High-power wireless vehicle charging technology licensed by HEVO

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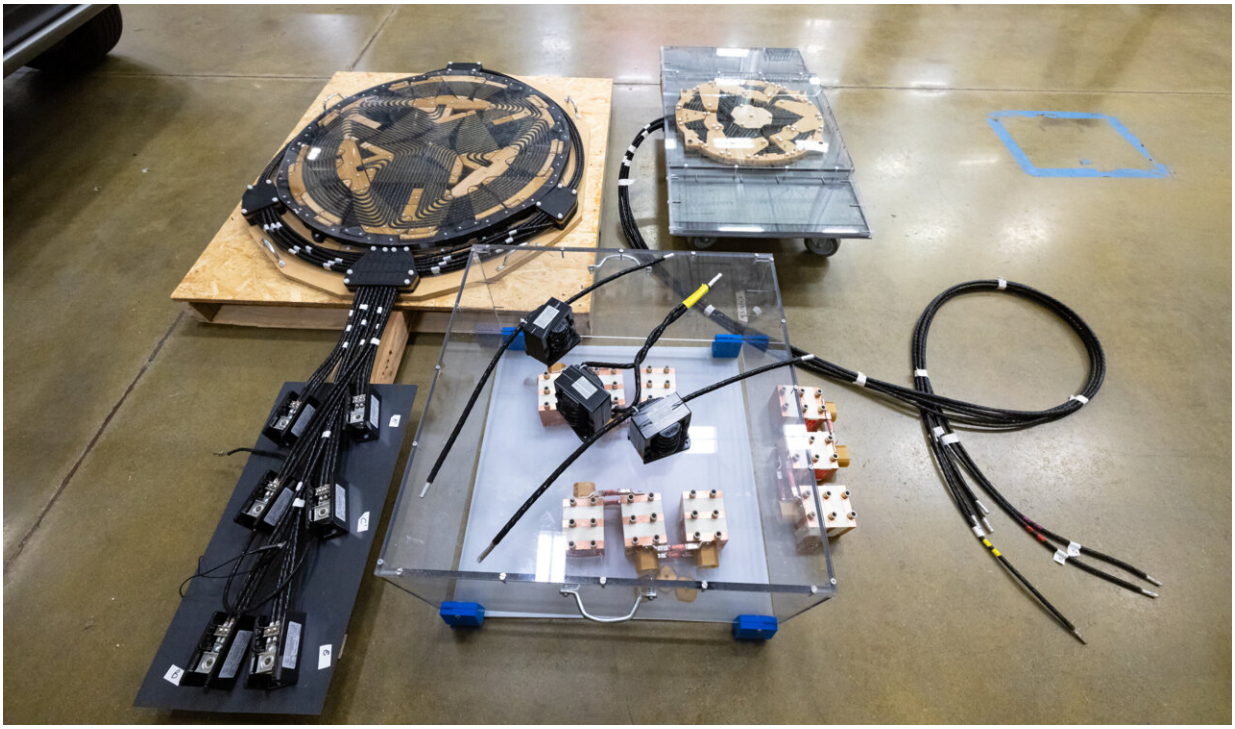

ORNL has licensed its high-powered wireless vehicle charging technology to HEVO, including the lab's unique, compact polyphase electromagnetic coils that provide the highest surface power density available. Credit: Carlos Jones, Oak Ridge National Laboratory/U.S. Dept. of Energy

The U.S. Department of Energy's Oak Ridge National Laboratory has licensed its wireless charging technology for electric vehicles to

Brooklyn-based HEVO. The system provides the world's highest power levels in the smallest package and could one day enable electric vehicles to be charged as they are driven at highway speeds.

HEVO intends to work with ORNL to continue development of this critical technology to increase power levels and efficiency of existing charging techniques.

"Highly efficient wireless charging is a breakthrough technology that can alleviate EV range anxiety and facilitate the U.S. effort to decarbonize the transportation sector," said Xin Sun, associate laboratory director for energy science and technology at ORNL. "We are excited to see another one of our technologies move into the private sector where it can create new green jobs and support the nation's clean energy goals."

The license covers ORNL's unique polyphase electromagnetic coil that delivers the highest surface power density available, 1.5 megawatts (1,500 kilowatts) per square meter—eight to 10 times higher than currently available technology. This surface power density supports higher power levels in a thinner, lighter coil, resolving the issue of adding range-sapping weight to electric vehicles.

