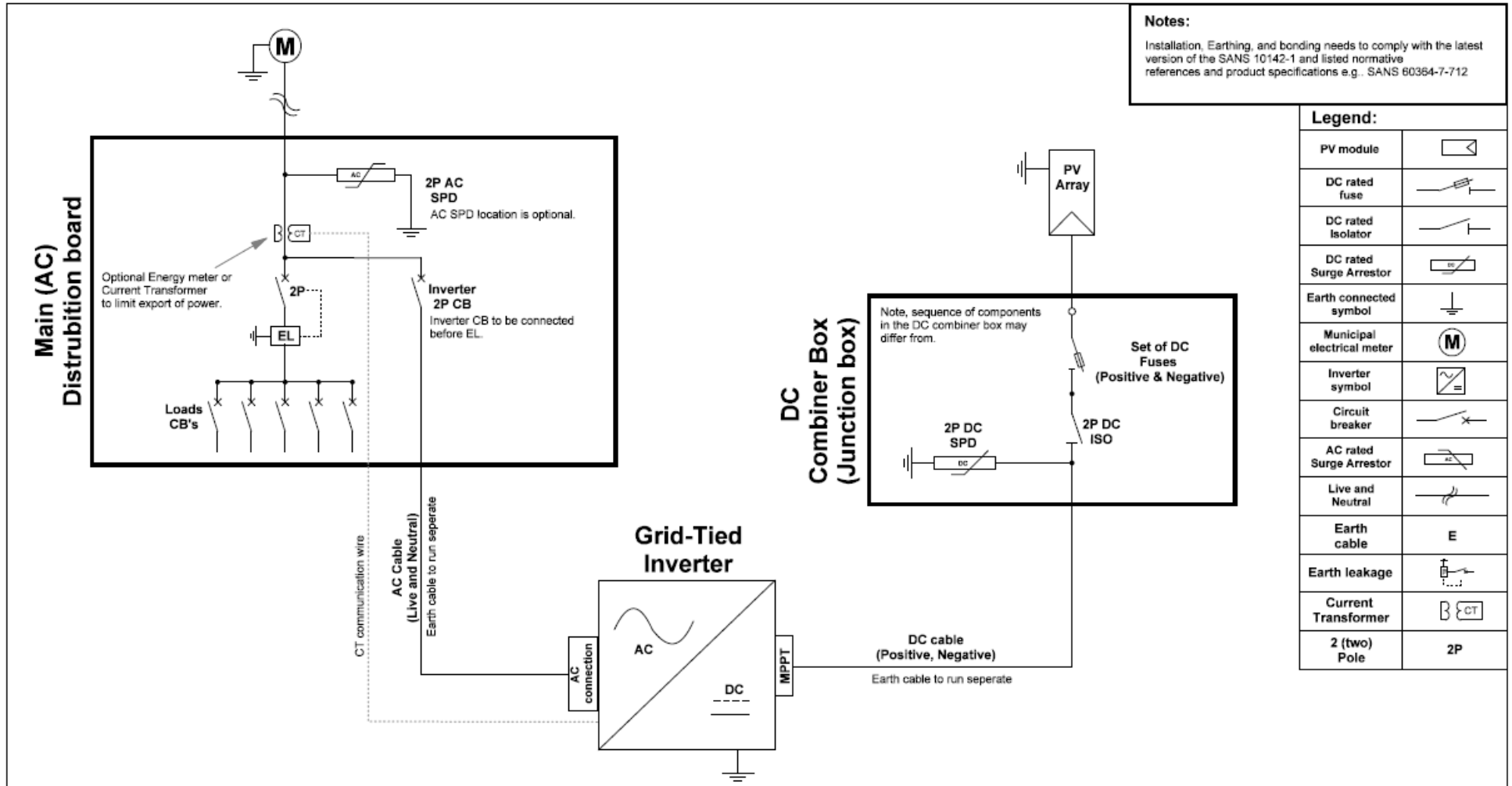
I, the Customer (Account Holder) acknowledge that I have read and understood the General Terms and Conditions: Contract for Connection of Embedded Generator and that by signing this declaration form, I agree to be bound by the General Terms and Conditions: Contract for Connection of Embedded Generator. I note that a copy of the General Terms and Conditions: Contract for Connection of Embedded Generator can be found on the Municipal website or is obtainable from the Energy Office on request. Any amended terms and conditions found on the aforementioned website will form part of the terms and conditions of the General Terms and Conditions: Contract for Connection of Embedded Generator, to which terms I, the Customer, agree to be bound. The information provided in the EG Application Form accepted by the Municipality also forms part of the General Terms and Conditions: Contract for Connection of Embedded Generator.

