Energy Savings in Intelligent Management Systems for Solar farms

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Small, low consumption power supplies are critical for alternative energies

The formerly “green” energy efficiency topics are now a main stream issue – and not just post Fukushima. Solar and wind power continue to gain ground as alternatives to fossil fuel energy.

New technologies in both control systems and power modules allow these new methods of energy harvesting to be more efficient, to generate cleaner power and at the same time reduce the costs of implementation and maintenance by using low energy / low consumption management devices.

Solar farms
Solar power plants, or solar farms as they are commonly called, require thousands of photovoltaic (PV) cell panels collecting the Sun’s energy and transforming the DC voltage generated into AC voltage that can be connected back to the grid to provide clean energy.

The size of the solar power plants is large, since each panel can only collect a limited amount of power, but it is still small compared to the size needed for hydroelectric dams or coal power plants.

A dedicated management system is required to transform the collected energy into usable AC voltage, through centralized inverters or micro inverters, and to monitor and optimize the transfer of energy. The more efficient this management system is, the more productive and efficient the power plant will be.

Solar power management systems
In the Alternative Energies market, control and energy savings together are critical for the success of implementation of these alternative power source solutions. Solar power is becoming more common to the landscapes but besides the green energy that they generate and the long-term return in investment, the short-term return in investment is also something that should not be overlooked.

All control devices essential for the intelligent management of a solar farm grid still require offline power to operate. Control over all the components involved in solar energy harvesting is necessary to optimize the power generated over all conditions through the day: the PV panel, the inverter, the grid, etcetera.

An effective independent management device, as opposed to a centralized management device, can increase the productivity of the solar panel by over 10%. For the success of a local, independent management system the power consumption of these devices must be very low to optimize the output power generated in the solar farms.

