For any Queries, please contact -

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CONNECTION OF INVERTER BASED GRID TIED PV INSTALLATION (<1 000 kVA)

GENERAL INSTRUCTIONS / GUIDELINES

Dear Applicant,

This letter serves as acknowledgement of receiving your enquiry for connecting the Photo Voltaic installation to the City Power electrical network. This letter also contains the necessary next steps to be followed by applicant(s) when applying for connection of PV installation to the City Power network grid. All CoJ customers planning for PV system installation shall follow the below process prior to installation and commissioning of the PV system. It is mandatory for customers with PV systems already installed to follow the same process and register/regularize their installations with the system and connection requirements of City Power. The connection shall be in compliance with all but not limited to the standards and conditions outlined in this letter. This letter covers all PV installations (<1MVA) under the purview of the NERSA Small Scale Embedded Generator (SSEG) guidelines. All applications should have a valid customer agreement and account with CoJ.

1. Application Process

The applicant shall follow the necessary steps as enlisted below –

1.1. The applicant shall visit the City of Johannesburg's walk-in center (nearest to the property location) and submit an "**Application for Electricity Supply**" as illustrated in Figure 1. "PV installations (Alterations)" shall be specified against "Other" of this form.

1.2. On submission of the above, the application shall be allocated a notification number, Business Partner (BP) number and Premise by the walk-in center consultant.

1.3. The applicant shall submit the completed "Application for Inverter based Grid Tied PV installation" (Annexure-1) to City Power's Energy Management Department (email to distributegeneration@citypower.co.za), with all supporting documentation and attachments as specified in the application form.

1.4. City Power's Capital Planning Department shall perform a desktop network study on the technical feasibility of the project. In response, City Power may approve the PV application in cases where the simplified connection criteria as detailed in NRS 097-2-1 are met. The approval may accompany a quotation for applicable fees (to be furnished by Applicant at CoJ walk-in centers against the aforementioned notification number)

1.5. If the simplified connection criterion is not met, then a detailed network study will be required. To enable a detailed network study, City Power shall provide a standard design quotation to the applicant. On receipt of the requisite payment (to be furnished by Applicant at CoJ walk-in centers against the aforementioned notification number), a detailed network study will be conducted. City Power may approve the PV application and/or advise the applicant of any connection or capital outlay costs required to facilitate the grid connection.

1.6. On approval of the PV application, the installation and testing of the PV system shall be conducted and the installer shall issue a certificate of compliance to the applicant and City Power shall be informed of the completion of the PV installation.

1.7. The applicant shall complete the "Commissioning forms" (Annexure-2) to be signed by a registered Pr. Eng or Pr. Tech from the installer. City Power shall witness and approve the installation after ensuring proper compliance to grid connection requirements. All commissioning documentation as requested by City Power shall be submitted to City Power for record and filing purposes. Until City Power approves the PV installation, the applicant shall not connect the PV system to the Grid under any circumstances.

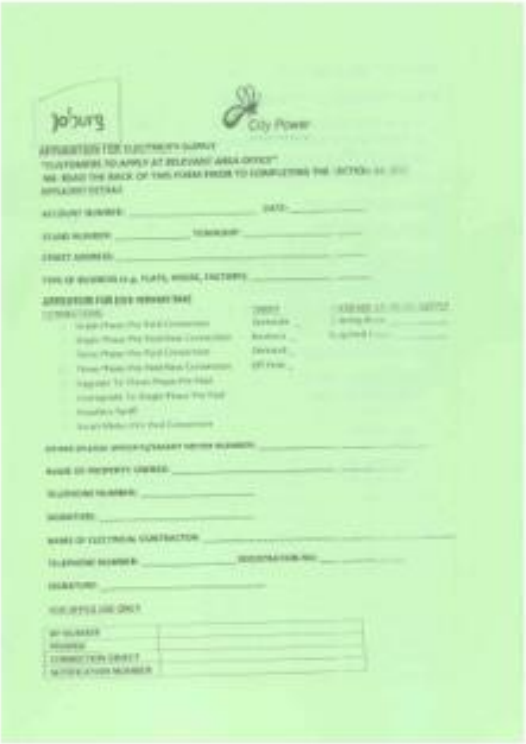

Figure 1: CoJ Application for electricity supply

2. Applicable standards and guidelines

The technical requirements for Small Scale Embedded Generation are covered in the following standards and guidelines. The applicant shall comply with the SSEG standards and guideline indicated below, amongst other recognized standards:

1. City of Johannesburg By Laws for Electrical Connections
2. **SANS 10142**
3. **SANS** 959
4. South African Renewable Power Plant Grid Code.
5. **NRS** 097-2-1 Grid interconnection Generation (Utility interface).

