

SOLAR ENERGY

A LOOK AT LOAD-SHARING HYBRID SYSTEMS

The rapidly increasing demand for energy in developing countries such as Lebanon, Bangladesh, China, India and Pakistan is creating a large and growing market for off-grid power systems. The electrification of rural or remote areas within these countries is problematic as many do not have the infrastructure to supply grid energy and investment into developing their networks does nothing to solve the immediate demand. It is often found to be cost prohibitive anyway, with some countries having additional challenges to consider. Independent hybrid power systems that maximise the use of readily available renewable sources, such as PV (Solar), in conjunction with generator sets is fast becoming a popular solution. Other countries are also switching on to the benefits of utilising PV in hybrid systems to help meet government green energy initiatives.

Looking to the future and the upward trend for continued growth in this sector of the energy market, it is time to consider the implications of load sharing two totally different power sources and learn how to simplify the merging technologies.

This paper identifies areas formerly thought to be problematic or complicated, and de-mystifies the subject using proven techniques and smart new age technology from DSE. We also take a look at how to maintain minimum fuel consumption from the genset and maximum utilisation of the renewable energy to meet modern energy targets.

Hybrid load sharing installations no longer need go hand in hand with the minefield of complex system design or specialised engineering resources. DSE's innovative control solutions offer a user-friendly control solution which helps to simplify system design and removes many of the myths and barriers to operating within the hybrid market.

There is no reason why renewable energy inverters cannot be paralleled with generator(s) in exactly the same way as they would parallel with the grid supply, however there are a few key points that must be considered.

Using a suitable genset control module from the DSE Genset® range offers all the usual sophisticated functionality associated with the product but until recently linking this to an inverter based system, while possible, has been complex. Now the alternative easy solution is to use a DSEM870 which has the ability to communicate with the DSE Genset® control module and the inverter and, depending on the information received, will regulate the inverter output accordingly.

SETTING THE INVERTER TO FIXED EXPORT

The inverter would be set for fixed export up to the appropriate maximum level, with the generator(s) set in Frequency Control mode to automatically provide the remainder of the power. Output from the renewable energy source will inevitably fluctuate up to the pre-set limit through changing weather conditions caused by climatic or seasonal changes etc., and so the load on the generator(s) would also fluctuate, automatically taking a smaller share of the load in favourable weather conditions.

However, be aware - the system will become unstable if the load on the generator falls below a specific kW loading, leading to the generator shutting down. This can be as much as 30%* of the genset capacity.

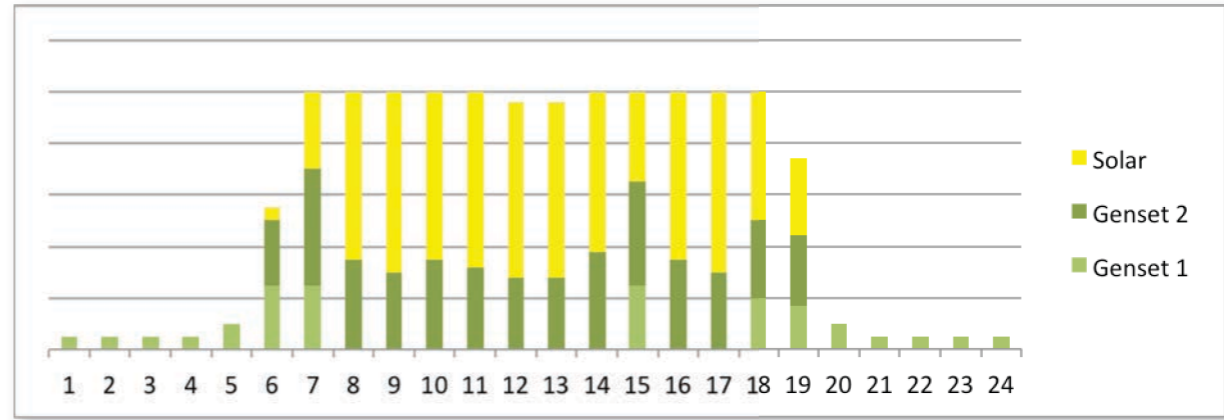
*All generators have different minimum load requirements affecting reliability, running efficiency, emissions etc. Manufacturers' specifications must be checked to determine this requirement.

