WORKING KNOWLEDGE BY TERRY MACKENZIE HOY

GRID CONNECTION OF 'EMBEDDED GENERATION'

Elon Musk, the South African-born owner of SpaceX and Tesla Motors has promised that everybody will soon be off grid and using the Tesla 'Powerwall'. Musk's company, Tesla Motors, claims that, *"Powerwall is a home battery that charges using electricity generated from solar panels, or when utility rates are low, and powers your home in the evening. It also fortifies your home against power outages by providing a backup electricity supply. Automated, compact and simple to install, Powerwall offers independence from the utility grid and the security of an emergency backup".*

There's a kind of magic in this claim, which may remind some people of the thrill of being independent from society and the blank faces that one encounters at supply utilities, such as water and electricity.

However, if you distil it down, the Powerwall is just a battery, made up of lithium-ion cell phone-type batteries, which are connected in series and parallel and put into a box and hung on a wall. Given time and a soldering iron, I could make you one in a day. The simple fact is that unless you want to have a home that runs on dc power, the Powerwall has to incorporate a dc to ac inverter that can synchronise with the grid if you want to make toast or use the iron.

However, after years of stiff resistance by the general public to any connection to the grid using a generator, solar panel, wind turbine and so on, most municipalities have finally accepted that there are people who would like to generate their own power; and the only stable, reliable way to do it, is to connect it to the municipal grid.

The reasons that municipalities have put up stiff resistance to this concept is one of safety.

If you de-energise a power line to work on it, it would be very unfortunate if the powerline became energised while you were working on it – and, potentially, this could occur if the power from a private generator (or other sources) was fed back into the grid. This problem is reasonably avoided by adopting the old concept: "Always earth equipment before working on it and the only earth you can trust is the one you can see".

Having accepted that private generation will occur (it is now called 'embedded generation'), there are a whole lot of guidelines that have been published, which contain recommendations from NRS and various municipalities.

This is where the paint hits the carpet.

The NRS guidelines are translated from some or other European language, probably French. Now, French may be the language of love but it's not the language of engineering when it's directly translated into English.

The relevant document is *NRS 97-2-3: Grid connection of Embedded Generation, Part 2: Small-scale embedded generation, Section 3: Simplified Utility Connection Criteria for Low Voltage Connected Generators.*

We read from paragraph 4.6.1 (a): *"The proposed criteria ... have been guided by (a) the approached used in other countries and utilities, as informed by work within Cigre ..."*

Ah. "... *informed by ...*" What does this mean? How about: Para 4.6.2 (c): *"... the maximum change in LV voltage (due to voltage drop/rise in the MV/LV transformer and LV feeders) due to embedded generators is limited to 3%. This is a common international practice where the generation is variable. This will ensure voltage changes due to short-term variations in generation output are within acceptable limits for example every time there is a cloud transient the LV voltage should not vary by more than 3% (as photo voltaic output changes). It is important to note that the generation supplies loads that would otherwise be supplied by the utility network ..."*

If I had written this, my English teacher, Mr Hugget, would have asked if it was inspired or just made up. Cloud transient ...?

Here is some advice to electrical contractors: Do not confuse yourself by reading these standards. All electrical installations that operate at 50 V or more have to be installed by a registered installation electrician and all have to have a Certificate of Compliance.

Leave the rest to the self-appointed experts but remember, you take the responsibility if it goes wrong.

Oh, and finally, most alternative energy components can't take high voltages. So, if you want to use a high voltage tester to test insulation ... rather don't.

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