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TECH TALK

Smart controller increases efficiency and lowers costs of small solar power systems

BY GARY BEERS • FOR ENERGY PIPELINE

TECHNICAL INTEGRATION

It was not that long ago, we met our on-the-go communication needs by toting around a camera, portable phone, watch and laptop computer. Since each performed a separate function, we did not expect technical integration into a single communication device — but someone did and the smart phone arrived.

Many industrial activities utilize component systems that do not appear to be candidates for integration, but clever engineers seize upon this opportunity and, boom, there is a break-through consolidated device that provides increased efficiency at lower cost.

TRADITIONAL CONTROLLER

Many upstream operations in the oil and gas industry are in remote locales and rely on combinations of imported electricity, diesel engines, and solar power to supply energy to motors for moving liquids and gases. Recently, an integration of the electrical components of small scale, solar energy systems improved the efficiency of energy production with lower capital and operating costs.

The traditional components of a controller — which transform the energy output (wattage) of a solar panel into power usable by pumps, compressor, and other motors — are shown in Figure 1. These components are made by different manufacturers and, when assembled, occupy a cabinet about the size of a large refrigerator. Each array of components is a custom design based on the type of motor and associated input/output power requirements. Consequently, a change to a different motor will require a modification of the components.

This specificity can be a discouraging factor to operators and their subsequent lack of interest in installing to solar power at a remote pad. They prefer off-the-shelf, simple units that require low maintenance.

SMART CONTROLLER

A smart controller has been developed that integrates the five components into a single system (Figure 2). This universal unit can power any motor independent of phase, voltage, or frequency and works with or without a battery bank. Importantly, this smart device uses only one-half of the wattage capacity required by a traditional controller. For most small solar-energy systems,



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FIGURE 1: TRADITIONAL CONTROLLER SYSTEM

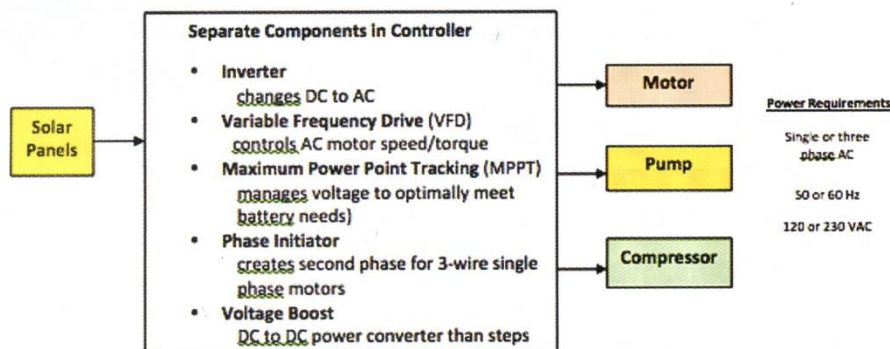
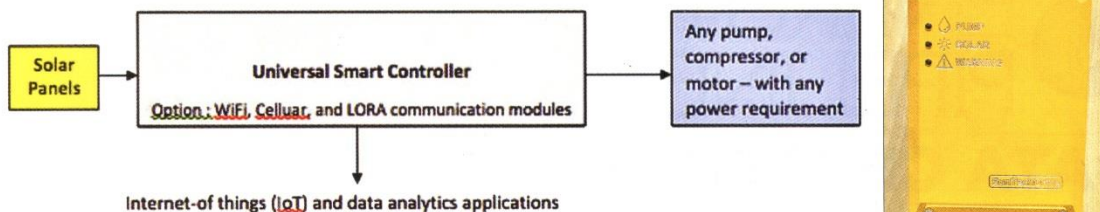


FIGURE 2: SMART CONTROLLER SYSTEM



this lower energy demand results in 50 percent reduction in total project costs and makes this option competitive with diesel power. An example of a smart controller, an circuit board which is housed in a yellow aluminum case about the size of a tissue box, is shown in Figure 3. The circuit board contains high-speed switching silicon, adaptive firmware, connections for wireless communication modules, and connections for external sensors. Adaptive firmware means software is embedded in the hardware and serves to operate the integrated components. This software can be accessed to update the programs, to meet the interface needs of added external devices, and to accommodate any unique needs of the customer. Incidentally, the smart controller contains no moving mechanical parts.

APPLICATIONS IN REMOTE AREAS

While the smart controller only has been recently commercially available, there are many successful off-grid applications in the Third World, especially where solar power is the energy source for pumping irrigation water. This demonstrated performance in remote areas, with increased efficiency and lower costs, is peaking interest in possible application to isolated oil/gas operations.

In a remote area of Wyoming, a small solar panel unit with a smart controller is proposed to enhance the evaporation rate from ponds at a produced-water, disposal facility. With an increased evaporation rate, the functional size of the pond can be significantly increased and results in increased profits. The generated energy will power motors driving arrays of mini-spray units on the pond surface during the warmer months and arrays of subsurface bubblers during the colder months. The operations of these arrays are under the control of the smart controller with sensors that monitor wind speed and direction. As the wind dynamics change, the smart controller optimizes the performance of the arrays. Basically, arrays in the upwind areas of the pond are operated at higher levels than those in the downwind portion of the pond: this serves to limit over-spray.

The efficiency and economy of the smart controller should attract possible use of small solar power systems to pump liquids and gases at oil/gas operations in remote locations.

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