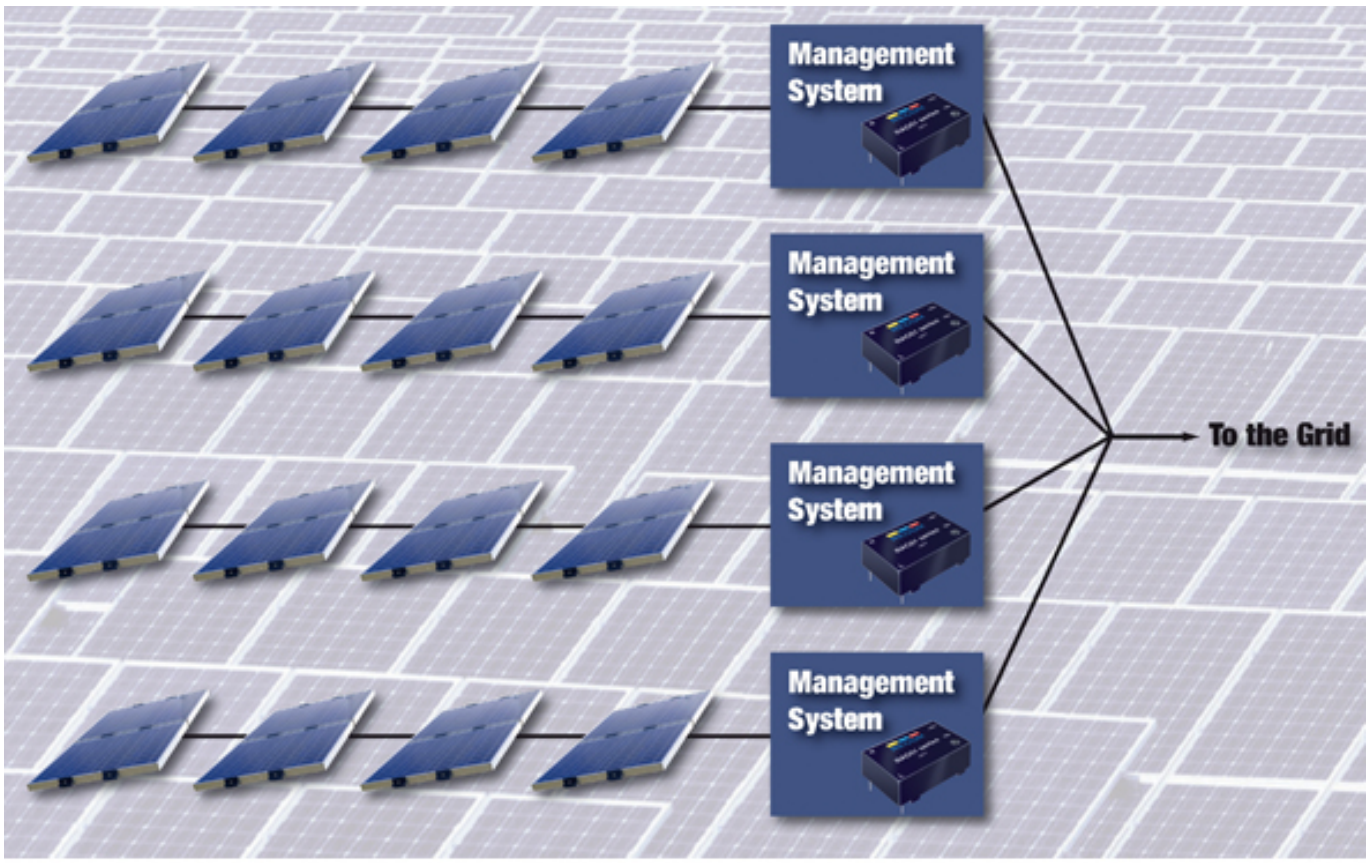

Figure 1: Diagram block of a simple localized intelligent management system in a solar farm

Low consumption power supplies

One of the critical components in the management systems is the power supply required to operate the control boards. A range of 1W up to 10W of power is required to control the different internal components. A larger switching power supply would substantially exceed the allowed consumption limits and conventional linear regulators are completely out of the question as their efficiencies are even worse. The answer is new low consumption power supply modules that are now available, which include all safety regulations, limit electro-magnetic interference and provide long reliability in compact packages, such as the RECOM Power RAC01 or RAC06 series.

Figure 2: RECOM´s 1 Watt AC/DC-converter RAC01 has a no-load consumption of only 30mW. The 6W-module also is significantly below the standard consuming only 250mW.

A wish list fulfilled – Reliability and efficiency for a no maintenance module

Another step forward in the adaptation of solar technology and their advanced management systems is increasing levels of efficiency and a reduction in the maintenance costs associated with the internal power supplies. In solar systems scales of efficiency are vital especially if you can achieve higher percentages of power savings per system string. Multiply this across multiple converters for several strings of management services and that starts to add up! The new systems are also integrating separate wireless communicators that allow for the units to communicate to each other and the grid which also individually require power modules. With so many modules the energy waste could quickly spiral out of control.

With the amount of units and in turn modules in a solar farm, high reliability is also a key decision making factor. A series of malfunctions could spell disaster and disrupt many of the careful calculations that go into the assessment of the payback period for the investment in these projects. This is why power modules today are such a great option not just because of the efficiency but also their proven reliability in the field and extensive warranty.

When considering the number of panels and controllers clustered together electro-magnetic interference can become a concern. However, a converter module like RECOM’s of the RAC-series has an integrated potted “Class B”-filter. Interferences are therefore eliminated right at their origin, so that the filter components needed are considerably smaller than those used for external solutions. This positively affects also the no-load power - using a complete module also eliminates the need to purchase components and carry out EMC-testing.

High life expectancy - 3 years warranty
The new RECOM AC/DC-modules were designed for many years of trouble-free operation. For the two small ones - the RAC01 resp. RAC02 a MTBF to MIL-HDBK-217F of >1 million hours has been specified. All types are isolated to 3,75kVAC/1 minute, are short circuit protected as well as against over voltage and overload. The ambient temperature can reach +85°C (RAC01) without derating.

Being a European manufacturer with a global orientation, RECOM only uses high spec. components. Already during various stages of their design, sub-assemblies are extensively subjected to “HALT”-tests. For this purpose RECOM set up an “Environmental-Laboratory” in Gmunden/Austria, in which production is continuously monitored on a sample basis. All converters carry a 3 years warranty.

Conclusion
An efficient and intelligent alternative energy power plant, such as solar panel farms, requires more than just good PV cells to capture the Sun energy. The management of that power and the ability to convert it into usable power in the most efficient way is critical to the success of the implementation of solar power in our society.

Localized power management systems versus centralized systems can increase the productivity by over 10% and require low consumption, high efficiency and minimum interference. Therefore, the new low power / low consumption modules like RECOM’s provide the necessary requirements to operate those independent power management systems in the most efficient way.

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