The Perfect Opportunity for Automotive Power to Move to 48V

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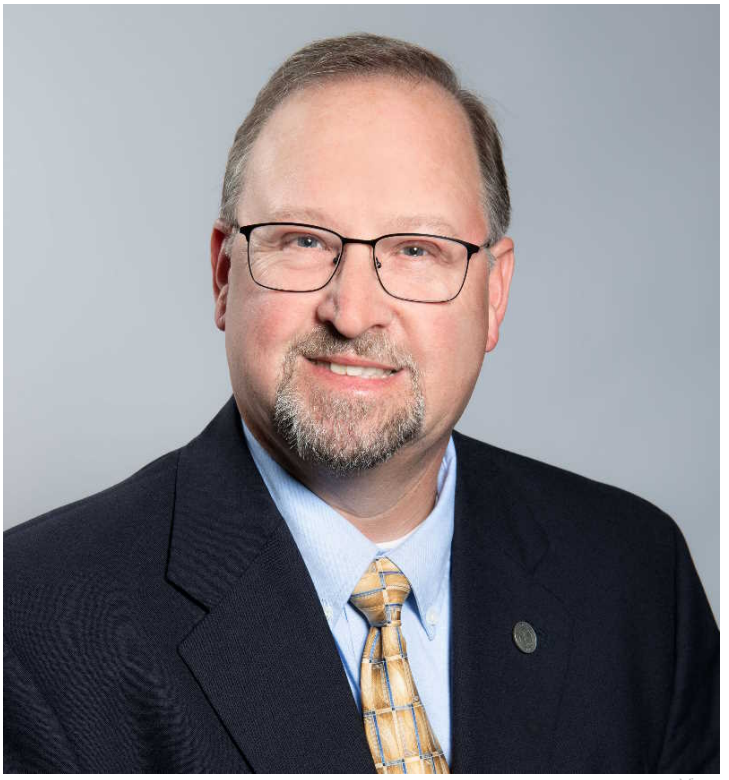
Saving weight has become a priority for vehicle manufacturers, and a move to a 48V power delivery network will help them achieve it.

Over the last two decades, there has been a movement towards migrating the power architecture in automobiles from 12V to 48V. Due to a number of reasons, this change has never taken off, despite it being the wishes of the industry. One of the main reasons for the delay is that legacy 12V equipment works well, and that developing the same type of devices for 48V would be expensive and time consuming. However, according to Greg Green, Automotive Director at Vicor, now is the time for change due to the introduction of electric vehicles along with the move to a zonal architecture in vehicles. In fact, it has already started with the Tesla Cybertruck already featuring a 48V power delivery network.

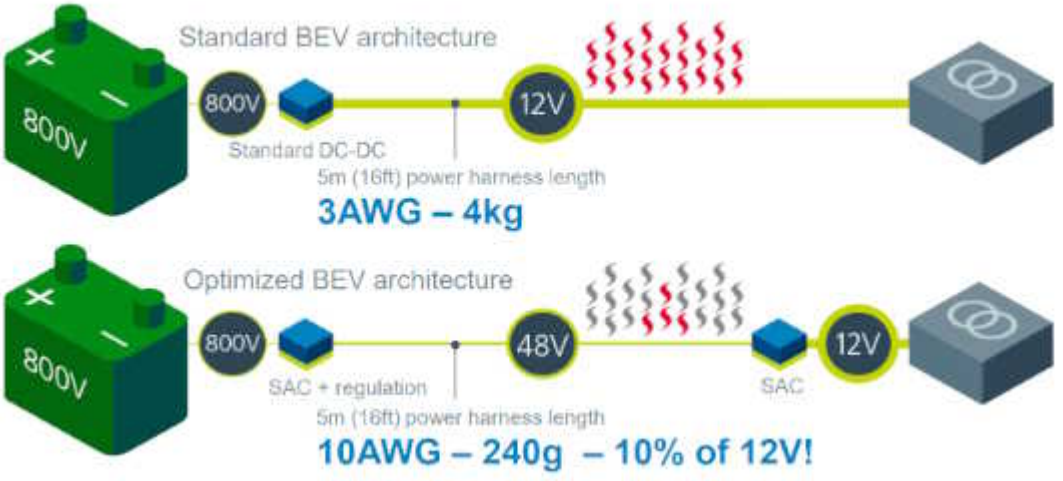


Vicor

Greg Green, Automotive Director at Vicor

The amount of electronics in vehicles, both by number and value, has been expanding rapidly over the past few decades until now when we have vehicle designs with up to 100 ECUs. Those electronics also add a lot of weight to the vehicle, especially in the wire harnesses required to link the ECUs. According to the National Transportation Safety Board, electric vehicles are already around 33% heavier than their ICE counterparts. As well as decreasing the mileage, the additional weight also makes the chances of fatalities much higher. The National Bureau of Economic Research estimates that adding an extra 1,000 extra pounds to the vehicle increases accident fatality risk by about 47%. Electric vehicles can be much more than that, for example, the Ford F-150 Lightning is between 2,000 and 3,000 pounds heavier than its ICE counterpart.

Green explains the situation in the industry further, “What we are seeing today from a number of different customers is that they're going to zonal architecture on the control side, and because of that, they are starting to look at using the zonal architecture for power distribution at the same time. Several of the top six OEMs in the industry are looking at ways to have a core 48V system with local 12 volt systems. Over time, they know they will get 48V versions of the 12V systems they have today, but they can't get them all at once and they don't want to wait. So they're looking at producing a 48V vehicle and then maintaining 12V devices for their cost and reliability while they build up enough demand to make 48V versions.”



Moving the power distribution system to a zonal architecture removes the vast majority of those ECUs, along with the wiring needed to connect them. It focusses on fewer, more powerful ECUs controlling all of the applications in a certain area of the vehicle. Connecting those ECUs takes much less wire. And, as the voltage is higher, current is smaller, meaning thinner, lighter wires can be used. According to research by Vicor, this could save as much as 85% of the weight from wiring alone. As for the legacy 12V components, they can be supported by either a 48V battery, or a 48V virtual battery consisting of power-dense, high-transient components that would convert the voltage down to 12V. Having a virtual battery would allow the manufacturer to use a much smaller battery for back-up. Additionally, the 48V and hybrid systems would run a lot cooler than the pure 12V system, meaning that a smaller system could be used that could remove up to a third of the cooling system's weight.

Vicor has already installed similar systems. Green expanded by saying, "we're taking already taking grid power down to 48V and then to lower voltage levels in server farms and other applications. Because the zero-voltage switching in our core technology offers fast slew rates, we can go from 0A to 75A at a rate of 8MA/s. This rate is actually faster than the speed of electrons flowing from a battery. So, it is already possible to go from a BEV's 800V primary battery and create the 48V electron flow faster than having a 48V battery in that vehicle. The 48V battery will weigh about 29 pounds, so it's a substantial cost and weight reduction. Most vehicles will still carry a 12V battery as a backup, but that can be reduced to the minimum size that is required for regulatory and functional safety requirements."

There have been many false starts for the move to 48V in the past. This time it looks like it could actually happen. The introduction of electric vehicles combined with the move to a centralized architecture has presented the perfect opportunity for manufacturers to remove weight from the vehicles, or perhaps even keep the same weight by adding more batteries to increase the range.

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