ENERGISING THE BUS

If the bus is not energised by a source other than the inverter, the inverter cannot produce any power, so the generator is used to keep the bus live.

An effective way to deal with this issue is to use a multi-set load sharing system with generators of different sizes so that when changes to the load occur or power from the inverter changes, individual generators within the system are automatically started and brought on line or powered down.

Looking for an alternative way to energise the bus can lead to massive investment into such as large batteries, which on top of the cost has a poor carbon footprint and life span. So the choice of system components must be carefully considered and balanced against the needs of reliability and efficiency.



EXAMPLE: 24 HOUR PERIOD IN A SOLAR HYBRID INSTALLATION

The factory's main hours of operation are between the hours of 7am and 7pm with minimum power needed overnight for maintenance and security equipment. During daylight hours solar provides up to 70% of their energy requirements.

In the solar hybrid example above, the factory runs one small genset overnight at 62% of its capacity, providing 100% of the load for security lighting etc., while the second larger genset is at rest. In the morning the DSEM870 starts up the second genset and they run in parallel ready for the factory start-up. When solar power becomes available, the dependency on the gensets is reduced accordingly, but never falls below 30% of their capacities ensuring maximum use of the Renewable source while maintaining stability of the system. The gensets continue in Load Demand Scheme mode, a built in feature of the DSE control module. The smaller set is shut down once the factory is at full load and the inverter output is sufficient, but can be easily brought on line if or when required.



The DSE Genset® controller best suited to load sharing applications as described above is the DSE8610 MKII.

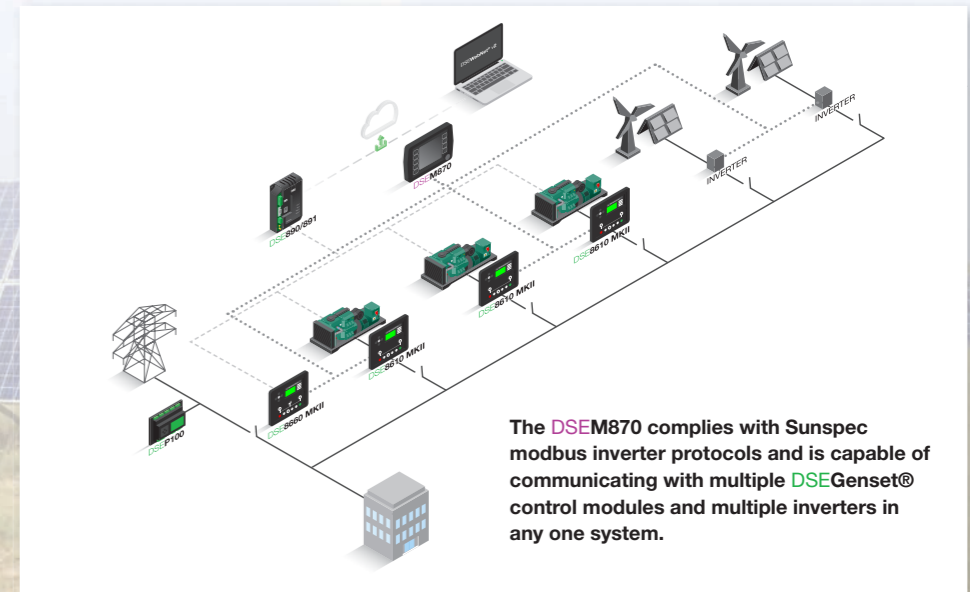
REVERSE POWER

If all of the above steps are taken to ensure the system is running as described, the following situation should never occur, but is something to be aware of.

It is essential to ensure the load does not fall below the output level of the inverter to avoid the genset(s) being driven into reverse power, leading to a trip and subsequent black out. In this scenario if the load were to drop, the DSEM870 is capable of reducing the amount of solar power being produced to an appropriate level or issuing instructions to switch the load entirely to the genset if necessary.

automation of the hybrid system. Sunny climates where solar energy is reasonably predictable lends itself very well to this type of application and is fast becoming popular, but hydro, wind and other Renewables can also achieve good results.

For more information please refer to the DSE website: www.deepseapl.com



The DSEM870 complies with Sunspec modbus inverter protocols and is capable of communicating with multiple DSE Genset® control modules and multiple inverters in any one system.

