De Zalze winelands golf estate	**Specification for connecting any Embedded Generation to the De Zalze Electrical Network**	**Date Issued:** 1 July 2016 Revision: Rev 0

Pre-amble

The De Zalze Home Owners Association (DZHOA) supports the use of renewable energy sources, but also needs to ensure that the safety of the owner and their staff is in no way compromised by unsafe installations.

Area of Applicability: This specification is issued on behalf of the Home Owners Association and is applicable to all home owners who would like to install their own generation to supplement their electrical supply from the De Zalze network.

Revision: This document will be revised as technology around alternative energy sources evolves.

Total Pages: 7

Next Review date: As and when required

Responsibility: The responsibility for complying with this specification is solely that of the home owner. If a deviation to this specification is found on any site, the electrical supply will be terminated with immediate effect. Re-connection will only be allowed once the Responsible Person for the site, gives permission.

Compiled by: **Marius van Rensburg - Pr. Eng; GCC**

Introduction

The recent Eskom need to do load shedding, has introduced battery back-up systems for many customers. As these only require an inverter and batteries, the systems was designed not to feed back into an electrical grid and was thus safe from the "outside" (from the grid point of view).
As the cost of solar panels dropped, it became feasible to add those to the above system. But an added complication was the possibility for a customer to sell back power to the network during periods of low consumption. This introduced a safety risk to the network as a network isolator is now not de-energising a network anymore, there are now other in-feeds to keep in mind as well.
This specification is written from a technical and safety point of view.

This document has to be read in conjunction with the NRS 097-2 "GRID INTERCONNECTION OF EMBEDDED GENERATION"

The complete solar installation itself has to comply with SANS 10142 and a CoC (Certificate of Compliance) should be obtained from the installer. A copy of which shall be kept on record at the DZHOA offices.

This document is also in line with requirements from several local municipalities.

Please also take note that the De Zalze Home Owners Association (DZHOA) issued a separate document to define feed-in tariffs, metering and aesthetic requirements.

1. Scope

This document defines the requirements for customer equipment if a customer would like to install alternative energy sources of any type on his/her premises and these are connected to the electrical network in his/her home. Typical these might be solar or diesel generators.
Note: The intention might NOT to export/sell the electrical energy back to the grid.

2. Normative References

IEC 60364-7-712, Electrical installations of buildings – Part 7-712: Requirements for special installations or locations – Solar photovoltaic (PV) power supply systems.
IEC 61727, Photovoltaic (PV) systems – Characteristics of the utility interface.
IEC 62116:2008 (ed. 1), Test procedure of islanding prevention measures for utility-interconnected photovoltaic inverters.
NRS 048-2, Electricity supply – Quality of supply – Part 2: Voltage characteristics, compatibility levels, limits and assessment methods.
SANS 10142-1, The wiring of premises – Part 1: Low-voltage installations.
SANS 60947-2/IEC 60947-2, Low-voltage switchgear and control gear – Part 2: Circuit-breakers.

3. Terms and Definitions

Backup supply
Power system that operates as a backup supply during loss-of-grid conditions, consists of storage (in the form of batteries, fossil fuels or fuel cells) and a synchronous static power converter or a generator which is able to operate in stand-alone mode
NOTE Examples of a generator that operates in stand-alone mode are a UPS or a diesel generator.

Customer network
Electrical installation downstream of the electricity consumption meter, usually on the customer premises
NOTE: This network can be backed up and operate as an island provided that it complies with the safety and protection requirements of this specification.

Disconnection switching unit
Switching unit that disconnects the embedded generator operating in parallel with the utility network from the network in response to an out-of-bounds condition embedded generator e.g. one or more energy generation sources that includes the energy conversion device (devices), the static power converter (converters), if applicable, and the control and protection gear within a customer's network that operate in synchronism with the utility's supply

Island
State in which a portion of the utility's or customer's network, containing load and generation, continues to operate isolated from the rest of the grid; the generation and loads may be any combination of customer-owned and utility-owned loss-of-grid condition in which supply from the utility network is interrupted for whatever reason

Low voltage LV
Nominal voltage levels up to and including 1 kV
NOTE: For the purposes of this specification, low voltage is defined as 230 V a.c. (alternating current) for single phase, 460 V a.c. line-to-line for dual phase and 400 V a.c. line-to-line for three-phase.

Parallel operation
Operation of the embedded generator which is synchronized to the grid and operates in parallel to the network

Photovoltaic PV
Method of generation of DC (direct current) electricity by a device when exposed to solar radiation point of utility connection interconnection between the embedded generator and the utility distribution network, referring to the node on the utility network electrically closest to a particular embedded generator's installation

Power factor
Ratio of the r.m.s. value of the active power to the apparent power, measured over the same integrating period
NOTE: Active power is measured in kilowatts (kW) and apparent power in kilovolt-amperes (kVA).

Prevention of islanding
Embedded generator's ability to detect loss-of-grid and prevent the condition of unintended islanding

Root Mean Square (RMS)
Effective value of an AC voltage or current

Safety disconnect
Independent control system that monitors the utility network conditions and disconnects the a.c. output of the embedded generator from the network for out-of-bounds conditions

Simple separation
Galvanic separation between circuits or between a circuit and earth by means of basic insulation

Small-scale embedded generator (SSEG)
One or more energy generation sources rated at up to 100 kW which includes the energy conversion device (devices), the static power converter (converters), if applicable, and the control and protection gear within a customer's network that operates in synchronism with the utility's lowvoltage supply
NOTE: Examples of energy conversion devices are photovoltaic modules, fuel cells, induction generators and synchronous generators.

