PowerON Technology

WE STRIVE FOR PERFECTION

Grid forming technology.

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When faced with a microgrid design, among many other, there are two challenges that stand out:

- First is the smooth and uninterruptable transfer of power between sources, especially when using the utility grid as one of the sources.
- Second is the keeping synchronization between the sources.

Conventional microgrid control uses voltage and frequency droop to locally control the flow of power from sources. This is a difficult situation to manage in practice and places limits on the relative power rating of sources.

Over the last 12 years we have been involved in various aspects of renewable energy and microgrids, and developed a solution that overcomes these challenges in a cost effective and reliable way. Using proven off-the-shelf components, a modular containerised solution has been developed.

We incorporate all aspects required for a microgrid into this solution, including some innovative concepts, such as

- DC protection to cope with the hidden fault found in DC reticulation.
- Diesel generator optimization, including aftermarket fuel and oil filter systems and battery storage to always operate at or near full load with the Diesel generator and reduce fuel consumption (kVA per liter)
- Seamless power flow control from various sources without the need for voltage and frequency droop type control.

Our solution is a grid former, that can be used for new and existing installations.

For example, it can be used with grid tied PV installations to enable the PV installation to continue operating during power cuts, without any switch over dips.

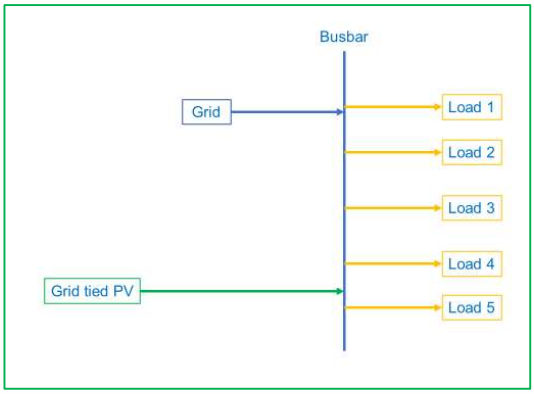
Because the design is modular, it can be expanded without limit to meet increasing power

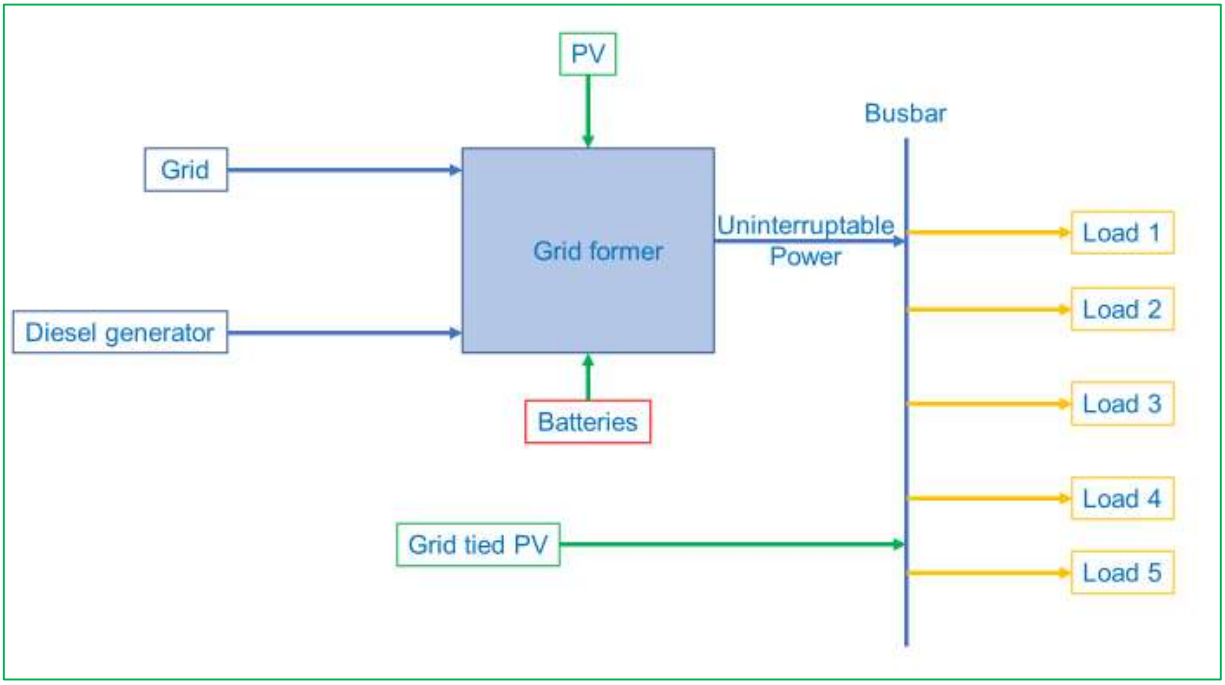
Here we illustrate how the grid former is used to turn an existing grid connected installation with grid tied PV into a microgrid:

This diagram on the right shows the installation consisting of a bus bar that is fed from the grid and grid connected PV.

