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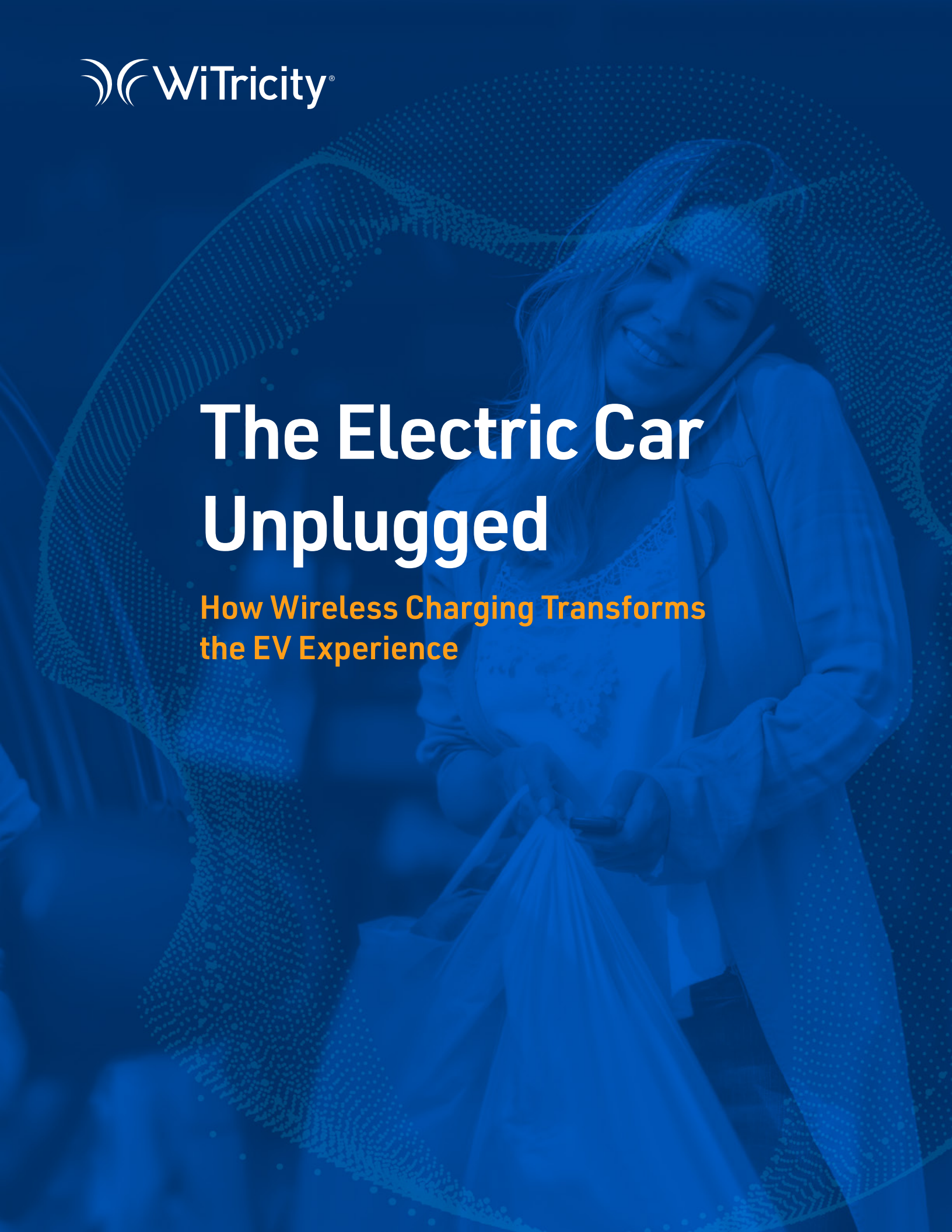

The Electric Car Unplugged

How Wireless Charging Transforms the EV Experience

Introduction

Electric cars promise a better experience than the gas vehicles that have dominated our roads for more than 100 years. They smooth out jarring stop-and-go traffic, sail down the highway with nothing more than a whisper from their motors, and accelerate instantaneously. EVs are cheaper to fuel and better for the environment than internal-combustion vehicles. They've even reshaped how we interact with our cars beyond driving, allowing owners to charge their vehicles at home and wake up to a full battery every morning.

For as seamless as driving and owning an electric car is, though, the experience of charging an electric car often incites frustration, anxiety, and confusion. American EV drivers must navigate a patchwork of public charging infrastructure with four different connectors while routinely dealing with broken equipment. Bulky cords present a trip hazard at public charging stations and at home. Cars shared by family members, employees, or customers aren't plugged in when they should be. And since automakers haven't standardized the location of the charging port on EVs, a driver may have to tailor how they park to accommodate the charging equipment. Dealing with these headaches is one of the major friction points of owning an EV.