Customer (Account Holder) Signoff:

Name	Date	Signature

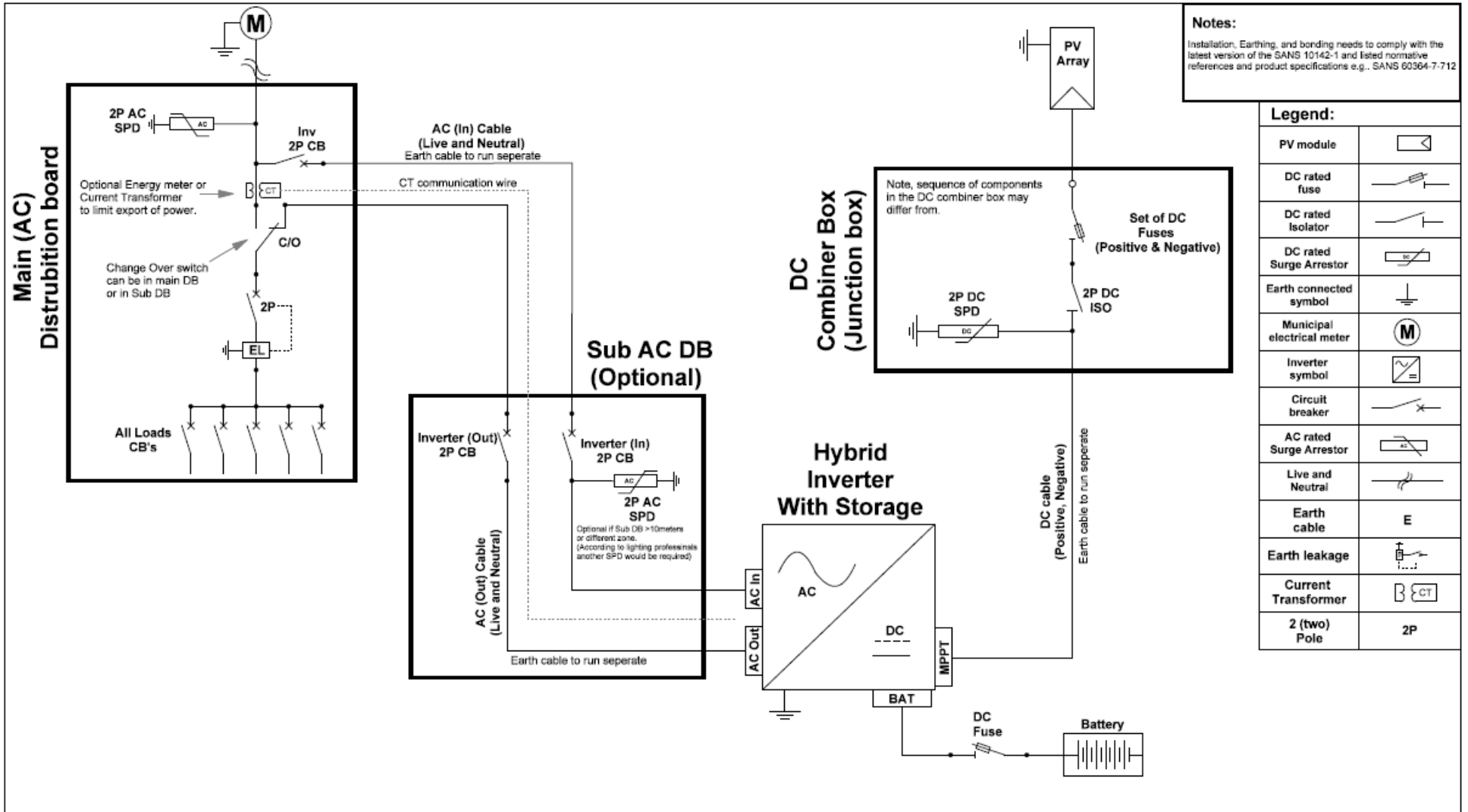
This declaration must be submitted to the Energy Office.

