Thermoharvester uses Waste Heat to Power Wireless Industrial Sensors

Micropelt, an innovator in thermal energy harvesting technology, has collaborated with Royal Dutch Shell to prove the concept of converting waste heat into a sustainable, maintenance-free power supply for wireless sensor devices. Shell sees wireless sensor networks as a strong contributor to increasing productivity and lowering maintenance costs through better status information. The concept of energy harvesting eliminates the need for primary batteries in many wireless sensors. Deployment in restricted access or even explosive areas, and those previously considered too costly, become commercially viable if both wiring and battery maintenance can be eliminated.

Shell's team, led by Don Mulder, who is responsible for development and implementation of energy saving new technologies, combined a Micropelt TE-Power PROBE Thermoharvester with an IPS thin film battery to create a buffered perpetual power source for a prototype Rosemount wireless pressure transmitter running WirelessHART, an industrial mesh networking protocol. Don summarizes Shell's field trial, "We assembled the thermoharvester, energy buffer and wireless transmitter in an explosion-proof manner. In our factory in Den Helder we mounted the thermoharvester to a hot water pipe of 75°C (167°F) and the wireless transmitter some feet away. This took less than an hour. The set-up worked flawlessly for the couple of weeks we had it out in the field, transmitting data once per minute to the associated Emerson wireless gateway. We are very pleased with both the easy set-up and reliable function of this novel energy source."

The TE-Power PROBE thermoharvester replaces a primary battery pack of more than 16 amp hours capacity, designed for 5 to 10 years of life. One version of the TE-Power PROBE supports attachment to a heat source via a 1/4" thread, while the

other features a straight copper pin that inserts into a 15 mm T-joint to harvest more efficiently from hot fluids. A temperature gradient of 20°C (36°F) produces 1 milliwatt of harvested power, equivalent to three 2,000 milliamp hour AA cells annually in a 3 Volt system. A 65°C gradient (117°F) leads to 10 times more energy, providing an annual budget of 30 AA cells. "We sincerely hope the instrumentation industry will soon start offering products which integrate Micropelt's energy harvesting technology," comments Shell's Mulder. "The benefit for both existing and new production sites will be invaluable due to substantial cost savings along with largely increased operational flexibility and process optimization."

Micropelt thermogenerators (TEGs) feature an intrinsic voltage-boost effect based on a high resolution thermoelectric microstructure. This makes TEGs as small as 12 mm^2 suitable to drive wireless devices which consume major battery sets over a maintenance period. The smallest standard TEG has a footprint of 6 mm^2, making it an ideal candidate for compact integral wireless and battery-less designs.

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