Brainstorm: Battery Technology

Sol Jacobs, VP and General Manager, Tadiran Batteries

In the future, how will battery technology need to respond to the increased power demands of today's advanced sensors?

Technological advancements are creating a dynamic growth curve for sensors intended for use in remote areas where there is no connection to the power grid. These devices must rely on self-contained power sources that offer exceptionally long life and reliable performance in challenging environmental conditions, able to last for the life of the sensor without recharge or replacement. Batteries made with bobbin-type construction using lithium thionyl chloride ($LiSOCL_2$) chemistry are the preferred choice for

By Joe Keating, Sr. Director, Applications Engineering, Infinite Power Solutions

Since the energy density of battery systems has traditionally increased at a rate that is relatively slow compared to the progress seen in the electronics industry, battery manufacturers have been working to increase all aspects of battery performance. Improvements in battery technology such as the introduction of solid state electrolytes and improved cathode formulations are resulting in batteries with greatly improved cycle life, shelf life and reduced leakage. These attributes allow sensor systems to

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Battery and automotive companies face a number of challenges in the electric vehicle market. For electric vehicles to succeed, batteries must be competitive with the incumbent diesel and gasoline engines used in today's vehicles.

At Valence, we see many positive trends in the electric vehicle market but also near-term impediments. Support for the EV movement is global, with nearly all major automotive companies investing and government entities

remote sensor applications due to their unique performance characteristics, including very high energy density, high capacity, and very low annual self-discharge (less than 1% per year). These batteries are also able to operate in extreme environmental conditions, including a very wide temperature range, and robust design and construction techniques able to survive vibration, humidity and other destructive forces. Lithium thionyl chloride chemistry has been field proven, with sensors in the field still operating for 25+ years on their original battery. Despite this proven track record, $LiSOCL_2$ chemistry cannot remain stagnant, as chemists and engineers are continually refining this technology to deliver the greater power and performance required by increasingly sophisticated, miniaturized and power-hungry remote sensors. As technology marches forward, $LiSOCL_2$ battery technology must continually keep in step.

use much smaller rechargeable batteries by scavenging energy from the surrounding environment and efficiently storing this energy in solid-state storage devices like THINERGY Micro-Energy Cells (MECs), a type of thin-film battery manufactured by Infinite Power Solutions. THINERGY MECs are unique and have unprecedented power and cycle capability, near zero leakage, and are permanently installed for the life of the system, allowing sensor nodes to operate autonomously and without maintenance for decades. The realization by the sensor market that batteries tend to develop slowly, combined with the increasing demand and application of wireless sensors, is also pushing the sensor industry to create sensors and sensor networks that will operate with decreasing power requirements. Substantial gains can be made in most wireless sensor node designs by using low power radio protocols and reducing standby and sleep mode power consumption where most energy is consumed. Therefore, it will be both the continuous improvement in battery performance combined with reductions in energy

providing incentives. While public interest is growing, true consumer acceptance still faces a number of obstacles, including higher up-front costs, length of service questions, performance comparisons, and safety concerns as exemplified by the recent press coverage of the Chevrolet Volt.

I believe these obstacles will be surmounted through new partnerships, continued cost reductions, technological advancements, and enhanced safety measures as standards emerge.

One novel solution to the pricing concern is the “Green for Free” program recently introduced by Freightliner Custom Chassis Corporation and Enova Systems that allows fleet companies to purchase commercial EVs for the cost of a diesel-powered vehicle. With reduced maintenance and fuel savings, over time the incremental cost of the EV is recovered by Freightliner and fleet managers enjoy additional operating savings and avoid the business risk of diesel fuel price volatility.

However, the industry must not sacrifice safety in the interest of reducing

	usage by sensor systems that will allow sensor system designers to meet their power requirements.	cost. Batteries are designed to store large amounts of energy, which can present a risk if that energy is released in an uncontrolled process. To address this concern, Valence employs redundant safety features that include the use of phosphate cathode materials commonly used in fire extinguishers, cell construction safety features built into all cells, and external control circuitry that will not allow the battery to be abused. As a result, Valence batteries have passed independent crush and nail penetration tests. In conclusion, Valence's patented lithium phosphate batteries offer long-life and safety that other lithium mixed metal and lithium oxide chemistries cannot. While there are dozens of 'lithium ion' chemistries, we firmly believe that our lithium phosphate chemistry offers the high performance and significant stability vehicle manufacturers demand from emerging technologies.

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