

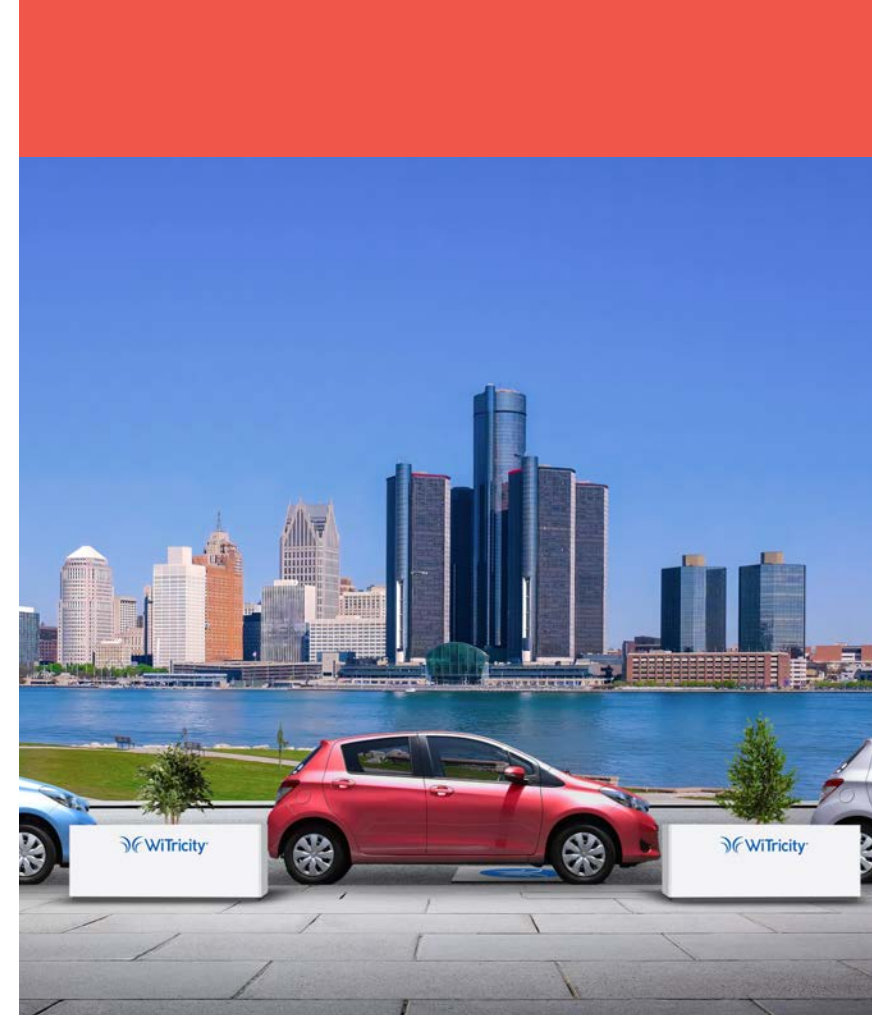
Wireless Charging

Alex Gruzen, CEO WiTricity

Thomas Wuerz, Head of Wireless Power Transfer, Siemens

Amy Barzdukas, CMO WiTricity

November 15, 2022



Charge Happy™

Agenda

1 Welcome and Introductions

4 Q&A

2 Overview – Alex Gruzen, WiTricity
CEO

3 Discussion on Wireless Charging –
Alex Gruzen and Thomas Wuerz,
Siemens



Meet WiTricity

- **The leader in bringing wireless EV charging solutions to the mainstream market**
 - > \$175 MM of capital raised
 - Driver and basis of key industry standards necessary for widespread adoption
 - Implemented at key automotive OEMs
 - Systems available starting in 2023
- **Established technology leadership**
 - Superior magnetic resonance technology
 - Full suite of automotive-grade software
 - Strong IP portfolio of 1,250+ patents
- **Market-ready solutions**
 - » Fleets and consumers
 - » On- and in-ground charging



US Government is Strongly Behind Wireless EV Charging

- **FY23 Appropriations**

- USG support and funding for EVs and related infrastructure remains a priority
- Significant dollars and opportunities for wireless EV infrastructure programs and dollars with robust, bipartisan support in both House & Senate

