



## Connecting Approved Grid Tied Systems to Utility Supplies

### The long road South Africans face when wanting to generate their own electricity with approvals

In certain parts of South Africa, solar power in the form of photo-voltaic (PV) systems have reached grid-parity. This means it is cheaper to generate your own electricity than to buy from Eskom, or local utilities. However, lack of regulation and implementations have led to many investors losing money in sub-standard PV systems. This paper addresses the current challenges an investor in PV technology faces, should he want to connect a grid-tied inverter to the utility supply.



## Background

Since the South African national energy crisis in 2008, we have seen some drastic changes in the energy, particularly the electricity sector in South Africa. Many people looked to alternative forms of electricity supply. Many people installed hybrid or island photovoltaic (PV) solar systems in order to ensure reliable energy supply. These systems were very costly, and affordable to very few South Africans. However, since then electricity tariffs have escalated at such a drastic rate, that it could well be in part to blame for the current economic woes of the country (Figure 1).

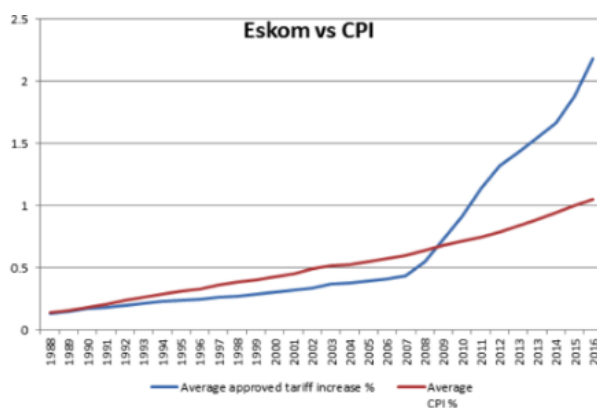


Figure 1 Electricity Increases since 2008 (Source: poweroptimal.com)

This is what caused the second, and much larger photovoltaic boom. However, this time around, grid-tied systems are the order of the day. The



large stakeholders, and regulators such as Eskom, National Energy Regulator of South Africa (NERSA), Electricity Suppliers Liaison Committee (who sets forward NRS standards), and the South African Bureau of Standards (SABS) have been slow to the party. This has left room for many “illegal connections”, or complicated application processes to be followed when one wants to invest in PV technology.

## Eskom and PV

Eskom is quickly gaining a reputation for being completely sided against renewable energy, especially PV. During 2017 they have refused to sign on new projects under the Department of Energy’s Renewable Energy “Independent Power Producer Procurement Programme” (REIPPPP), saying it cannot afford renewable energy. Eskom has also made news stating they now have an oversupply of energy, and they are getting out priced by renewable energy.

This has probably led to the complete lack of response regarding small scale PV from Eskom. In October 2014 Eskom released some Questions and Answers relating to application of small scale embedded generation devices (SSEG) to their low voltage (LV) network. The document states that within 3 years the framework will be in place for customers to make applications for embedded generation\*. (A draft application form was released in 2015, but nothing has come of this draft.) In that same document Eskom states that while the framework is being drawn up, they will accept applications and handle them on a case by case basis. After speaking directly with an Eskom representative, it is clear that no applications have been processed or approved by Eskom.

Eskom have mentioned that they will not process SSEG applications where clients do not have NERSA licenses. However, most clients do not need NERSA licenses. The electricity regulation act (Ac 4 of 2006) states that when generating electricity for “own use”, you are exempt from requiring a license.

*\* Grid Tied PV is a form of embedded generation.*

Eskom claims that they are not aware of any grid-tied inverters connected on the LV side of their network, but estimate there might be around 500 such connections. We believe the number to be much higher, and growing daily.

There is currently an application in place for medium voltage (MV) connections. However, since this is not applicable to the majority of South Africans, it will not be addressed by this document.

## Municipal Connections

Municipalities have realised that they cannot turn a blind eye toward PV, and many South African municipalities have PV policies, with approval processes in place. They may vary on small details, but certain requirements are standard across the municipalities.

NRS 052-2-1, NRS 052-2-2 and NRS 097-2-3 have become the standard which municipalities base their minimum requirements on. Some of the main points concerning a grid tied installation are summarised in this document. Applications should usually be submitted prior to installing a new system.

## Professional Sign-Off

The first point is that grid tied systems must be signed off by a *registered* professional engineer, or professional technologist (registered according to the engineering profession act 46 of 2000). This is to ensure sound technical compliance of the design of systems. Please note this is not a Certificate of Compliance as given by an electrician.