The license also includes ORNL's Oak Ridge Converter, which eliminates one of the power conversion stages needed for wireless power transfer, resulting in more compact and less costly stationary infrastructure.

The ORNL technology enables very fast hands-free charging and even in-motion charging so vehicles could be reenergized as they're driven at interstate speeds over specially equipped roadways.

Under the license, HEVO will work with ORNL to further develop the technology, including making it ready for commercial manufacturing.

In a recent announcement supporting deployment to the marketplace, Secretary of Energy Jennifer Granholm unveiled a DOE Technology Commercialization Fund award in which HEVO and ORNL will co-develop and demonstrate a 300-kW wireless charging system based on the ORNL converter and associated power electronics.

"EV charging must be simple, seamless and safe in order to accelerate mass adoption and prepare for an autonomous future," said Jeremy McCool, HEVO founder and CEO. "Our collaboration with ORNL utilizes HEVO's strength in designing, developing and commercializing wireless charging technology and software as the first and only company in the world that is compliant with both SAE and UL safety and performance standards."

"Together, we are developing the fastest and most universal wireless charging platform in the world," McCool added. "From only one device mounted on the vehicle, a driver will now have the advantage of wirelessly charging at all levels up to 300-kilowatts, powering their home through a vehicle-to-grid interface, and even charging while driving at highway speeds with grid-to-battery efficiency of 90-96.5%. All of this functionality is built into a vehicle-side package the size of a medium pizza box and the ready-made capability to charge electric vehicles without a human behind the steering wheel."

DOE has set a goal to develop hands-free, automated wireless electric vehicle charging that is at least as fast as conventional refueling as it seeks to decarbonize the nation's transportation sector. High-power charging also encourages buy-in by consumers concerned about driving range and the availability of charging infrastructure. In wireless charging, EV batteries are energized when vehicles are parked over a charging pad or driven over specially outfitted roadways while power is transferred across an air gap between magnetic coils embedded in the ground and installed on the car.

Resolving range, infrastructure challenges

Enabling very high power levels is essential for practical charging.

Most of today's commercially available light-duty EVs have battery packs rated anywhere from 30 kWh to 60 kWh, and most of the higher end, longer range electric vehicles come with 100 kWh battery packs. Reaching a 15-20 minute charge time for a 100-kWh battery pack requires a 300-kW charging system. Targeting an even faster 5-10-minute charge time means power must be scaled up to half a megawatt or more. Heavy-duty vehicles like electric semitrucks would require battery packs with several hundred kWh energy storage capacity, which would require megawatt-level charging, ORNL researchers noted.

"Opening up new parts of the transportation sector to electrification is a key benefit of this technology," said Burak Ozpineci, section head for Vehicle and Mobility Systems Research at ORNL. "It's not just about charging your vehicle really fast. It's also about being able to convert to electricity long-haul trucks, which burn a significant portion of the vehicle fuel used in this country."

The dynamic charging system being developed at ORNL likewise supports electrification of heavy-duty trucks. "Right now, those big trucks would require massive battery packs that add significant weight and cost to the vehicle," said Veda Galigekere, who leads ORNL's Electric Drives Research Group. "But with dynamic wireless charging on interstates, for instance, you can reduce the onboard battery capacity needed while alleviating range anxiety."

The Oak Ridge Converter will be part of the TCF project and is included in the HEVO licensing agreement. It directly converts 60-hertz AC power from the grid to high-frequency AC without taking an intermediary conversion to DC power. The converter design reduces the

weight, volume and size of stationary, grid-side infrastructure by as much as 50%.

"That means you could park another vehicle in the space saved in a city garage, for instance, and we would need less construction to embed charging pads under roadways or parking spots," noted Omer Onar, leader of the ORNL Vehicle Power Electronics Research Group. ORNL also actively works on shielding technologies to ensure system safety and reduce interference with other vehicle components.

"With ORNL's advancements, wireless charging is becoming more feasible, practical, and safe," Onar said.

"The world of automotive is going to change faster in this decade than it has in the past century, and we need a step change in EV charging to unlock the full potential of this burgeoning multi-trillion-dollar industry," said McCool. "We believe this is the leapfrog technology that will change people's way of living and doing business across the globe. HEVO is excited to be at the forefront of this movement."

The ORNL research and development team also includes Erdem Asa, Gui-Jia Su and Mostak Mohammad.

Provided by Oak Ridge National Laboratory