Even the act of plugging in an electric car mimics the process of refueling a gas car—a regular reminder that the way we charge EVs hasn't kept pace with technological advances. There's a better way to charge electric cars.

WiTricity, a trailblazer in wireless charging for electric vehicles, has developed a solution to these problems. Its magnetic resonance technology allows a driver to simply park their EV over a charging pad and walk away knowing that their car will recharge with the same speed and efficiency as plugging in to Level 2 equipment. The first vehicles with this capability are now entering production in Asian markets. As automakers and Tier 1 suppliers look to differentiate their EVs with this leading-edge technology, we wanted to understand U.S. car buyers' interest in wireless EV charging. Based on our latest research, it's clear that EV shoppers understand and value the benefits that this technology provides.

EV Shoppers Want Wireless Charging

In March 2022, WiTricity partnered with Qualtrics to conduct a survey of 1,053 American adults interested in purchasing an electric vehicle within the next two years. The sample included 512 current EV owners and 541 people intending to purchase their first EV.

The results show that wireless charging resonates almost universally among shoppers considering electric cars. When asked to think about an electric vehicle with wireless charging capability, 96% of respondents indicate it is appealing, with 71% of participants saying the feature is extremely appealing.

Examined in detail, the data reveal that interest rises even higher among younger demographics. While 95% of Gen X respondents are interested in wireless charging, 98% of Millennials find the technology appealing. This generation grew up with the internet and learned to drive as cell phones became ubiquitous. They're used to technology's inexorable forward march, and they are more likely to find the newest technology to also be the most natural. To Millennials, wireless EV charging is intuitive–the way it should be.

Among U.S. drivers planning to buy an EV in the next two years,

96%

find wireless charging appealing

These findings are notable considering that wireless charging hasn't been introduced in the U.S. market yet and has received only limited recognition in mainstream publications. In a October 2021 survey conducted by WiTricity and TideWatch Partners*, 65% of current EV owners said they had heard something about wireless vehicle charging. That number fell to 32% for people planning to buy an EV in the next 18 months, and just 9% for those who indicated they might consider an EV for their next vehicle.

How could people be so interested in a technology they've never used or even seen in action? We credit the growing prevalence of wireless phone charging for proving the concept and its benefits. As of 2021, more than 1 billion phones with wireless charging capability had been sold, according to Strategy Analytics. Wireless device charging has seen a major boost since Apple began installing it in every iPhone introduced since the third quarter of 2017. Out of 195 million iPhones sold in 2019, 165 million had this feature. Based on their exposure to these devices, U.S. consumers don't need to be convinced of the advantages of wireless EV charging. *(We should note that the Qi wireless charging technology used for phones is not the same as WiTricity's magnetic resonance wireless charging. Magnetic resonance is much more efficient - as efficient as the plug.)*

Exactly which benefits resonate strongest with EV shoppers varies with demographics. Baby Boomers appreciate not dealing with cords. More than Gen X and Millennials, they identify not having to physically plug in (72%) and not having to think about unplugging (62%) as benefits of wireless charging. Millennials are more likely to cite having access to the latest tech as a benefit (46%) than not having to think about unplugging (43%).

* https://witricity.com/wp-content/uploads/2021/11/WiTricity-EV-Adoption-Whitepaper.pdf