- **NDAA**

- Deputy Assistant Secretary of Defense for Environment and Energy Resilience must brief House Committee on Armed Services not later than February 1, 2023, on efforts to deploy wireless electric vehicle charging infrastructure at defense installations.
- Wireless EV charging achieved official definition within FY23 NDAA, via Representative Brenda Lawrence

- **Inflation Reduction Act**

- Strong positive outcomes from the Inflation Reduction Act – Passed in House and Senate
 - \$3 B for purchase of USPS zero-emission vehicles and requisite infrastructure purchase, design, and installation
 - High investment in EV tax credits → leads to more EV chargers in the future

- **Department of Transportation**

- Bipartisan Infrastructure Law allocates \$7.5 B for EV charging – wireless expected to play a key role in deployments



EV Charging Landscape



Level 2 Charging

Positives

- Most common method of charging
- Familiar to consumers

Negatives

- May require electrical work for installation
- Prone to component failure and vandalism
- Impacted by adverse weather conditions
- No single type of connector
- Inaccessible for disabled drivers

Use Cases

- Public charging stations
- Commercial (work) offices
- Home charging



Direct Current Fast Charging (DCFC)

Positives

- Fastest method of charging

Negatives

- Very expensive to install and to use
- Impractical for widespread adoption
- Very demanding on power grid
- Damages EV battery systems
- Same accessibility issues as L2 Charging for the disabled populace

Use Cases

- Highway corridors for distance travel
- Fleet charging for vehicles that require very high uptime



WiTricity Wireless EV Charging

Positives

- Easiest way to charge
- Versatility
- Greater reliability
- Increased accessibility
- Matched efficiency

Negatives

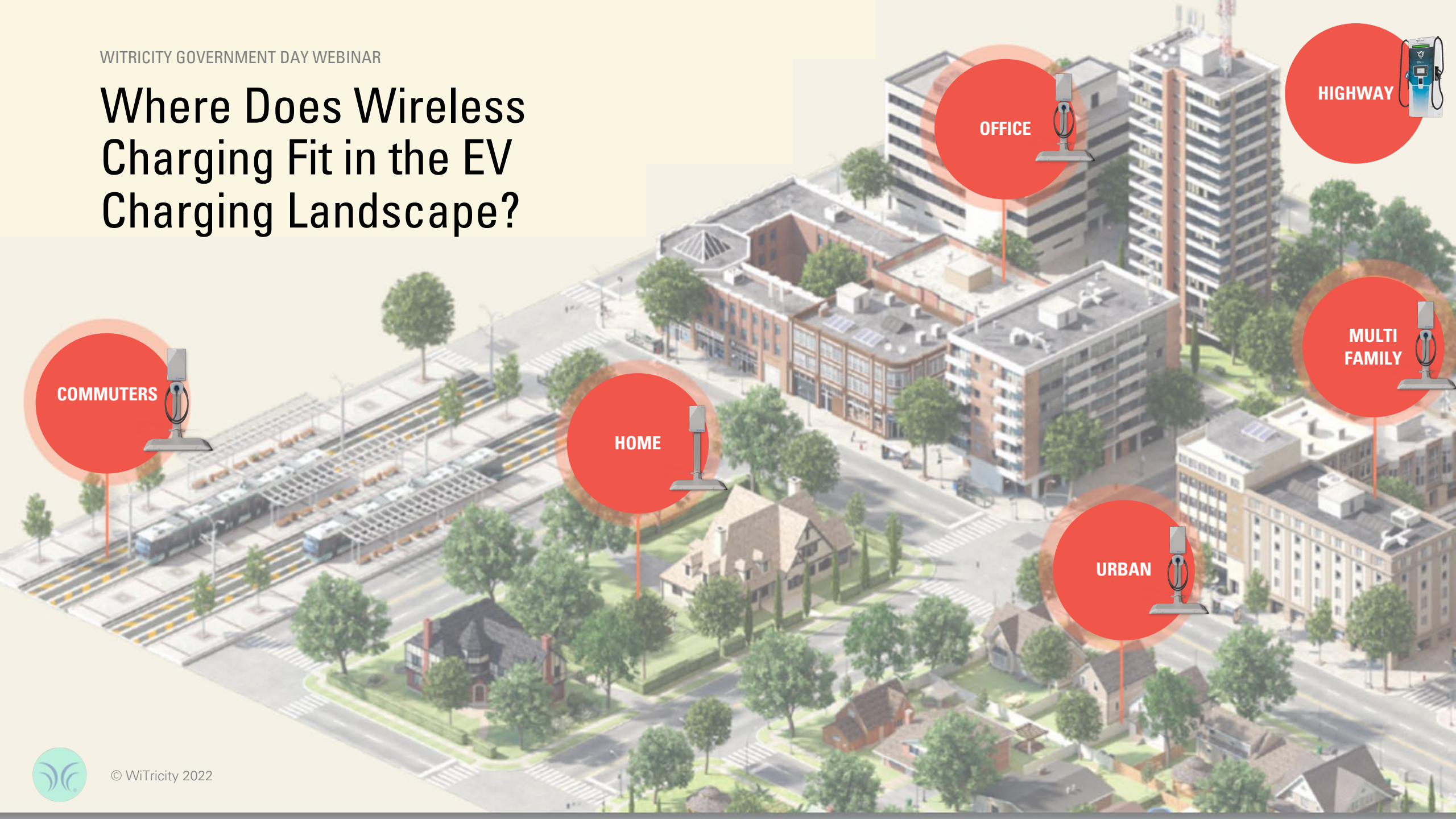
- Not yet widespread
- Initial cost
- Similar requirement for electrician as L2