The load connections are shown to the right.

The problem is that when there is a power cut, the grid tied PV shuts down as well and the installation is without power, despite an investment in on-site grid tied power generation.





The grid former is connected to the bus bar where the grid connection used to be, and supplies uninterruptable power to the installation, with no switch over.

The grid tied PV continues to power the site, even if the grid falls away.

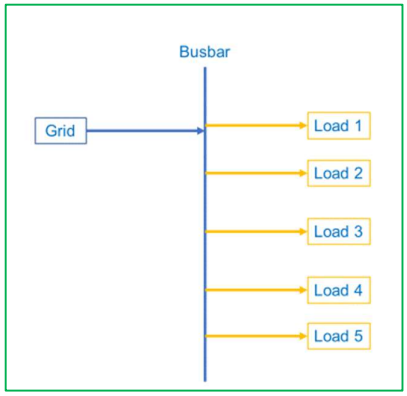
There is no problem adding sources like additional PV, batteries, and Diesel generators of any power rating, unlike with conventional microgrids where voltage and frequency droop control requires limits on the power ratings of the various sources to ensure stability.

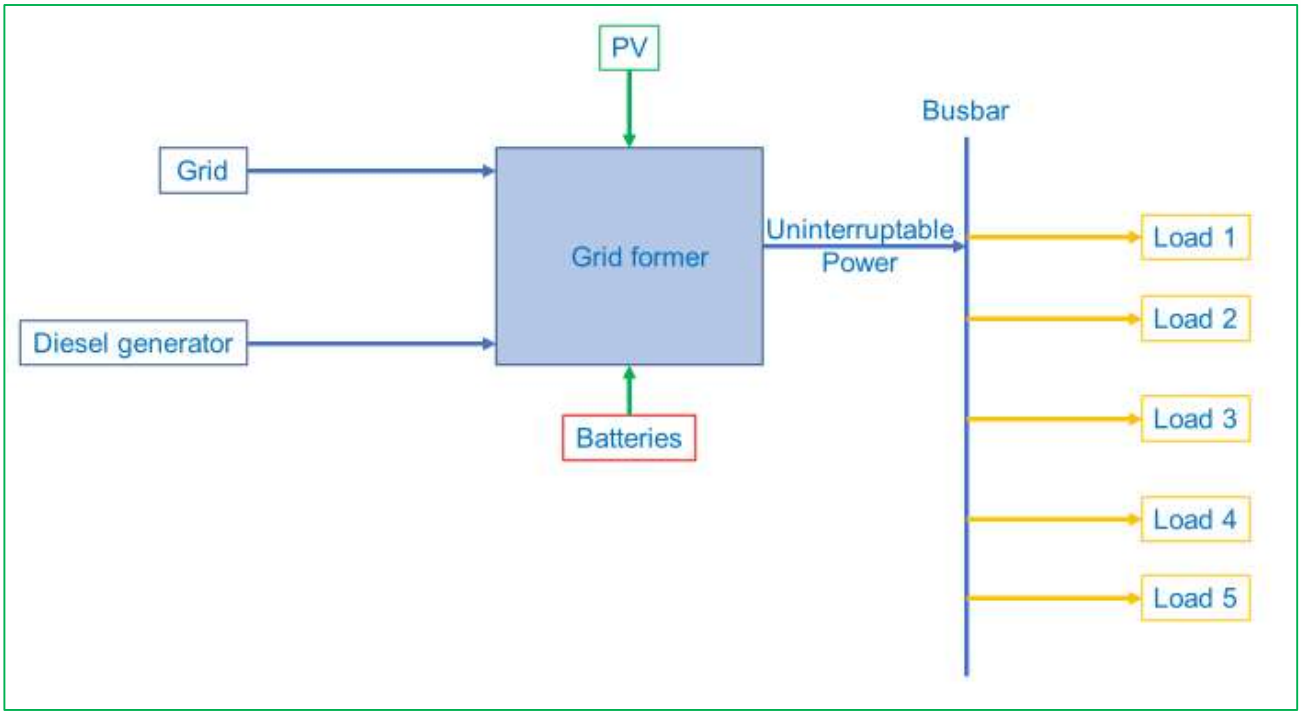
Here we illustrate how the grid former is used to turn an existing grid connected installation into a microgrid:

This diagram on the right shows the installation consisting of a bus bar that is fed from the grid.