SLD template: SSEG PV no storage



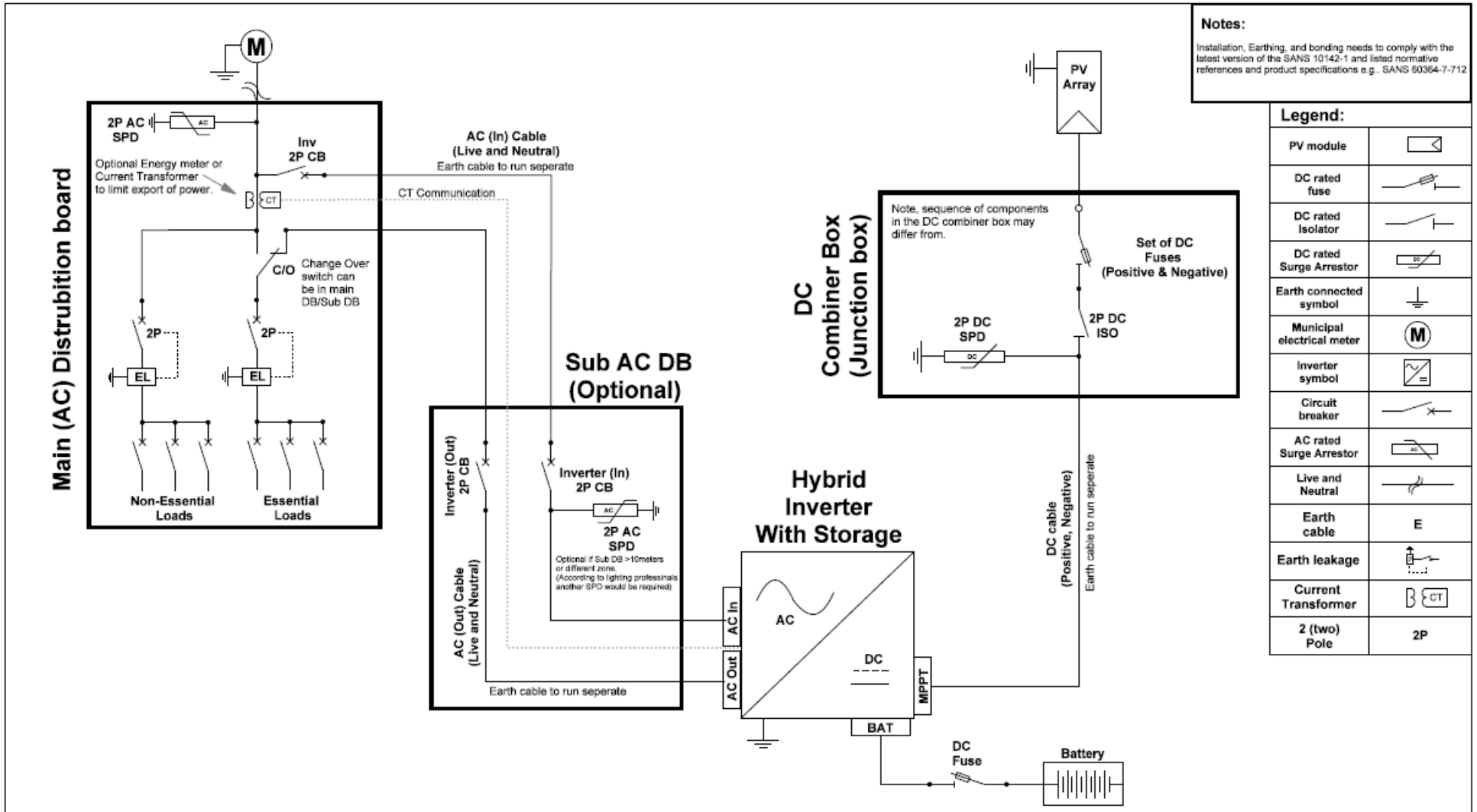
REVISION:		DATE:		PROJECT NAME: SEA SSEG PV No Storage	SHEET 1
Municipal Embedded Generation Support Program Template		EDITOR:			
		INSTALLER:			
		SIGNOFF:		Description: Grid Tied system Single phase	SCALE N/A
		PRINT NAME:			OF 1

SLD template: SSEG PV with storage (Hybrid system)



REVISION:		DATE:		PROJECT NAME: SEA SSEG PV with storage	SHEET 1
Municipal Embedded Generation Support Program Template		EDITOR:			
		INSTALLER:			
		SIGNOFF:		Description: Hybrid system - All loads Single phase - Eskom Style	SCALE N/A
		PRINT NAME:			OF 1

SLD template: SSEG PV with storage (Hybrid system, split loads)



REVISION:		DATE:		PROJECT NAME: SEA SSEG PV with storage	SHEET 1
Municipal Embedded Generation Support Program Template		EDITOR:			
		INSTALLER:			
		SIGNOFF:		Description: Hybrid system - Split loads Single phase	SCALE N/A
		PRINT NAME:			OF 1

Embedded Generator Grid Impact Study Guideline

Version 1.0

Developed under the ***Municipal Embedded Generation Support Programme***

Partners: SALGA, DMRE, GIZ, AMEU

Programme implemented by:

Sustainable Energy Africa NPC, SunCybernetics, Power System Dynamics, DIgSILENT Buyisa

21 October 2022

Document Control

Version	Date	Description/Changes	Author
1.0	18/10/2022	Updated structure	GV Moodley (DIgSILENT Buyisa)

For further Information, comments or queries please contact

Email: support@sseg.org.za

Contents

1. Objective of Guideline

This document sets out parameters and functionality to be checked in assessing whether an embedded generator can be connected to a distribution network. It also stipulates methodologies considered acceptable and reporting requirements. Detailed assessments as covered by this document are normally only required where parameters of the NRS097-2-3 have been exceeded.