6. **NRS 097-2-3** Grid connection of Embedded Generation (Simplified utility connection criteria for low-voltage connected generators).
7. **IEC 62116** Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters.
8. **IEC 62109-2** Safety of power converters for use in PV power systems – Part 1: General requirements.
9. **IEC 62053-22** Electricity Metering Equipment
10. **IEC 60364** - 1 Low Voltage Electricity Installation

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

3. Sizing of Supply

3.1. Conditions of supply

The minimum technical requirements for Low Voltage (LV) generators connected to the City Power network, as required by the grid code for renewable power plants connected to the electricity transmission and distribution system are specified in this section. The connection details are stipulated in NRS 097-2 guidelines.

In general, the following limits shall be utilized to determine if the application falls within the simplified NRS connection criteria:

1. For shared LV connection, the maximum size of the PV system shall not exceed 25% of the circuit breaker size, up to a maximum of 15kVA (as outlined in the table below).

Distributed Generation system size limit for customers on Shared LV feeder is illustrated below -

1	2	3	4
No. of phases	**Service circuit-breaker size**	**NMD (kVA)**	**Maximum individual generation limit (kVA)**
1	60A	4,6	1,2
1	60A	13,8	3,68 (~4)
1	80A	18,4	4,6 (~5)
3	60A and 80A	41,4	13,8 @ 4,6 per phase (~15)

In dedicated LV feeders, the maximum individual generation limit is a function of:

a) For dedicated LV connection, the maximum size of the PV system shall not exceed 75% of the circuit breaker size, however not more than 25% shall be exported back into the grid at any given time. The notified maximum demand; the maximum generator size is limited to 75% of the NMD. Generators greater than 15kVA shall utilize a three phase invertor.

b) The maximum export that shall be allowed is 25% of their NMD

The dedicated feeder cable size is limited such that the voltage rise between the point of supply and transformer busbar is limited to 1%.

3.2. Power Export Metering Capability

A meter change or upgrade will be required in the event of PV installation.

Two (2) metering configurations that apply to the feed-in tariff (FIT) metering are acceptable in the case of properties where PV systems are operated.

For power consumption, the applicant may either choose to remain on/ move to the flat rate post-paid billing or migrate to a time of use (TOU) based billing. The exported power shall only be purchased by City Power at a flat rate (to be determined by the NERSA SSEG guidelines- but zero rated @ present).

In the event that the applicant is willing to export, the existing meter shall be converted to a 4 quadrant AMR meter. It may also be noted that without a meter change or upgrade, any power exported at any time will be read by the existing meter as power consumption. Should the applicant not have a smart metering system or the existing smart meter requires reconfiguration, the standard quotation of R1200 (one thousand and two hundred rands only) or when requires a meter change a standard quotation of R2600 (two thousand and six hundred rands) as outlined in the tariff booklet shall be quoted to the customer.

3.3. Network studies

Should there be any network studies required for connecting the PV installation to the network; City Power Planning Department will conduct the studies at a cost of the applicant (Clause 1.5). Network studies would be necessitated if the PV installation does not fall within the simplified NRS connection

criteria. City Power would conduct a study on the voltage rise and overloading caused on its distribution grid caused by PV installations that exceed the simplified NRS connection criteria.

3.4. Testing of islanding procedures

Islanding is a condition in which a portion of an electric power grid, containing both load and generation, is isolated from the remainder of the electric power grid. To satisfy the concerns of electric distributors, commercially-available utility-connected PV inverters have implemented a variety of islanding detection and prevention (also called anti-islanding) techniques. The IEC 62116 standard provides a consensus test procedure to evaluate the efficiency of islanding prevention measures used by the power conditioner of utility-interconnected PV systems. The standard describes a guideline for testing the performance of automatic islanding prevention measures installed in or with single or multi-phase utility interactive PV inverters connected to the utility grid.

Testing procedures are clearly stipulated on the IEC 62116 standard, for single or multi-phase inverters. Type test certificate of compliance will be required for the inverters.

Please be informed that the TOU metering is expected to be rolled out as on 1st July 2016. It shall also be noted that customers on pre-paid tariff structure will be required to migrate to a post-paid tariff structure if a PV system is being installed (irrespective of export or no export to the grid).

