SHIFTING THE LIMITS

TECHNICAL ARTICLE

A distant dream or today's reality?

Requirements for inverters in large photovoltaic systems

Every major project essentially consists of a number of solar modules, cables and inverters – just like any system in the residential sector. What is it then that makes these projects so special, so challenging and so complex? A range of regulatory requirements makes project management more complicated. Further challenges are posed by system monitoring and the ever-present cost pressures, not to mention having to make a decision as to whether to employ a centralised or decentralised topology. Notwithstanding the above, what we can state with absolute certainty right from the start is that every project is unique. Inverter manufacturers in particular must be equipped to cope with this wide variety of potential solutions.

The sector is agreed on one thing: the selling of hardware alone will in future not be sufficient for a provider to acquire a relevant role in the market. The phrase on everyone's lips nowadays is system costs, or to be more precise, investors, system operators and, further down the line, project managers, are now thinking increasingly in terms of the “Levelized Cost of Energy” (LCOE). This means that in business case calculations, all aspects of the project, starting with the costs associated with installation, operation and maintenance, right through to dismantling costs, will be taken into account.

Understanding the Levelized Cost of Energy

The challenge for an inverter manufacturer is therefore to understand the LCOE. Appropriate hardware components and services have to be developed that will help plant operators reduce their overall costs over the entire product life cycle. Fronius demonstrated how this can be done in 2015 with the Fronius Power Package. This system solution combines the inverters with a perfectly matched AC combiner. The preassembled cables simplify the installation process, consequently minimising the number of errors and enabling installation times to be shortened and costs reduced.

Save costs while maintaining quality levels

Another increasingly important point to be borne in mind is the ability to install system components in the inverter, thus doing away with the need for additional DC boxes. Every DC box that does not have to be installed saves the system operator money in terms of hardware and installation costs. It is for this reason that the Fronius Symo and Eco series, for example, are supplied with an integrated surge voltage protector type 2 and a combined arrester type 1+2 as an option. The Fronius Eco is also equipped with integrated string fuse holders for the optional fuses. These features save time and money whilst maintaining the usual high levels of quality.

View every project in its entirety and individuality

As mentioned at the outset, every project is unique. The requirements that apply to a major project in India will not necessarily apply to a project in Great Britain, and vice versa. To develop a device that covers all eventualities is, due to the pricing structure, no longer a practical option. Product variants must be provided. For example, projects requiring a great deal of flexibility in the input voltage range will place special requirements on the software. Special attention also has to be paid to serviceability. The possibilities are endless, which makes it necessary to view each project as an entity.

Focus on the individual customer benefits

Individual customer benefits have become the focus of our attention. The Fronius Symo and Eco platforms provide the necessary flexibility, something that has already been touched on above. Both products share the same installation, data communication and service concept. With its broad input voltage range and two MPPT (Maximum Power Point Trackers), the Fronius Symo epitomises flexibility, while the Fronius Eco, with its high level of efficiency, provides a cost-efficient solution. Combining the advantages of both devices represents the ideal solution for a wide range of requirements.

High demands placed on data communication

The demands placed on data communication are becoming increasingly multifaceted. Open- and closed-loop control requirements, e.g. reactive power compensation, zero feed-in or dynamic effective and reactive power control for local grid backup, are already minimum requirements for a grid connection in most distribution or transmission networks. The direct marketing regulations that came into force in Germany on 01.01.2016 stipulate that an interface to the direct marketer must be offered from as little as 100 kW_{peak}. In future, it will not just be plant operators and distribution grid operators who have access to the system; the ability to access and control a system will also be available to the energy trader. This is a major challenge from a software point of view. One of the consequences is that third-party components will be more widely employed in the future. It is therefore important to provide open interfaces and ensure compatibility.

The ability to provide open interfaces, for example to Solarlog or Meteo Control, is also an important point in terms of the visualisation of system data. Many plant operators are already using these well-established market players or their own visualisation software. The FTP Push service provided by Fronius enables system data to be integrated into these packages without any problems.