All generators connected to the electricity distribution system must comply with the RPP grid code [1]. Where any recommendations made in this document are contradictory to the grid code [1] , the grid code requirements will take preference.

2. Definitions and Abbreviations

All definitions used within this document are in accordance with the definitions in the Distribution Code [2].

Embedded generator

A legal entity that operates one or more unit(s) that is connected to the *Distribution System*. Alternatively a legal entity that desires to connect one or more unit(s) to the *Distribution System*.

Point of connection (POC)

The electrical node on a distribution system where a customer's assets are physically connected to the Distributor's assets.

Abbreviation	Meaning
CT	Current transformer
EG	Embedded generator
NMD	Notified maximum demand.
OEM	Original equipment manufacturer
POC	Point of connection
RETEC	Renewable Energy Technical Evaluation Committee
SCADA	Supervisory Control and Data Acquisition
SLD	Single line drawing
VT	Voltage transformer

2.1 Supporting Documents

This guideline is to be used in conjunction with the following supporting documents

1. Grid Impact Data Requirements Rev1.0.xlsx
2. Grid Impact Evaluation Form Rev1.0.xlsx

3. Studies and Responsibilities

The following section explains the studies that are to be undertaken to evaluate the EG impact and the responsible party for the study.

3.1 Customer Classification

When traditional consumers connect embedded generators to their networks, they become prosumers i.e. ability to both produce and consume energy from the network. The energy produced by the EG is primarily for own use. There may be certain cases whereby the energy produced can be fed back into the network. However even though the EG may not feeding energy back into the network, the impact the EG will have on the network, when operational, must be assessed. Figure 1 shows an overview of the studies that are undertaken and which party is typically responsible for the studies.

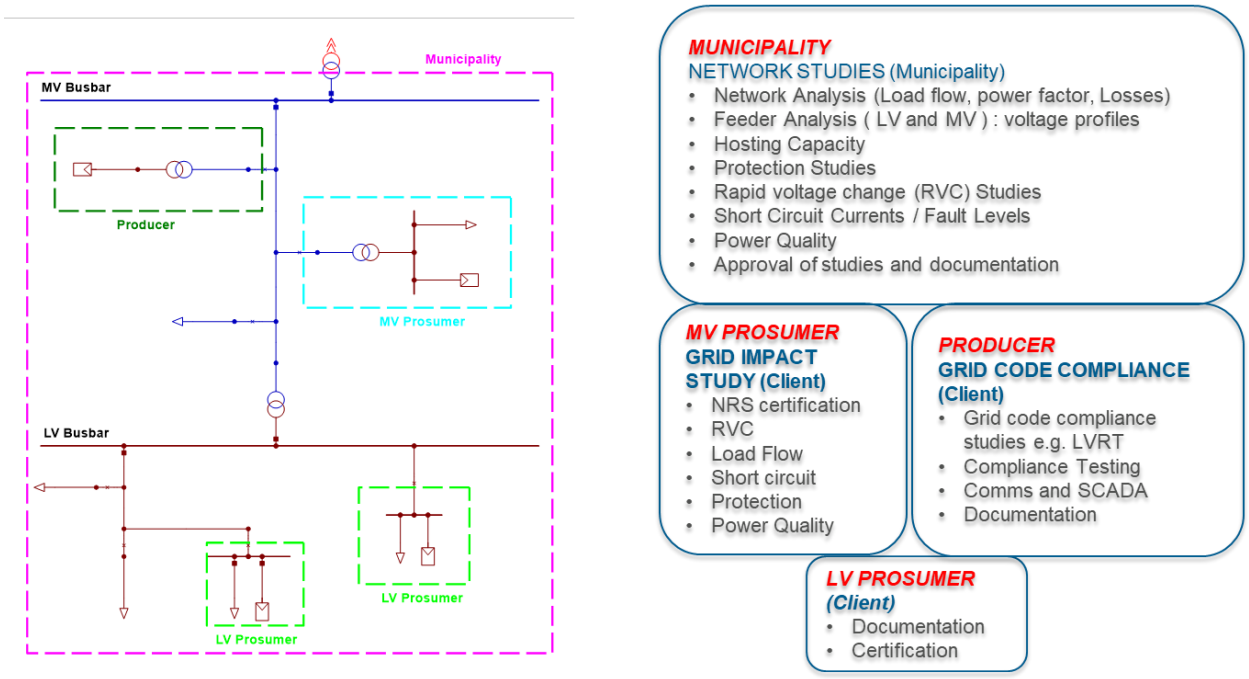


Figure 1: Studies and responsibilities

3.1.1 LV Prosumer (< 350kW)[1]

These customers have a LV connection to the distribution (municipal) network and typically install EG for own use. Evaluation should be done as prescribed in the NRS097-2-3 (Simplified Connection Criteria). This evaluation typically does not involve any network studies. A detailed description thereof is outside the scope of this guideline.

