Enviable growth spurs on control technique specialists

Andy Green has worked for Emerson Control Techniques for 25 years, holding various positions including those of Systems Sales Director and General Manager. For the past three years, in the position of Industry Development Manager – Solar Inverters, he has channelled his knowledge of grid tie inverter applications in support of Emerson's goal of becoming a leading player in the central inverter market.

PES: Welcome back to PES. Can you tell us a little about how the company has been performing this past year and if you have unveiled any major product/service developments?

Andy Green: 2010 was another year of outstanding growth for our PV business driven primarily by continued penetration of the utility-scale PV inverter market with our SPV inverter systems which we launched in 2009. To service the demand for these products we have expanded our manufacturing facilities in Central Europe and we anticipate additional capacity being brought on line in Asia and the Americas during 2011.

PES: When the company last appeared in the magazine you told us about your transformerless central inverter system for utility-scale photovoltaic power plants. Can you tell us a little more about how this and about how sales are progressing?

AG: Our SPV inverter systems offer a range of transformerless central inverters from 145kVAp to 1.59MVAp. With the exception of the smallest power ratings in the range, each inverter is constructed from multiple standard 175kW power modules which are mass produced and derived from modules used in industrial motor control applications. This approach has given us a very robust and reliable inverter solution that has been extremely well received in the market.

PES: You also say that the inverter solutions 'enable investors to exceed their return on investment expectations through high-yield inverter systems'. Can you tell us a little about how they can achieve this?

AG: A PV inverter - be it central or string - can appear as a bottleneck to a PV plant if the system is poorly engineered. A Central Grid Tie inverter, such as the Emerson SPV product, has three principle effects on the total PV plant yield.

1. System losses

In other words, how efficiently does the inverter convert the available DC power from the PV modules to grid quality AC power? Losses are attributable to switching and conduction losses inside the inverter and associated components such as filters, cabling and fuses. Efficiency, as a function of load, generally follows the red curve in the graphic. Emerson SPV inverters, using their novel Master-Master approach, achieve significantly higher operating efficiencies at low loads, shown by the green curve. The Intelligent Inverter Control system matches the optimum inverter capacity to the solar load presented by the PV modules, therefore only the losses that are absolutely necessary are incurred. The area between the red and blue curves represents increased revenue if Emerson inverters are utilised.

The DC power available to the inverter can be optimised by minimising the losses exhibited by DC cabling. The obvious way to do this is to increase the size of the DC cables between the modules and inverter to minimise the voltage drop. However

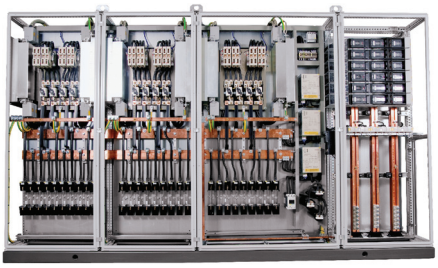
this represents an increase in cost. An alternative is to operate the whole system at higher DC and AC voltages by increasing the PV module string length / DC voltage which can lead to reduced cable losses. More importantly perhaps is, at a higher AC system voltage the inverter size, which is nominally rated at 340VAC, can decrease proportionally with a corresponding reduction in price or quantity

2. Maximum Power Point tracking (MPPT) The instantaneous power presented to the inverter is not only a function of light intensity hitting the active material in the PV module, less the DC cable losses, but also of the ability of the inverter controls to detect and operate the PV modules at their maximum power point or MPP. There are many types of MPP trackers available ranging from simple hardware implementations to sophisticated software-based systems. The hardware platform, the software algorithms and importantly the instrumentation used on the SPV enables the class leading tracking of the maximum power point and hence optimum real power delivery to the grid. Accurate control of reactive power is also available.

3. Inverter System Availability

This is easily overlooked. However it has the most important effect on the overall plant yield. What are the chances of an inverter fault occurring, how long to recover from the fault and what are the consequences on plant profitability, should the worst happen? Take a moment to place a value on one day of total failure and relate that as a percentage of inverter cost. Not unreasonably you could multiply this by the life expectancy of the inverter in years and typically 20 per cent of the capital cost of the inverter is returned. Traditionally those who consider such scenarios tend to opt for smaller inverters in larger quantities thus the loss of any single inverter is seen as less catastrophic. This is balanced by an increased likelihood of failure due to the number of inverters deployed and by increased cost per kWp of the inverters. In reality this means that there is actually no increase in availability but a large increase in cost from the additional inverters, shelters, medium voltage switchgear, transformers MV cabling to each inverter, access roadways and additional SCADA connections.