3.5. Off-grid Operation

If the PV system uses the reference voltage of the grid, then it is considered to be grid tied. If the SSEG will never be grid-tied to an electrical installation connected to the City Power's electrical network, a registered person in terms of the Electrical Installation Regulation (2009) must install the SSEG and issue a Certificate of Compliance to the owner in terms of South African National Standard. The issued Certificate of Compliance will indicate the wiring of the premises (SANS 10142-1 Low voltage installations), is not grid-tied to City Power's electricity network and that it only supplies an off-grid electrical installation. City Power shall be provided a copy of the Certificate of Compliance.

A standard application for decommissioning of the utility connection shall be made at the walk in centers.

3.6. Other Requirements

3.6.1. For all installations for any given size, a Residual Current Device Detector in line with IEC shall be installed on the circuit connecting the PV array. It shall be located between the invertor and the customer's installation.

3.6.2. Where consumers have generation equipment for standby or emergency supply purposes, changeover switches and changeover devices are required such that any probability of parallel operation is eliminated

4. Tariff details

Subject to the provision of the Electricity Regulation Act (Act No 4 of 2006) and in terms of section 17(3)(a)(ii) and 22(a)(i) and (ii) of the local government: municipal finance management act, 2003 (act 56 of 2003) and sections 21(1) and (3), 21a and 75a(3) and (4) of the local government: municipal systems act, 2000 (act 32 of 2000) as amended, it is hereby notified that the City of Johannesburg has, in terms of section 11(3)(i) and 75a(1) and (2) of the local government : municipal systems act, 2000 (act 32 of 2000) as amended, read with section 24(2)(c)(ii) of the local government: municipal finance management act, 2003 (act 56 of 2003), as amended from time to time, the prices to be charged monthly will be as set out in the applicable City Power tariff book.

The prices are also subject to City Power's obligation to adjust the prices it charges for the electricity supplied for the duration of any rationing and conservation program/scheme introduced, adopted or implemented by NERSA, the Department of Energy or any other regulatory body or in accordance with any obligations imposed upon City Power under the provisions of the Electricity Regulation Act.

It may be noted that NERSA is in the process of preparing and releasing Small Scale Embedded Generation (SSEG) guidelines. The guidelines shall be binding on City Power and the customers. In the interim, the following shall be applied on customers with approved PV installations in terms of the tariff:

- Provided PV Tariffs for 2016/2017 for use
- A fixed grid availability service charge of R 0.5 per day per kVA of the PV system (eg 3kW x 0.5 x 30= R 45/month)
- From July 1, 2016, City Power shall accept exported PV power into its grid from all approved PV applications(Residential customers shall be paid a flat rate of ___ per kWh of

power exported while commercial and business customers shall be paid an energy export, the recommended PV tariff for 2016/2017 of all tariffs)

It may be noted that the aforementioned export tariff shall apply until such time as NERSA releases the SSEG guidelines or City Power revised tariff at its discretion whichever is earlier. However, the PV rate has been zero rated until further notice.

5. Safety and Protection

The following requirements for a SSEG installation are applicable:

The applicant shall be responsible for ensuring that the installation complies with the Occupational Health and Safety Act (Act 85 of 1993) or relevant safety legislation. The applicant is also required to forward City Power the details of the appointee or certificate of compliance duly completed and signed by the registered electrical contractor.

The upstream protection devices shall be coordinated with the protection installation for your installation. The details hereof shall be made available to you for co-ordination purposes. The applicant will provide overcurrent and earth fault protection that is capable of isolating the applicant network from City Power supply in the event of a fault on your network.

All equipment up to the point of connection shall be provided, installed, operated and maintained by City Power.

The applicant will, at their own expense, provide, erect, connect up, operate and maintain all circuits required to connect their electrical installation to the point(s) of connection and equipment necessary for controlling such circuits. This will be undertaken to the reasonable satisfaction of City Power for the protection of City Power's equipment against faults and lightning on the electrical installation.

The applicant shall be responsible for all cost of installation, maintaining and operating their own embedded generation plant from the point of connection to City Power's network point.

Prior to commissioning the Plant, the applicant (or installer) shall perform test(s) as per City Power commissioning procedure in the presence of authorized City Power technical personnel and thereafter, furnish City Power with the signed commissioning form indicating the results of the test(s) performed before Facility equipment may be commissioned.