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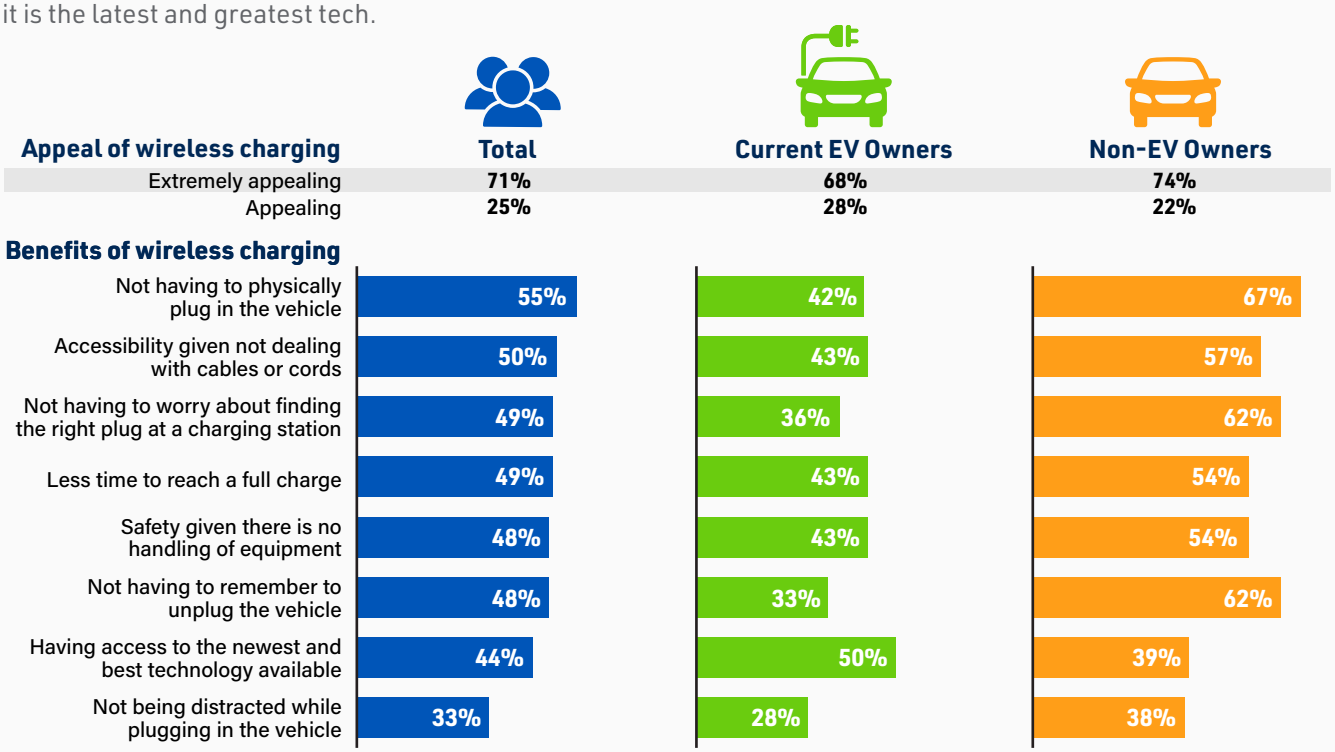
Wireless Charging Appeal: EV Ownership

Most EV buyers find wireless charging appealing, but more non-current EV owners find the feature extremely appealing, implying that the hassle of charging is a barrier to EV adoption. In fact, in our October 2021 study, the availability of wireless charging increased the likelihood of an EV purchase by up to 68% for new EV buyers. Convenience is the top benefit for non-EV owners, specifically not having to plug or unplug the EV. Current EV owners, like all early technology adopters, are more likely than non-EV owners to like wireless charging because it is the latest and greatest tech.



Base: Total (n=1,053)

Wireless Charging Is More Desirable Than Full Self-Driving Capability

Automotive product planners are in the business of making compromises and tradeoffs. They constantly juggle the need to outfit their vehicles with competitive or unique features while keeping costs in check. In recent years, automakers have tried to use advanced-driver assistance systems to distinguish their vehicles from the competition's, and in pursuit of hands-free driving, they've created systems that cost the customer more than $10,000 yet still require a driver to remain alert and ready to take over at any moment. Is that really what customers want? Our survey suggests that wireless charging has broader appeal with more tangible benefits than the most advanced driver-assistance systems.

When asked to rate their interest in select features on a new electric vehicle, 86% of respondents say they are extremely interested or very interested in wireless charging. That compares to 64% for full self-driving capability. Wireless charging also proved more popular than commonly touted selling points such as acceleration performance, a unique exterior design, and a unique interior. It also beat out popular upgrades such as premium audio systems and park assist.

We attribute wireless charging's popularity to its simplicity and clear benefits. The confusion created by similar-but-not-the-same active safety features like lane-departure warning, lane-keeping assistance, and lane-centering technology means car owners don't always understand what their vehicle is capable of or when and where to rely on those features. Many drivers disable them because they find the systems intrusive. You don't need to open an owner's manual to understand what wireless charging is or when to use it, and unlike so many of today's driver-assistance systems, wireless charging is a truly hands-free experience that doesn't require human oversight.

EV shoppers rated wireless charging

34% higher

than self-driving capability as a feature they look for.

Interest in Features: EV Ownership

Wireless charging is a top feature all future buyers are interested in, exceeding other, more common add-on features such as park assist and top-of-the-line audio systems.

Extremely Interested/ Very Interested In...	Total	Current EV Owners	Non-EV Owners
Longer driving range	91%	90%	92%
Rapid charging capability	89%	90%	89%
Wirelessly charge by parking over device	86%	87%	85%
Acceleration performance/speed	77%	82%	72%
Unique interior	70%	82%	59%
Unique exterior design	69%	79%	59%
Park assist	67%	78%	57%
Top-of-the-line audio system	66%	76%	55%
Full self-driving capability	64%	79%	49%

Base: Total (n=1,053)

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EV Buyers Want to Use Wireless Charging at Home

According to the Department of Energy, most vehicle charging—more than 80%—happens at home, so it's not surprising that 76% of EV shoppers want to use a wireless charging pad in their own garage or driveway, per our survey. While they also expect to use wireless charging opportunities at public locations (68%), at work (60%), and in the parking lots of condo or apartment complexes (57%), they understand that the convenience of charging at home becomes even more convenient when it doesn't involve a cord.

