Keeping electricity affordable on wireless charging highways

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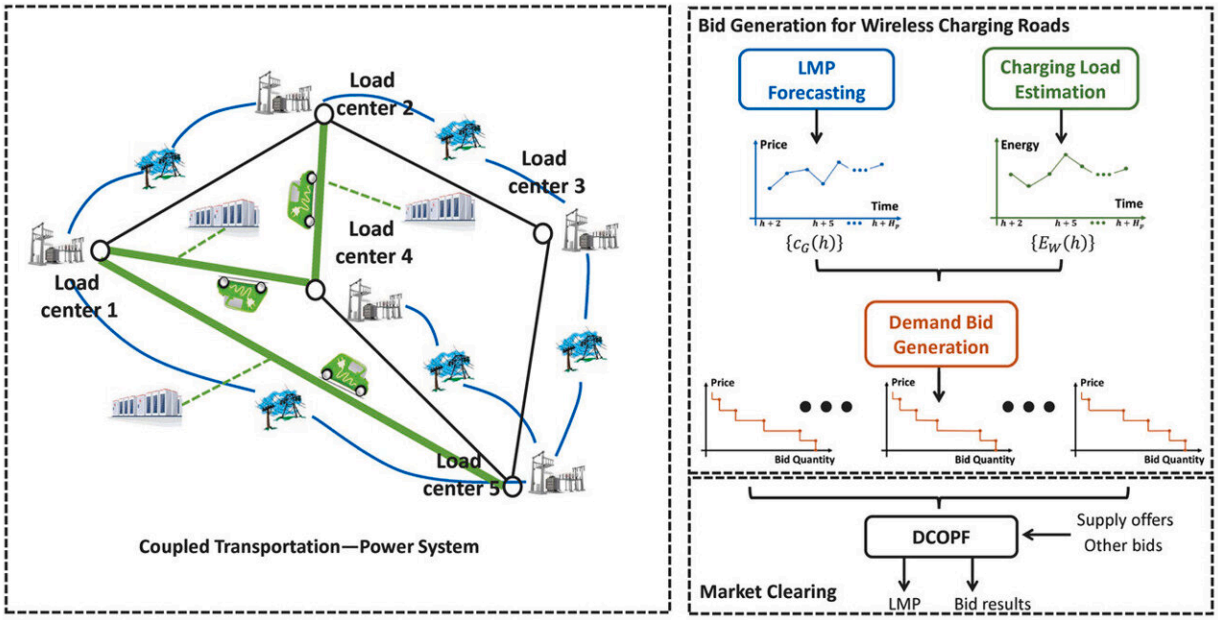

Graphical abstract. Credit: *Applied Energy* (2022). DOI: 10.1016/j.apenergy.2022.120035

Efficient pricing will be crucial to minimize energy costs for private operators who provide on-the-highway wireless charging for electric cars—and for consumers who will use this service, according to new Cornell research in *Applied Energy*.

Employing dynamic pricing strategies in the marketplace could save

consumers as much as 6% off the retail electricity price, according to the new paper, which envisions future wireless charging highways that allay so-called "range anxiety" about low batteries on longer trips.

"Electrifying transportation is great, since you can eliminate carbon emissions," said senior author Oliver Gao, the Howard Simpson Professor of Civil and Environmental Engineering in Cornell Engineering. "You can energize your car while driving in the charging lane. But if you're managing a charging highway that can provide energy to cars, you're buying and selling electricity on an industrial scale. We're trying to suggest a smart business strategy."

Electricity prices can change drastically within a day, according to Gao, who is a faculty fellow at the Cornell Atkinson Center for Sustainability.

An efficient bidding strategy is crucial to minimizing the energy cost for operators of wireless charging roads. The primary goal of the new research is to design a competitive, price-sensitive demand bidding strategy for wireless charging road owners—who have electricity storage capacity.

The paper, "Bidding Strategy for Wireless Charging Roads with Energy Storage in Real-Time Electricity Markets," designs an efficient, price-sensitive way for a wireless charging road to participate in a real-time electricity market. The research suggests an algorithm to predict the real-time electricity load on a charging highway, in order to evaluate a price forecast and electricity availability.

The proposed bidding strategy not only reduces the energy cost for operating a wireless charging road but helps to alleviate electricity load pressure on a power network.

"Our paper comes from the perspective of running a gas station," Gao

said. "If you're running a charging highway—or if you get the contract to run a charging highway—you're buying electricity and you're selling electricity. It's dynamic. You either buy an hour ahead of time and then you sell it one hour later or you bid on electricity, you submit your bid, buy it and then you sell it."

Today, it takes a lot of time to charge an electric vehicle and—due to battery limitations—a car's range may only be a few hundred miles. With wireless charging lanes, a driver may simply move into the charging lane, much like today's high-occupancy vehicles move into special lanes to avoid dense traffic.

Lowering energy costs imposes less pressure on the existing power grid, according to the paper. "These two merits can bring broad benefits to our society," Gao said. "Cost reduction in operating wireless charging roads is likely to attract more investment in constructing these roads and lower the corresponding charging price—promoting overall electric vehicle adoption.

"The alleviation of required pressure on power grid is great news to the power industry," Gao said, "which already suffers significant strain on the existing infrastructure."

More information: Jie Shi et al, Bidding strategy for wireless charging roads with energy storage in real-time electricity markets, *Applied Energy* (2022). DOI: 10.1016/j.apenergy.2022.120035

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https://techxplore.com/news/2022-10-electricity-wireless-highways.html