[1] This limit may increase to 1000kW in future revisions of NRS097-2-3

3.1.2 LV Prosumer (> 350kW) and MV Prosumer

Such customers install EG primarily for own use. Grid impact studies will be applicable to these types of customers. Studies can be done by either the municipality or the client. This evaluation falls within the scope of this guideline and is conducted to check the impact of the EG at the POC.

3.1.3 MV Producers

These customers install EG primarily for supply of energy to the distribution network. Such customers must be evaluated against the RPP grid code and the full grid code compliance process must be followed i.e.,

a) Grid code compliance studies (includes steady state and dynamic LVRT, HVRT, phase jump studies etc)
b) Testing of the plant's capability and controllability
c) Submission of all supporting documents

Grid code compliance should be conducted in collaboration with RETEC. This evaluation is outside the scope of this guideline.

3.2 Point of Evaluation

It is very important to establish the reference point for evaluating the impact the EG will have on the distribution network, for all studies considered. All necessary technical requirements, will then be evaluated at this point. The RPP grid code [1] is evaluated at the point of connection (POC) between the RPP network and the distribution network.

This guideline, unless otherwise stated, will utilise the POC between the EG network and the distribution network, as the point of assessment for grid impact studies.

4. Data Exchange

This section specifies the minimum set of data to be exchanged in order for the grid impact studies to be completed.

4.1 Applicant conducted Grid Impact Studies

Where the EG applicant is requested to conduct the grid impact study, the following data should be provided by the municipality to the applicant;

i. The short circuit current / fault level (kA / kVA) at the POC
ii. The equivalent network impedance (X and R) from the POC, looking back into the distributor network

Should the municipality also require the applicant to evaluate the singular *impact that the EG will have on the feeder* connected to the POC, then the following information should also be provided, *at the feeder infeed point*;

i. Short circuit current / Fault level (kA / kVA)
ii. Equivalent network impedance looking back into the distributor (municipal) network
iii. Feeder cables and lengths. Preferably a SLD or drawing of the feeder
iv. Feeder loading

Regarding the feeder loading, the municipality need only provide cumulative values of the feeder loading and other EG on the feeder. Ideally provide the maximum and minimum loading of the feeder

NOT taking the SSEG into account. For example assume the maximum feeder load is 1 800 kVA and minimum load is 1 200 kVA. The total other EG on the feeder is 700 kVA (0.7 MVA). Then, the municipality may provide the following information;

- Maximum feeder load = 1 800 kVA excl EG
- Minimum feeder load = 1 200 kVA excl EG
- Total other EG installed on feeder = 0.7MVA

If measurements of the feeder loading are available, then the municipality can provide the maximum and minimum feeder loading only, and clearly state that the values provided take into account the other EG installed on the feeder already.

Where evaluation of the **protection co-ordination** between feeder protection and customer protection is required, then the municipality should also provide the following information;

i. The type of protection functionality utilised e.g. 50/51 or relay model used and active functions.
ii. Protection settings e.g. Standard inverse, time multiplier = 0.2, current pickup = 0.8
iii. CT/VT ratios.

4.2 Municipality conducted grid impact studies

In order for the municipality to execute the grid impact studies, it is recommended that the applicant complete the Worksheet "**Client Info**" in the Excel file titled "**Grid Impact Data Requirement Rev 1.0.xlsx**"

All supporting documentation should be also supplied with the completed file, referenced for easy access.

4.3 Power Quality Assessment

Where the total installed EG is greater than 5 MW, then a separate power quality assessment at the POC needs to be undertaken. The municipality would need to provide the apportioned current harmonic limits to the client, in order to complete the assessment. The limits are used to check the measured data against and ensure compliance.

Harmonic current emission shall be in accordance with IEC61727 and flicker in accordance with SANS61000-3. Total harmonic distortion shall be less than 5%.

5. Studies

The studies that need to be completed are explained in this section. Studies are separated into required studies and optional studies. Where the municipality requests the applicant to conduct the studies, the municipality must clearly state the optional studies that are to be completed by the client.

5.1 Required Studies

These studies must be completed for all grid impact studies.