The load connections are shown to the right.

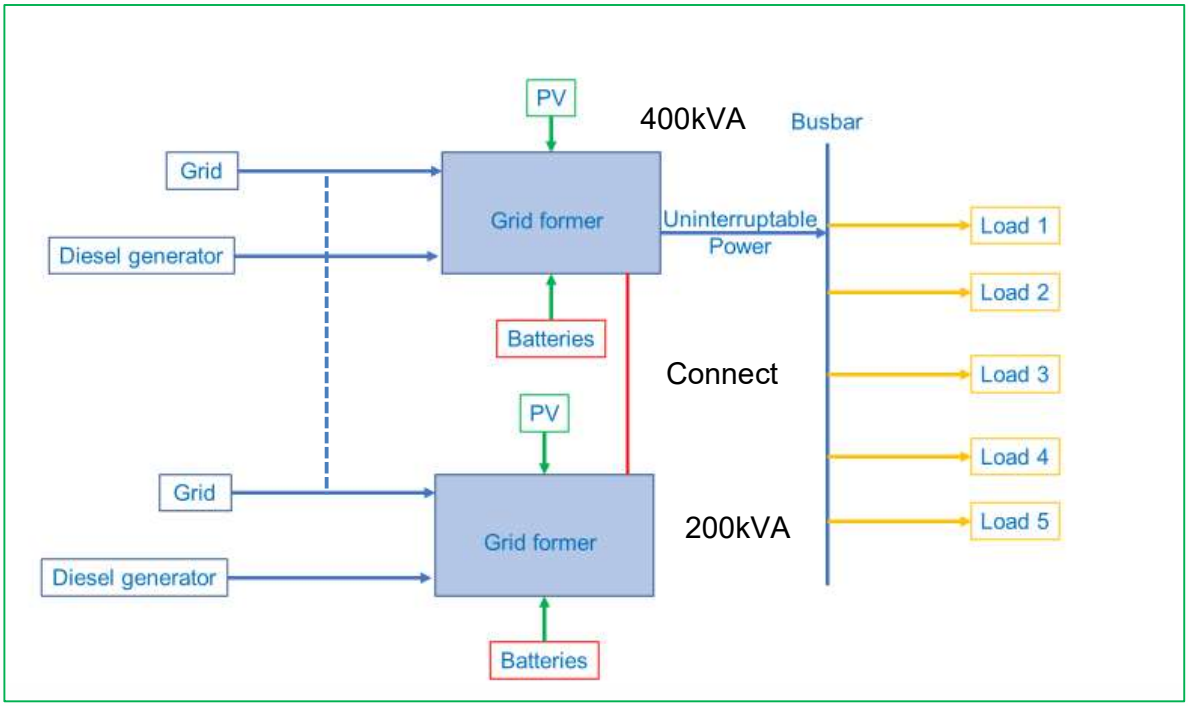
This is a typical industrial or commercial reticulation found on many sites.





This is how the power rating is expanded. The first unit is a 400kVA unit and the subsequent unit is a 200kVA unit that connects internally to the first unit.

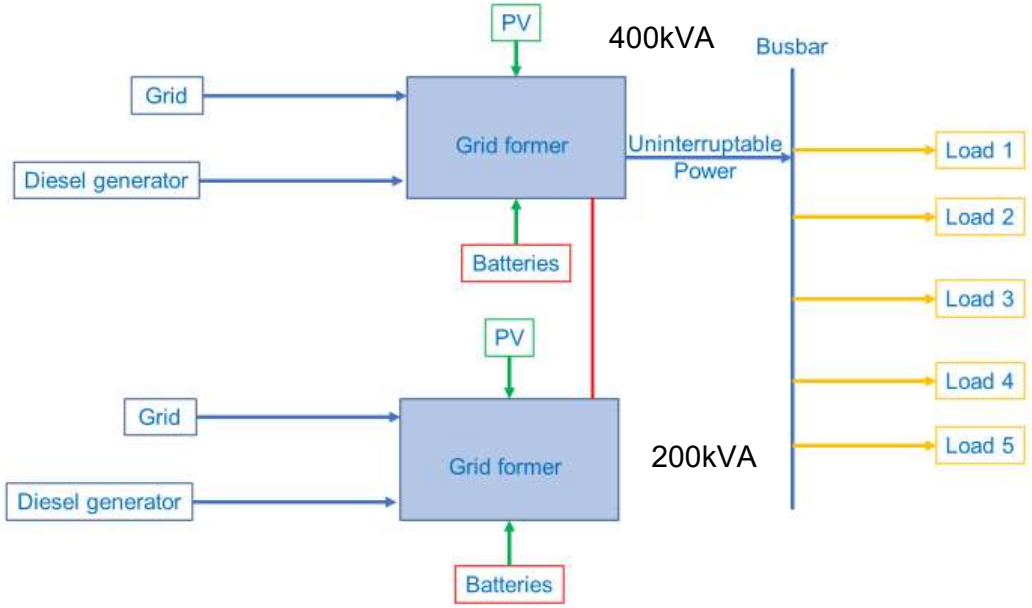
There is no synchronization needed.