Use Cases

- Home charging
- Public parking spaces
- Urban environments
- Fleet vehicle charging



Where Does Wireless Charging Fit in the EV Charging Landscape?



The Power of Magnetic Resonance

Power Transfer as Efficient as Conventional Plug-in

(90-93% grid to battery)

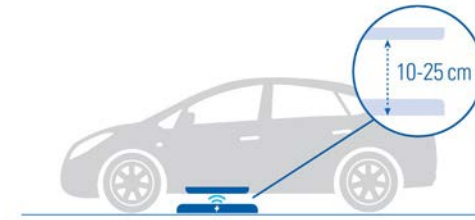


Powers Through Materials (In-ground placement)

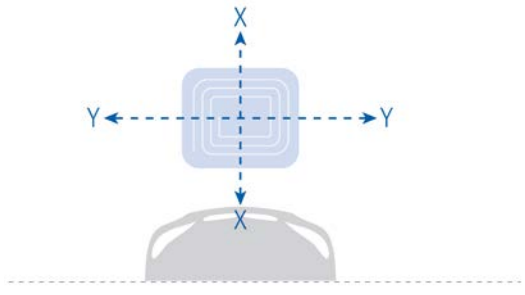
Asphalt, cement, snow, ice, etc.



Spans all Vehicle Heights with Single Design and No Moving Parts (Static or dynamic)

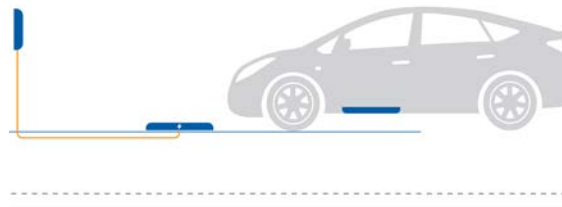


Park-and-Charge X-Y Flexibility



Charges as Fast as Conventional Plug-in

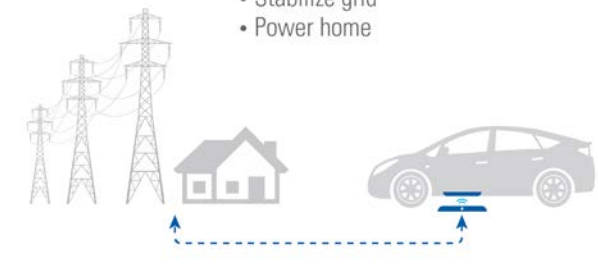
3.6 → 7.7 → 11 → 22 kW →



Bi-Directional Power Transfer

Use large battery on EV to:

- Stabilize grid
- Power home



WiTricity Driving Global Standards Development



Globally

SAE J2954

Published in October 2020

Global standards bodies ISO and IEC have aligned and will follow suit

SAE J2954/2

Currently in development for heavy duty vehicles



WiTricity: The Right Partner for the USG

- **First to market:**
 - » WiTricity is the first magnetic resonance wireless EV charging company to be ready for the mass market
- **Standards compliant:**
 - » In line with global standards for wireless charging with SAE, ISO, and vehicle OEMs
- **Staying power:**
 - » Well capitalized, backed by leading Tier 1 investors and strategic partners
- **Resources to modify systems to meet USG needs:**
 - » Charging system can span a wide variety of fleet vehicles
- **Durability:**
 - » Does not require the same level of maintenance as plug-in solutions
- **TRL 8:**
 - » ready for commercial production in 2023



Wireless EV Charging Use Cases

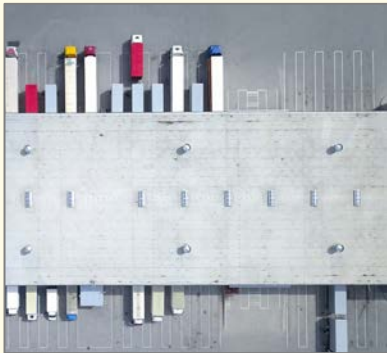
Commercial



Commercial Facilities



Urban Environments



Fleet Charging



ADA Access



Extreme Weather



Government



Government Installations



Municipal Fleet



USPS Fleet



Military Fleets



WiTricity Wireless EV Charging Use Cases

Degree of Importance

WiTricity Benefit	Government Installations	Military Bases	USPS Fleet	Military Fleet
Reduce Total Cost of Ownership	+	+	+	+
Multi-shift Operations	-	+	-	+
Multi-Vehicle Type Charging	+	+	+	+
Reduce Peak Demand Charges & Grid Strain	+	+	+	+
Future-Proofing	+	+	+	+
Disabled Access	+	+	-	-

Government



Government Installations



Municipal Fleet



USPS Fleet



Military Fleets



Government Installations & Military Bases

- The Federal Government offers 49 different EV models – PHEV & BEV – across all vehicle types
 - » WiTricity offers a standardized approach to charging so any OEM vehicle can be compatible with charging infrastructure
- WiTricity Wireless EV charging can be implemented without the more costly grid upgrades required for DCFC



USPS Fleet

- The 2022 Inflation Reduction Act sets aside \$3 Billion for the purchase, design and infrastructure installation to support zero-emission Postal Service vehicles
 - WiTricity's wireless charging infrastructure can reduce costly demand charges
 - Wireless charging allows for dense-pack charging
 - Greater safety for drivers by eliminating trip hazards and drop damage



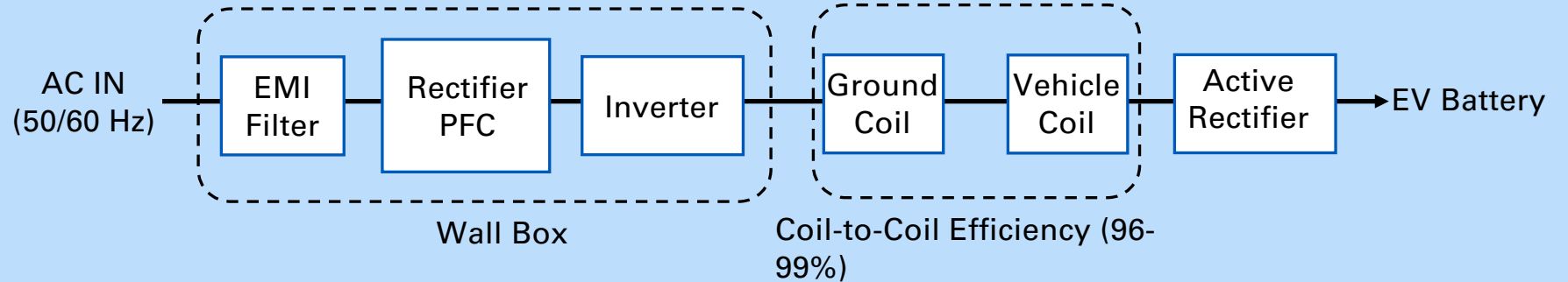
Military Fleets

- Electrifying military fleet vehicles will require strong, versatile wireless charging infrastructure
 - Heavy duty vehicles have bulky cords and cables that are difficult to wrangle, subject to drop damage
 - Eliminates opportunities for driver error remembering to plug in, unplug
 - Wireless charging requires less ongoing maintenance and inspection