5.1.1 Assessment of production and consumption data

A detailed analysis of the consumption and production data is required in order to establish the different operating scenarios the EG may operate under. In order to do this the following is recommended for consumption measurements;

a) Measurement of the site consumption should be undertaken at the POC. Preferably recording the kW and kVAr at the POC.
b) Where kW/ kVAr is measured, then the minimum resolution should be 30 minutes between data samples
c) If energy kWh is measured then the minimum resolution should be 30 minute between data recordings
d) The minimum period of measurement should be at least 1 week, however recordings over a month or a year are preferable.

If the EG is not installed, then the simulated EG production should also be provided. The simulated EG production should take into account any seasonal change in production.

The raw data should be processed (e.g. using histograms) in order to remove erroneous data due to;

a) Outages or load shedding
b) Missing data

Where an EG is installed, the measured EG production, separated from the consumption, should be provided.

The data should be clearly labelled including units and preferably in Excel format.

Once the data has been processed, further analysis using pivot tables are required in order to establish the;

a) Maximum and minimum site load consumption (no EG considered). Both the active and corresponding reactive power must be determined, at the same time stamp. If only active power is available, a suitable assumption based on the nature of the customer's consumption needs to be made about the power factor. If not known, then a power factor of 0.95 lagging should be used for the studies.
b) Maximum and minimum EG production (kW)

5.1.2 Load Flows Studies

Utilising the processed data in 5.1.1, the following study scenarios should be setup for load flow analysis;

a) Zero generation, (maximum) high load: (ZGHL)
b) Zero generation, (minimum) Low load: (ZGLL)
c) (Minimum) Low generation, (maximum) High load: (LGHL)
d) (Minimum) Low generation, (minimum) Low load: (LGLL)
e) (Maximum) High generation, (maximum) High load: (HGHL)
f) (Maximum) High generation, (minimum) Low load: (HGLL)

If the minimum generation was not calculated, the following criteria can be used to determine minimum generation

i. For category A plants, 20% of maximum generation
ii. For category B and C plants, 5% of maximum generation

This aligns with the grid code requirements of minimum active generation where the reactive power must still be controlled.

For all scenarios, the following control conditions of the EG must also be studied;

i. The EG operating at unity power factor (at its terminals).
ii. The EG operating in power factor control mode, controlling the power factor at the POC.

All studies must take into account the reactive power limits of the EG in order to be deemed valid. Where reactive power limits are reached, this must be clearly indicated in the results.

Where **power blocking** is required by the municipality, then the studies must not consider any power export to the grid. If only active power is blocked, the impact on power factor must be clearly reported.

If the **feeder** maximum and minimum loading was provided, then the study scenarios for the EG need to be combined with the feeder loading scenarios and studied. If the total EG on the feeder has also been provided, then study scenarios need to be setup considering the other EG on the feeder as well. For minimum feeder EG, this can be assumed to be 20% of the maximum installed EG capacity on the feeder.

For all studies, the following parameters should be recorded/saved;

i. voltages at the POC
ii. equipment loading on the feeder
iii. active and reactive power at the POC (client side)
iv. power factor at the POC (client side).

5.1.3 Short Circuit Current Contribution

For a fault at the POC, the short circuit current contribution of the EG to the POC, needs to be evaluated.

If static analysis methods are used to calculate the short circuit current contribution, it is recommended that the IEC60909:2016 method or a superposition method be used. The maximum short circuit current contribution should be calculated from the EG at both the terminals of the EG and the POC.

5.1.4 Rapid Voltage Change

Rapid voltage change, is a study of the instantaneous step change in voltage before and after a switching or disconnection/ connection event in the system. To study the rapid voltage change, the following methodology can be followed;

1. Execute an AC load flow calculation considering all tap changers, shunt tapping and other control actions in the network.
2. Save the voltage results at the POC.
3. Fix all the transformer and shunt tap positions (positions).
4. Disconnect the total installed EG. Regardless of how unlikely this may seem, this is the worst case consideration.
5. Execute an AC load flow study, however do not consider any shunt or transformer tap changer action. The tap positions should stay locked as per 3 above.

6. Record the results of the voltage at the POC.
7. Compare the results to determine the % step change.

5.2 Optional Studies

5.2.1 Feeder Losses

If the municipality provided the feeder information, then the losses for the different operating scenarios can also be evaluated.

5.2.2 Protection Co-Ordination

Some EG applicants may review and update their protection relay settings on site, after the installation of EG. It is important that the co-ordination between the customer relay and the feeder relay is evaluated to ensure that the customer relay operates first, for any faults within the customer network.

5.3 Power Quality Assessment

Where the total installed EG is greater than 5MVAin capacity, it is recommended that a separate power quality evaluation is performed at the POC. The recommended method for evaluation is as per the RPP grid code, Appendix 13.