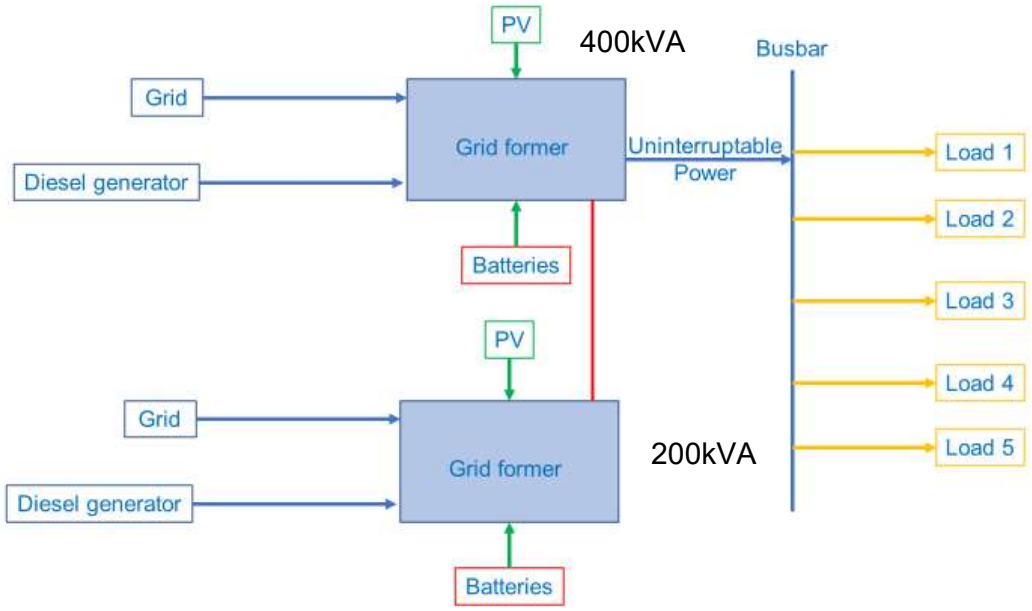
The second 200kVA unit can be connected to a separate grid connection or in parallel to the same grid connection as the first 400kVA unit, provide that the grid connection has a capacity of 600kVA. This connection is shown by the dotted line.

Expansion is in blocks of 600kVA, starting with a 400kVA unit, and then adding a 200kVA unit. Each 600kVA installation is connected to its own separate bus bar.

First installation of 600kVA



Second installation of 600kVA



Features and benefits:

1. Benefits of DC microgrid but with AC reticulation and AC sources,
    a. No need for synchronization of sources.
    b. Automatic power flow control, blends power from various sources seamlessly and without dips.
    c. No limit on the power rating of additional sources, like additional PV and batteries, which is usually the case with microgrids (for example 33% Diesel Generator and 66% PV is usual for a microgrid)
2. Is used with conventional AC reticulation, no rewiring of the site.
3. Turns site with grid tied PV into microgrid that operates through power cuts.
4. Retrofit to existing installation to make it resilient against power cuts and add renewable on-site generation in combination with Diesel Engines.
5. Optional conversion for Diesel generator to operate from 50% LNG/CNG and 50% Diesel or 20% Hydrogen and 80% Diesel.
6. Aftermarket on-site fuel and oil filter to extend service interval from typically 500 hours to 2000 hours and improve the fuel and oil quality that is delivered on site.
7. Advanced DC reticulation protection against the hidden or blind spot fault that exists in DC power generation and reticulation.
8. Use off-the-shelf proven building blocks integrated in new and innovative way.

More detailed material is available on each of these aspects on our website and Youtube channel (https://www.youtube.com/@powerontechnology2767).