Just as it has done for phones, wireless charging stands to change one of the fundamental elements of living with an EV. It means never having to juggle grocery bags as you plug in, or wonder if your teen remembered to charge the car last night, or fuss with a cord when you're running late.

EV shoppers are looking to automakers and their dealers to facilitate the transition to EV ownership and wireless charging. When it comes to a wireless charging pad, 64% expect to buy it from the vehicle manufacturer when they purchase an EV. Half of shoppers also want to be able to buy the unit from the automaker independent of a vehicle purchase.

Public Charging Gets Better With Wireless Technology

Wireless charging presents an opportunity to simplify America's confusing public-charging landscape, where EV drivers currently have to figure out which of the four different plug designs are compatible with their vehicle. WiTricity's technology complies with SAE J2954, a global industry standard that defines requirements for wireless charging. Any vehicle receiver and charging pad designed to the standard will be compatible regardless of the vehicle brand or hardware supplier. This stands to ease one of the biggest headaches of charging an EV today. While gas stations outnumber charging stations three to one, that gap grows even wider when you consider that a given EV can't charge at every location. Nearly half (49%) of EV shoppers identify not having to find the right plug as a benefit of wireless charging. The extent of that frustration is made clear by current EV owners, 40% of whom report that finding a compatible charging device has been a challenge when using public charging.

WiTricity's wireless charging uses a WiFi-based communication protocol to automatically initiate charging once the vehicle has parked over a ground pad. That means never needing to exit a warm, dry, and secure car in a blizzard, a downpour, or a dark parking lot. It also reduces the time and effort it takes to pay for and initiate a charge—a process that can take several minutes using today's wired charging stations. With a frictionless charging experience, EV drivers are more likely to take advantage of brief charging opportunities as they go about their daily errands. This behavior, which we call Power Snacking™, reduces the need to seek out DC fast-chargers or plan your schedule around long charging sessions.

For EV drivers with physical limitations, wireless charging erases the challenges presented by conventional charging. Public stations are often installed behind curbs or parking bollards to protect the unit from being damaged, and vehicle charging ports are often positioned to be used by a standing, average-height driver. These create obstacles for wheelchair users and those with other mobility issues. In our survey, 46% of Boomers say they have concerns about the accessibility of public charging stations.

At conventional charging stations, the cord and plug are vulnerable to damage, wear, and vandalism. With no moving parts, wireless charging also has the potential to make public charging stations more reliable for customers and increase uptime for operators. The ground pad, which can be mounted on top of the pavement or embedded under the surface, is designed to be driven over and is unaffected by inclement weather.

Conclusion

As the EV market matures, automakers are likely to reach stalemates on today's competitive battlegrounds of range and charging speed. Many new models can cover 300 or more miles; a few can restore more than 200 miles of range in less than 20 minutes of charging. Pushing range farther comes with weight, packaging, and cost penalties, while also stressing the already-fragile battery-materials supply chain. Vehicle charging speeds will be limited for the foreseeable future by the maximum power of today's 350-kilowatt DC fast-charging stations.

That will leave brands looking for new selling points to differentiate their EVs. Many are already doing just that, marketing wild acceleration, extreme off-road capability, sophisticated driver-assistance features, or avant-garde styling. But even these attributes are at risk of being commoditized based on the number of options consumers will soon have.

For the brands that adopt it early, wireless charging is poised to be a standout feature in next-generation electric cars. The technology has been proven for production, and EV buyers express immense interest in purchasing and using the technology. The only unknown is which automaker will grab the first-mover advantage and give U.S. consumers the better EV experience that they're seeking.

WiTricity has many resources to help you stay informed about wireless EV charging.

- Stay in-the-know by subscribing to our monthly **newsletter:** https://witricity.com/newsletter
- Check out our other **white papers:** https://witricity.com/media/additional-resources
- Watch **videos** that bring wireless EV charging to life: https://witricity.com/media/videos
- Read our **blog** with posts featuring keen insights and information on the hot topics surrounding wireless EV charging: https://witricity.com/media/blog

About WiTricity

WiTricity is the pioneer in wireless charging for electric vehicles, leading the development and implementation of magnetic resonance technology across passenger and commercial vehicles alike. The company's products are backed by an extensive patent portfolio critical to ratified global EV wireless charging standards including SAE, ISO, and GB. Automakers and Tier 1 suppliers rely on WiTricity to help accelerate the adoption of EVs by eliminating the hassle of plug-in charging and setting the stage for future autonomy. Beyond EVs, WiTricity technology is indispensable to the wireless charging of all products, from consumer electronics to micro-mobility to robotics.

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