For sites with total installation of WEG < 5MVA, the individual inverters used on site must not exceed the limit specified in Appendix 13 A13.4.3.1 of the RPP grid code [1].

6. Assessment of Grid Impact Study Report

6.1 Evaluation criteria

Since the assessment is performed at the POC, the criteria used to evaluate the results must take into account the operation of the EG. When the EG is operating as;

Consumer: The criteria used to evaluate the impact will be as per the supply agreements e.g. allowed voltage ranges, NMD etc.

Producer: The criteria used will be as per the requirements of the RPP grid code [1]. The supply agreement should also be taken into account.

The assessment of the results of a grid impact study along with supporting documentation, should be done utilising the Excel file named "***Grid Impact Evaluation Form Rev1.0.xlsx***".

6.2 Assessment of Study Results

The following notes are provided as additional considerations when evaluating the results.

For all data processing and studies, the client is to clearly state the methodology and assumptions used.

6.2.1 Classification of EG category

The RPP grid code categories are determined by the rated power of the RPP. The rated power is defined in the RPP grid code as "*The highest active power measured at the POC, which the RPP is designed to continuously supply*."

Considering EGs are installed primarily for own use, the highest active power that can be delivered at the POC may vary, as it is a function of the consumption on the EG site. So this maximum power is not necessarily continuous. For example, a total EG installation is 6 000kW and under certain operating

conditions may supply a maximum of 500kW to the grid, for a short period of time. If the RPP grid code definition is utilised, then the EG will be classified as a category A plant. However this 500kW is not continuous maximum power and can only be delivered for short period of time.

For the purposes of this guideline, the maximum installed capacity of the EG will be utilised to determine the category of the EG. In the case of this example, the EG will be classified as category B. All requirements of the RPP Grid code for category B plants will therefor be applicable to the EG.

Where the results indicate that the EG is supplying power to the network, the evaluation of the EG's ability to control the power factor at the POC is required. Depending on the category of the EG, the following power factors is required, when export maximum power to the network;

- Category A3: 0.95 leading and lagging,
- Category B: 0.975 leading and lagging
- Category C: 0.95 leading and lagging

6.2.2 Production vs consumption

The client should provide a detailed analysis of the load/consumption measurements, at the POC. The raw data can be provided along with the processed data, clearly indicating how the maximum and minimum consumption (load) was determined.

Often clients may measure the energy at the POC (kWh). It can be assumed that the measured value for that hour, is the peak kW recorded for the hour (assuming hourly interval reporting).

If the EG is still to be installed, the applicant is to provide a simulated production data. Preferably the simulated production should take into account seasonal variations of the EG as well.

The maximum load consumption and EG productions as well as the minimum load consumption and EG production, independent of each other, should be clearly stated in the report.

6.2.3 Load Flow

The results of a minimum of 6 study scenarios identified in 5.1.2 must be presented in tabular format. The following results must be checked;

From NRS 048-2: [2]

a) The magnitude of supply voltage shall be within ±10% for voltage levels <500 V and ±5% for voltage levels >500 V.
b) The compatibility level for voltage unbalance on LV, MV and HV three-phase networks is 2%. On LV networks, a compatibility level of 3% may be applied.

The NRS 097-2-3 states the following as technical limits that constrain embedded generation:

c) The maximum change in LV voltage caused by embedded generation may not exceed 3%.
d) The thermal ratings of the installed equipment such as feeder cables may not be exceeded.
e) Where thermal loading of equipment on the client side is noted, the client should provide necessary plan to upgrade in order to reduce/limit network failure.

[2] Note that requirements may be amended by mutual agreement (and specified in the connection agreement). For example, voltage of ±7.5% is often considered acceptable above 500 V.

Results considering different feeder loading scenarios and other EG should also be presented.

The results for operating the EG at unity power factor and power factor control mode are to be presented.

Ensure that the reactive power limits are implemented in the models / taken into consideration, in the study calculations.

6.2.4 Rapid Voltage Change

The NRS 048-4 [3] Table A5 specifies "Compatibility levels are not defined for rapid voltage changes (these are largely addressed by flicker requirements). Table A.5 provides indicative planning levels for rapid voltage changes as a percentage of nominal voltage (i.e., ΔU/UN, in %) under normal operating conditions. These limits depend on the number of changes in a given period of time (r).

Table A.5 — Indicative planning levels for rapid voltage changes as a function of the frequency of repetition

1	2	3
Repetition rate of changes in a period of time *r*	**Rapid voltage change as a percentage of nominal voltage** $\Delta U/U_N$ %	
	MV	HV/EHV
$r \leq 1$ per day	6	3-5
$1 < r \leq 4$ per day	5	3-4
$r \leq 1$ per hour	4	3
$1 < r \leq 10$ per hour	3	2,5

NOTE 1 At HV/EHV, the permissible voltage change has a wide range due to the significant range of voltage levels covered (e.g. >35 kV to 500 kV).

