Panel: Carmakers should charge to 42 V battery

By Peter Clark

DETROIT - The advent of a 42-volt power supply system for automobiles, with its implications for automotive suppliers and semiconductor companies, could arrive within three years if automakers pluck up the courage to drive the necessary standards, according to panelists here at last week's Society or Automotive Engineers (SAE) 2000 World Congress.

The use of higher voltages at lower currents is more powerand weight-efficient, partly because it can reduce the copper cabling in vehicles, and 42 V now has unanimous support as the highest practical voltage for automobiles that stays within legislated low-voltage safety ranges. But the industry wide cost of a transition to either a dual 14-V /42-V architecture or to a single 42-V system still appears to have many automobile makers frozen in the headlights of advancing technology.

Pressure to act

Time is running out for making some key decisions on the new technology, some observers said. The semiconductor industry already has the higher voltage technologies needed for new components, said panelist Claus Geisler, vice president of the automotive power business unit at Infineon Technologies AG (Munich, Germany). Those technologies, he said, could provide weight and cost savings to the auto industry – as soon as it makes up its mind what it wants.

The accelerating urgency for 42-V standardization stems from an imminent change in automobiles. Panelists agreed that autos would soon change from 1- to 1.5-kilowatt means of transportation, becoming rolling offices and entertainment complexes. At peak consumption, they could burn 5 to 8 kW as computer, communications and Internet technologies are brought on board and as drive-by-wire systems become the norm.

The panelists estimated 2002 or 2003 for the first showing or a 42-V power system within a commercial vehicle. Peter Thoma, director of the electric/electronic development department at BMW, said his company will proceed directly to a single 42-V power distribution network, bypassing a dual, 14-V/42-V system. Other panelists debated the weight, cost and architectural issues holding back the adoption of such dual systems.

Dual-voltage systems are attractive to carmakers because they allow the piecemeal introduction of 42-V components, so manufacturers won't have to wait for every type of electronic component to be available, said Thomas Keim, co-director of the Massachusetts Institute of Technology Consortium on Advanced Automotive Electrical/ Electronic Components and Systems. The downside is that they usually require two battery systems (12 and 36 V), extra wiring and added complexity. Unresolved issues include whether to have separate or integrated alternators and how such features will affect the "jump-start" facility on which drivers rely in emergencies.

Cary Wilson, director of electrical and electronic systems engineering for advanced vehicle technology at Ford Motor Company, said a step function in vehicle power consumption is expected sometime soon after 2003 introductions, when consumption might typically be 1.4 kW. By 2005 introductions, he predicted, consumption will be 5kW.

But Wilson cited the cost concerns in introducing a technology that is only an enabler of additional features and not a feature itself for which consumers would be prepared to pay directly.

"There are issues of service and maintenance infrastructure, or service and maintenance training. This is a redesign of the entire vehicle – part of the hurdle is just believing you've got to do it. We've even got to think about providing 110-V /220-V outlets in cars," he said. "42 V will happen; it's just a question of when. The OEM who figures out the value-added features enabled by 42 V and is first to market with volume will have a competitive advantage."

Another issue, Wilson said, is how long it will take legacy 14-V systems to be designed out of vehicles.

BMW's Thoma agreed with Wilson on vehicle power consumption, saying, "We are at 2 kW, and it's ramping up to 6to 8 kW over the next 10 years. Everything will he electric, including steer-by-wire and brake-by-wire, by 2006 or 2007. [But] we have to start [the move to 42 V], or all these additional features will he introduced on the wrong voltage and then have to be re-engineered for 42 V."

The difficulties of changing the auto incandescent bulb industry to 42 V was cited as one reason dual-voltage systems must come first.

Infineon's Geisler noted that while the basic power switch semiconductors and smart-power technologies are already available at the appropriate voltages, there are still some choices to be made. "Whether you choose chip-area optimization or power-dissipation –optimized devices can have a big effect on silicon area," Geisler said.

Geisler's main message was that the adoption of power and smart-power devices could reduce costs for automakers almost immediately. He pointed out that just as the reduced-current requirement at 42 V could contain wiring harness weight and cost for semiconductor devices, it could allow heat sinks to be dispensed with and smaller packages to be used.

Geisler showed estimates comparing a smart-power switch (offering in-built protection and limited diagnostics) with the electromechanical relay and drive transistor that the switch would replace. Whereas at 14 V the all-electric solution could be 3.5 times as expensive as the mechanical version, at 42 V the mechanical solution goes up in cost but the electronic option comes down to 80 percent of the 14-V relay.

Panel chairman Andrew Brown, Jr., called for a global industry workshop that would leverage 42-V work at the MIT automotive consortium (auto.mit.edu/consortium/), the SAE (www.sae.org) and the European Sican Bordnetz consortium.