Static power converter
Power electronic device that converts variable d.c. or a.c. to grid compatible a.c. either synchronously (able to operate in stand-alone mode) or asynchronously (requires utility interconnection)

Synchronous generator
Type of rotating electrical generator that operates at a speed which is directly related to system frequency and is capable of operating in isolation from other generating plants

Total harmonic distortion THD
Ratio of the r.m.s. value of the harmonics to the r.m.s. value of the fundamental and is defined as:

$$THD_x = \frac{\sqrt{\sum_{n-2}^{\infty} x_n^2}}{x_1}$$

where
x_n is the r.m.s. harmonic voltage or current of the order n;
x_1 is the r.m.s. fundamental voltage or current.

Uni-directional meter
Meter that measures the active energy flow in one direction only and ignores the active energy flow in the reverse direction
NOTE: Active energy is measured in watt-hours (Wh).

Uninterruptible power supply system UPS
Power system that comprises a synchronous static power converter, a charger, switchgear, control circuitry and a means of energy storage (e.g. batteries) for maintaining continuity of electricity supply to a load in the case of a disruption of power supply from an electricity distribution network

Utility
Electricity distribution supply authority (see foreword), in the area of the installation responsible for the low-voltage electricity network infrastructure, in this case it will be **De Zalze Home Owners Electrical Network (Not Eskom)**

Utility-interconnected inverter
Asynchronous static power converter of the utility connected to the electricity distribution infrastructure operated and controlled by the utility

Utility network
Electricity distribution infrastructure operated and controlled by the utility

4. Requirements

A. Responsibilities of Embedded Generators to DZHOA

i. The Embedded Generator shall enter into a connection agreement with DZHOA (Distributor) before connecting onto the Distribution System.
ii. The Embedded Generators shall ensure that the reliability and Quality of Supply complies with the terms of the connection agreement.
iii. The Embedded Generator shall comply with the Distributor's protection requirement as well as protection of own plant against abnormalities, which could arise on the Distribution System.
iv. The Embedded Generator shall be responsible for any dedicated connection costs incurred on the Distribution System as a result of connection of the Embedded Generation facility to the Distribution System.
v. The Embedded Generator shall be responsible for synchronizing the generating facility to the Distribution System within pre-agreed settings.

B. Connection Point Technical Requirements

i. The Embedded Generator shall be responsible for the design, construction, maintenance and operation of the equipment on the generation side of the connection point.
ii. The Embedded Generator shall be responsible for the provision of the site required for the installation of the Distributor's equipment required for connecting the generating facility.

iii. The technical specifications of the connection shall be agreed upon by the participants based on the Distribution System Impact Assessment Studies.
iv. A circuit breaker and visible isolation shall be installed at the connection point to provide the means of electrically isolating the Distribution System from the generating facility.
v. The Embedded Generator shall be responsible for the circuit breaker to connect and disconnect the generator plant.
vi. The location of the circuit breaker and visible isolation shall be decided upon by the participants.

C. General Protection Requirement for Embedded Generators

i. The Embedded Generator's protection shall comply with the requirements of DZHOA.
ii. Additional features including inter-tripping and generator plant status to be agreed upon by the participants.
iii. The protection schemes used by the Embedded Generator shall incorporate adequate facilities for testing and maintenance.
iv. The protection scheme shall be submitted by the Embedded Generator for approval by DZHOA.

D. **Specific Protection Requirements:**

i. Phase and Earth Fault Protection:

a) The protection system of the Embedded Generator's protection shall fully coordinate with the protection relays of that of the De Zalze network.
b) The Embedded generator shall be responsible for the installation and maintenance of all protection relays at the connection point.

ii. Over/Under Voltage and over/under Frequency Protection

a) The Embedded Generator shall install over/under voltage and over/under frequency protection to disconnect the generating facility under abnormal network conditions.

iii. Faults on the network of DZHOA

a) The Embedded generator is responsible for protecting its own equipment in the event of any faults or abnormalities on the network of the DZHOA.

iv. Islanding

a) The Embedded Generating Facility shall be equipped with "loss of mains" detection protection to prevent the generator being connected to a de-energised network.

E. **Earthing Arrangement:**

i) This must be in accordance to SANS 10142-1. Earthing requirements for typical earthing systems are described in NRS 097-2-1.

5. Responsibilities

A. Where the Embedded Generation is for behind the meter use only:
The design and installation can be done by an electrician who have to issue a CoC upon completion. It is the responsibility of the owner to ensure that the installation is safe. An application form still has to be completed and a copy of the CoC must go to the DZHOA.

B. Where the Embedded Generation will also export into the DZHOA network:
The design has to be done by a professional engineer and the installation done by an electrician who can issue a CoC. The design and the CoC must go to the DZHOA who will file a copy of both.

C. The DZHOA will not be kept responsible for loss of income to the home owner where the DZHOA network prevents the owner from exporting power into the network. The DZHOA also reserves the right to disconnect any connection where an installation does not comply to the minimum safety requirements.

6. Recordkeeping

The DZHOA will keep records of CoC's and designs on owners files. The owner is also responsible to keep copies of all relevant documentation. The owner is also responsible to keep records of all maintenance/tests that is done periodically.

7. Register

The HOA will keep a register of all SSEG installations which will include the following information:

i) Home owner and Erf number
ii) Total Output in kWp and kVA
iii) Battery capacity if applicable
iv) Name of Contractor
v) Professional person certifying compliance to De Zalze's requirements
vi) Person providing CoC
vii) Date of approval
viii) Date of registration of grid feedback

8. Application

The De Zalze Estate's application form has to be completed and approved before work can commence.