NOTE 2 Higher values may be permitted under abnormal system conditions.

The study is done considering a worst-case event of a trip of the total EG on site. Such events are assumed to occur less than 1 times per day therefore the maximum allowable step voltage change limit should be 6 %. Considering that there may be other EG on the feeder that could also possibly trip, half this limit i.e., 3 % should be use as the limit for the RVC evaluation.

The RVC should also be evaluated with no EG present on the site.

If it is found that the RVC for cases both with and without EG are > 3%, then check the results to see if the EG improved the RVC (made it less) when in service as compared to when there is no EG.

6.2.5 Feeder Losses

Feeder losses are reported more for information rather than for evaluating the EG for connection to the network or not.

6.2.6 Protection co-ordination

Where clients have updated their onsite protection settings, the following should be evaluated

i. There is sufficient grading margin between the feeder protection and the client's protection
ii. Where power feedback into the distributor network is noted and the power feedback is greater than the feeder load, this may result in a reverse power flow through the feeder protection. If there directionality protection active on the feeder protection, this may be activated hence should be checked.

iii. The difference between the feeder loading current and pickup current, for the different scenarios, should also be checked.

Assessment of mandatory grid code requirements

The grid code specifies several requirements that are to be considered as mandatory when evaluating the impact and compliance of the EG. The following requirements are extracted from the RPP grid code [1] and should be checked by the municipality

If the EG has NRS 097-1 certification:

i. Most of the requirements of the grid code will already be checked and tested. The NRS 0970-2 test certificate and test report should be supplied with the grid impact study report.
ii. The NRS-097-2 certification does not take the following into account and the municipality should ensure that the installers adjust on site.
    a. The NRS 097-2 test is conducted for the EG to trip if the frequency exceeds 52 Hz for longer than 4 seconds. To be compliant with the RPP grid code clause 6.1 (3) [1] , it is recommended that the installer adjust the over-frequency limit to trip the inverters if the frequency exceeds 51.5 Hz for longer than 4 seconds.
    b. The reconnection time after disconnection of the EG should be > 60 s to makes it compliant to the RPP grid code clause 5.1.1 (1) [1] .

Where the EG is not tested to NRS 097-2 certification, the following test results of the EG must be presented:

Voltage Assessment:

- Ensure that the voltage range of operation is as per Section 5.1 of the RPP grid code [1] .

Frequency Assessment:

- Frequency range of operation is as per section 5.1 of the RPP grid code
- The EG is fitted with over frequency power reduction functionality as per Section 6 of the grid code [1]. [1]

Anti-Islanding:

- The unit is fitted with anti-islanding capability. Where no such capability is on the EG, proof of an external protection relay needs to be supplied as part of the grid impact study report.

Safety Disconnection:

- The EG should be connected through 2 series disconnectors to the POC and distribution network. These disconnecting devices can be within the EG or external to the EG.

6.3 Communication

Embedded generators or generator systems larger than 100 kVA may have additional requirements, for example, they must be able to receive communication signals for ceasing generation/disconnection from the utility supply, if the utility requires such. Communication facilities

shall be provided to utility at no charge for integration with SCADA or other systems when required. Refer to Annex G (G.1) of NRS 097-2-1:2017 for further details.

7. Deliverables of Grid Impact Studies

Whilst the grid impact study report is an integral part of the approval process, it is recommended that all supporting document is also provided to the municipality. A list of deliverables is provided

- Report
    - Clearly indicating study results, assumptions and findings
    - Summary of key information e.g. anti-islanding, protection, 2-breaker configuration, confirmation of mechanical chop over if EG runs in island mode, protection (anti-islanding, over-frequency, voltage range)
- Supporting documents (NRS certificate and test document, SLD of site showing protection, power blocking, SCADA, series protection switch, location of EG, location of CTS, VT, metering)
- Simulation model (if simulation software utilised for the studies)
- Copy of Application form
- Completed Grid Impact Data Requirements Rev1.0.xlsx document

8. References

[1] SA Grid Code Secretariat, “Grid Connection Code for Renewable Power Plants (RPPs) Connectedt to the Electricity Transmission System (TS) or Distribution System(DS) in South Africa. Version 3.1,” NERSA, Johannesburg, January 2022.

[2] RSA Grid Code Secretariat, “Distribution Code Glossary, Version 6.1, August 2019,” NERSA, Pretoria, 2019.

[3] NRS, “NRS048-4 Electricity Supply - Quality of Supply,” ESLC NRS, South Africa, 2009.