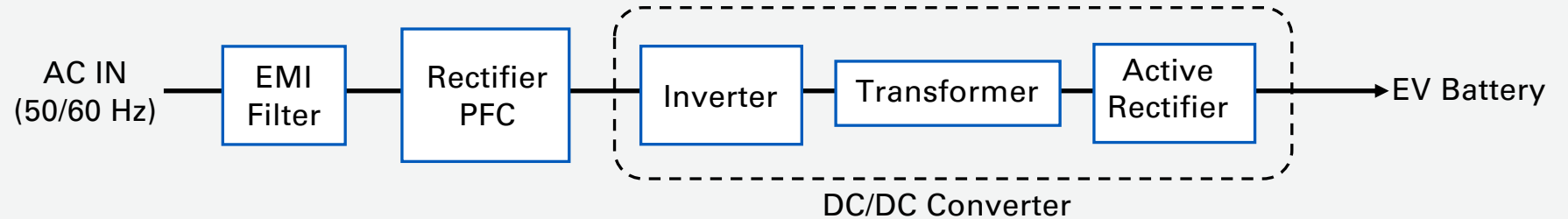


Wired v. Wireless Charging: Efficiency

Wireless Charger (90-92%)



Conductive Charger (AC or DC) (83-94%)



Wireless and conductive chargers have similar functional blocks
End-to-end efficiency is comparable for both type of charging

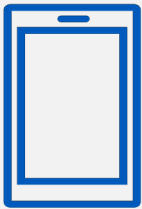


A Complete Solution



Hardened Automotive-Grade Software

- **Data, Cloud:** Cloud-based user session and vehicle data capture
- **Simulation Suite:** Full system modelling for design and performance analysis without prototyping
- **Applications Controller:** Ground-to-vehicle communication via WiFi and cloud connectivity via OCPP, MQTT and utility companies via ADR
- **Power Controller:** Dynamic tuning and power management with automatic efficiency optimization



Magically Simple Driver Experience

- **Mobile Application** for personalized experience
- **Position Detection:** Provides visual cues to driver for vehicle-to-ground pad alignment or positional data for auto-parking systems
- **Foreign Object & Living Object Detection:** Automatically shut off power if foreign objects (e.g. metal) or hands/feet enter charging area
- **Modern industrial design** in a compact, efficient form factor



Core Power Transfer: Patented Magnetic Resonance Technology

- **Magnetic near-field** used to transfer energy between resonant coils
- **Specially designed low-loss resonators** allow high efficiency
- **Proprietary tuning** technology enables efficient operation over a wide range of conditions
- **Compact and powerful** power electronics



Technology Roadmap

	Today	Future
WiTricity Halo™ Wireless Chargers	☒ On ground ☒ Charging speed parity with L2 chargers for passenger vehicles and light trucks	☒ In ground ☒ DCFC speed parity for heavy commercial vehicles
Vehicles	☒ Ready to engage to upfit existing electric fleets	☒ More EVs with wireless charging support from the factory
Software	☒ Asset control, mobile app, OCCP compliant	☒ Deeper integrations available



Summary

- Leader in wireless EV charging
- Strong technology suite and roadmap
- Aligned with USG goals for EV charging infrastructure
- Ability to tailor to USG needs
- Wide variety of USG use cases
- Global partnerships

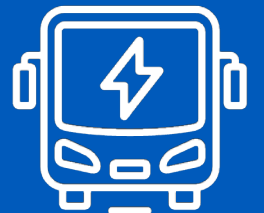


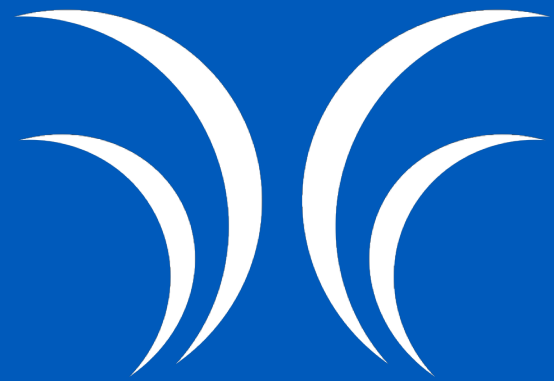
WiTricity has many resources to help you stay informed about wireless EV charging.

- 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.





WiTricity®