## Certificate of Compliance

Certificates of Compliance (COC) to existing wiring codes as set out by SABS should also be issued. PV technology comes with new challenges of its own, but sound wiring practice and wiring standards have been available in South Africa for many years. PV, the same as any electrical wiring systems, should comply with these standards.





Figure 2 Contrary to popular belief, things can go wrong with PV panels.

One should remember, that when a PV system is installed on your roof, you are trusting someone to make sure that the system is safe. DC voltages of over 600V are typical, and under the right circumstances some strings can reach 1000V. You are trusting the installer to make sure that these voltages pose no danger to you or your family. PV cells cannot be switched off, as long as light is hitting the panels, there will be voltage at the terminals!

## System Size

System sizes are also limited according to your Notified Maximum Demand (NMD) (In basic terms, this is how much power you are allowed to use). Generally in residential areas, power is fed with shared feeders. According to NRS 097-2-3, shared feeders' users may only install generators up to 25% of the NMD. Table 1 summarises the system sizes according to the typical residential service breaker size, or NMD. As a rule, phases should be balanced. Please note this table is what is given by certain municipalities and is not necessarily exactly 25% of NMD.

Phases	Breaker Size	NMD	Max Inverter size
1	20A	4.6kVA	1.2kW
1	60A	13.8kVA	3.68kW
3	60A	41.4kVA	13.8kW (4.6kW per phase)

Table 1 Typical System sizes for Residential Clients

For clients with a greater NMD than listed in the table, the maximum individual size on a shared feeder is 20kW.

Certain large commercial or industrial clients may have dedicated feeders. In this case, the maximum generator, or inverter size is 75% of NMD. It should be noted that the above is only some of the required criteria, more regulations apply.

## Grid Feedback

Unless otherwise stated, it should be taken as a rule that feeding energy into the grid is **not allowed**.

The first concern is metering. Some prepaid meters will shut down as soon as reverse power is detected. In this case authorities would need to reset the meter.

Most prepaid meters will however not necessarily shut down, but they cannot distinguish the direction of power flow. In these cases, when energy is exported, the meter will see it as energy being imported. In other words, the customer will pay for energy exported as if it is being bought.

In areas where energy export is allowed, the customer will usually have to pay for a new meter to be fitted. Generally, a daily admin fee is also charged, and the rate at which the municipality buys energy is much lower as the rate at which it sells energy. Thus it is rarely profitable for owners of small systems to sell energy back into the grid. They are also required to remain net users, meaning that more energy has to be bought over a month, or year, than energy sold.

It is often easier, and cheaper, to fit an export limit device, which will measure the local energy consumption and limit the PV power should more PV power be available than demand at the premises.

## Municipalities without policies

Where municipalities do not yet have SSEG policies, it should be assumed that they will be



brought in soon. In cases where municipalities have issued policies, previous existing systems are also required to meet the new standards. In many cases where PV systems which were not signed-off, or complied with the regulations, they were removed or switched off.

It should also be noted that grid export is illegal in areas without PV policies.

One should also remember that policies and regulations such as those outlined in NRS 097-2 do not exist to complicate systems, they are there for a reason. Everyone who makes use of our country's national grid should be responsible for its stability and safety. These regulations are found upon safety and reliability, and without regulations such as these, we would have no electricity at all! Where no regulations are enforced, it would still be wise to follow them as guidelines.

With municipal connections it is generally easier, as many municipalities already have the framework in place to handle, and process the applications.

Irrespective of policies being in place or not, common regulations such as NRS 052-2, NRS 097-2-3 and all other existing wiring standards set out by SABS should be followed. Clients should insist on Certificates of Compliance (COC's), and professional sign off from the installers and design teams.

Solar Engineering (PTY) Ltd is a group of professional engineers who are passionate about using new technology to yield great returns on our clients' investments. We do this by providing turnkey solutions to install PV Solutions. Learn more about "*SOLAR INVEST*", "*SOLAR ASSURE*" and "*SOLAR INDEPENDENT*" online at [www.solarengineering.co.za](http://www.solarengineering.co.za).



## Conclusion

Before deciding to purchase a grid-tied PV system and connecting it to the network, one should find out if applications need to be made, and what regulations apply in the area. Because there is not yet a national standard set out by SABS, the local regulations may vary.

If an Eskom direct connection is to be made, the client should look at the options and have consultation meetings regarding the connection.

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