Keeping an eye on the total system

What affects the software in particular are the different standards requirements and the various installation conditions in the individual markets. One example that can be quoted here is the Fire Department switch-off for the roofs of commercial properties in the USA. NEC 2014 stipulates that there must be a shut-off device in the vicinity of the module array that can isolate the entire string in the event of a fire, or that does so automatically as soon as the AC power supply is interrupted. Inverter manufacturers were therefore obliged to develop solutions that would be able to satisfy these safety requirements. As a result, Fronius developed its own Rapid Shutdown Box. This is another situation where the uniqueness of the projects and markets makes it essential to concentrate on the entire system and the prevailing conditions, rather than just on the inverter.

Storage systems play an increasingly important role

A distinction always has to be made between “behind the meter” applications, such as “peak shaving”, and “in front of the meter” applications, such as control power output for grid backup. At present, it is impossible to tell which type of application will prevail in the future. “Behind the meter” applications will certainly remain the domain of conventional inverters, while grid services may possibly be implemented by highly specialised manufacturers of large storage systems. In any event, it will become increasingly important for inverter manufacturers to familiarise themselves with the various applications and their requirements and to offer specific solutions to the market. Fronius has recognised this trend and, as part of its “24 hours of sun” campaign, released the Fronius Energy Package, the first customised storage solution on the market.

1500 V – to be or not to be?

Leaving the best till last, we now need to take a look at the small matter of the 1500 V question. In terms of the LCOE, a central topology is clearly the preferred choice for a 1500 V project. This means that the inverter would be located centrally and that most of the cabling will be direct current. In view of the high system voltage, the produced energy can be transported through the array with less loss than on the alternating current side. However, we return again to the old mantra: every project is unique. In this case, the project manager must weigh up whether the additional costs associated at present with 1500 V modules make up for the lower cabling costs and reduced losses. The first 1500 V projects implemented with central inverters are now in operation across the globe. Internal studies carried out by Fronius lead it to conclude that there is no advantage for customers involved in major projects in using 1500 V technology for string inverters as well.

Summary

In conclusion, it is fair to say that inverter manufacturers will in future also have to focus much more on product diversification and customised solutions. System concepts are becoming increasingly important and must help the project manager reduce his LCOE costs. Products will have to be developed that can satisfy the most varied data communication requirements, offer compatibility with third-party providers and address the differing installation requirements of the various markets. Storage will also play a decisive role in major projects. Every project is unique, and it is up to the respective inverter manufacturers to offer unique, flexible solutions.

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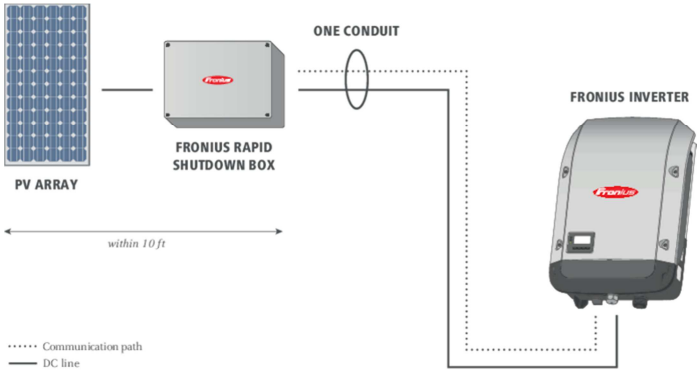
The Fronius Power Package system solution combines the inverter with a perfectly matched AC combiner.



Fronius has developed its own Rapid Shutdown Box to meet the requirements of NEC 2014. This shutdown device is installed in the vicinity of the module array and isolates the entire string in the event of a fire.

Every project is unique, and it is up to the respective inverter manufacturers to offer unique, flexible solutions.

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About Fronius International GmbH

Fronius International GmbH is an Austrian company with headquarters in Pettenbach and other sites in Wels, Thalheim, Steinhaus and Sattledt. With 3,385 employees worldwide, the company is active in the fields of welding technology, photovoltaics and battery charging technology. Around 91,5% of its products are exported through 21 international Fronius subsidiaries and sales partners/representatives in over 60 countries. With its innovative products and services and 928 granted patents, Fronius is the global innovation leader.

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