An alternative is the Emerson Master-Master approach in which there are relatively few points of common failure, allowing the plant designer to select a smaller number of higher power inverters to benefit from best cost per kWp, with corresponding reductions in balance of system equipment. Take for example the SPV2700 (1590kVAp) which internally has nine parallel connected inverter modules. Should an inverter module failure in the SPV2700 arrangement, it is automatically isolated from both the AC and DC power sources and the system continues to operate with peak capacity reduced by 11 per cent or 175kWp. Depending on the ratio of DC kW to AC kVA the loss of a small amount of capacity may not impact at all on production of kWh.



PES: We note you're ultimately-based in St Louis, Missouri – how do your international offices fit into the bigger picture, and what is the market like in Europe?

AG: Emerson's direct presence in 45 countries worldwide and many more indirectly is significant as we drive our solar growth programme. Importantly we're not setting up a new office, training new people and installing new business systems as we already have most of the necessary business infrastructure in place. Additionally the inverters used in the SPV product are the same as those already used in thousands of industrial automation applications giving us a huge base of project execution experience around the world.

PES: How much significance does Emerson place on R&D?

AG: The pursuit of technology leadership is one of four business imperatives at Emerson that serve as the foundation for steady growth and drive our organisation. The success of this focus is clearly indicated by the fact that overall in Emerson new products represent 37 per cent of our total sales.

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Andy Green,
Industrial Development Manager – Solar Inverters

PES: There's been a good deal of talk lately about the recession, especially in Europe. Have you noticed any adverse effects of these current economic trends?

AG: The general economic slow-down does not appear to have had any significant impact on sales of PV inverters at all. Importantly, investors in PV plants appreciate our solution and in the first full year following the launch of our SPV product we achieved sales exceeding more than twice our already ambitious sales plan. The year 2011 is shaping up in similar fashion with sales expected to more than double again. With increasing oil prices and uncertain supplies due to Middle East instability, the rush towards renewable energy sources and in particular PV seems set to continue.

PES: What kind of after-sales support do you offer your clients?

AG: After-sales support provides an insurance policy for the user and a revenue stream for Emerson. Beyond our standard warranty we can provide service contracts with availability guarantees for up to 20 years. The strong trading history (in part bankability of Emerson) provides a great deal of comfort to the investor that obligations will be honoured over these extended time periods.

PES: Do you offer a one-stop solution for your clients or can they go for a more custom-built approach from you, if required?

AG: Our scope of supply always includes a grid tie inverter. The inverter can be customised in several ways including supply voltage, protection and disconnection and of course relevant equipment to meet local grid codes. Beyond the inverter we optionally offer the inverter shelter with medium voltage switch and transformer, SCADA, UPS, metrological instruments and String Connection boxes. Of course a full range of services are available including commissioning, monitoring, preventative maintenance and repair.

PES: We note you say your CT modular solution offers longer service life. Can you tell us about how it achieves this and what advantage this gives you over your competitors?

AG: This is a feature of the Master-Master concept. Firstly only the capacity required is operational at any one time. An important objective of the control system is to minimise losses from the active inverters, and this is achieved by ensuring that the operating points allow the electronics to run as cool as possible. Secondly, a Rotary Master concept is imposed upon the Master-Master control. This means that the first inverter module to start up in the morning is cycled every day. Both of these features ensure that the inverter is exposed to the least operational time with a corresponding improvement in life expectancy / reliability. ■

About the company

Emerson (NYSE: EMR) is a diversified global manufacturing and technology company, which offers its customers worldwide a broad range of products and services in the areas of network power, process management, industrial automation, climate technologies, and tools and storage businesses.

Recognised widely for its engineering capabilities and management excellence, Emerson has approximately 127,700 employees and 240 manufacturing locations around the world. Based in St Louis, Missouri (USA), the company is a global leader in bringing technology and engineering together to provide innovative and imaginative solutions for customers in industrial, commercial, and consumer markets through its network power, process management, industrial automation, climate technologies, and tools and storage businesses.

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