

Wireless Charging is NOW

EV wireless charging technology and market trends

WiTricity

Sung-Ki Kang
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Workshop #3 Wireless Charging

2023 KIEES
Summer Conference



Charge Happy™

Overview

1 Why Wireless Charging?

2 Passenger Vehicles

3 WiTricity Retrofit

4 Autonomous Vehicles

5 Adaptable to Future Market Requirements

6 Meet WiTricity





Electric
vehicles are
beautiful...



...but power
cords
are not.




Cut the Cord!




The #1 Barrier to EV Adoption = “The Hassle of Charging”

Those considering buying an EV view charging as a key impediment¹

40% 
worry they will forget
to charge

39% 
worry their charger
will get lost or stolen

31% 
worry that another
driver in the house
will forget to charge

¹ Research conducted by Tidewatch Partners, an independent research firm, in Fall of 2021



Today's EV Charging Landscape



Level 2 Charging

- Faster than “trickle” charging
- Appropriate for residential and commercial use
- Moving parts can break or wear out
- Subject to vandalism
- Largest install base in US



DC Fast Charging

- Fastest charge time
- Appropriate for highway corridors
- Most expensive to install and maintain
- Most demanding on the power grid



Wireless Charging

- Same speed and efficiency as L2 for residential use
- Higher power for commercial use
- No moving parts to maintain



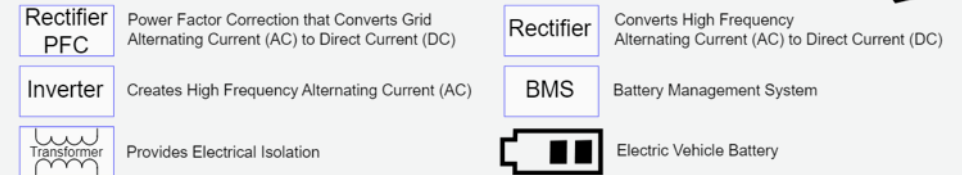
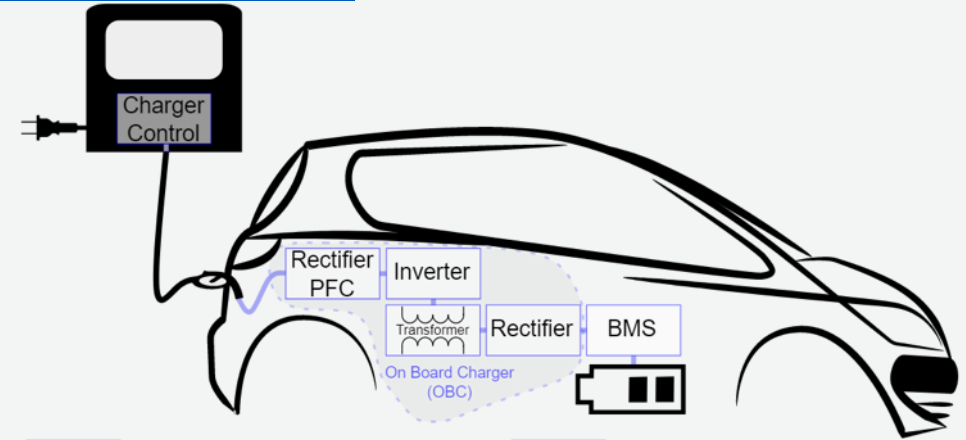
Wireless Charging is as Efficient as the Plug

Both are about 90% efficient from Grid to Battery

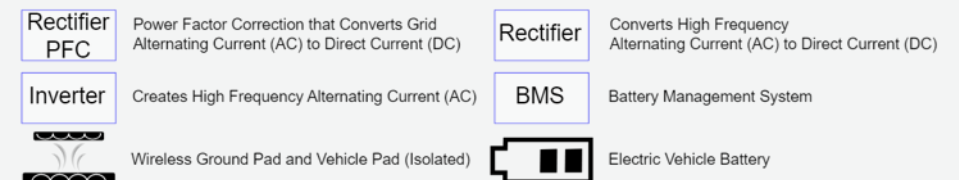
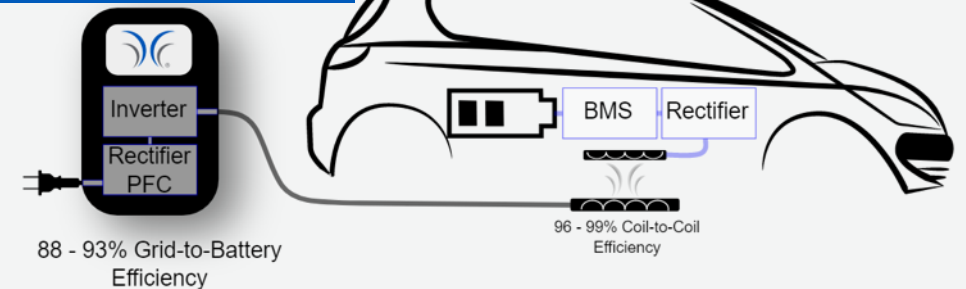
The power electronics that provide resistance and loss, are present in both systems

- Both must convert AC power to DC power
- Both contain PFC, Inverter and Rectifier

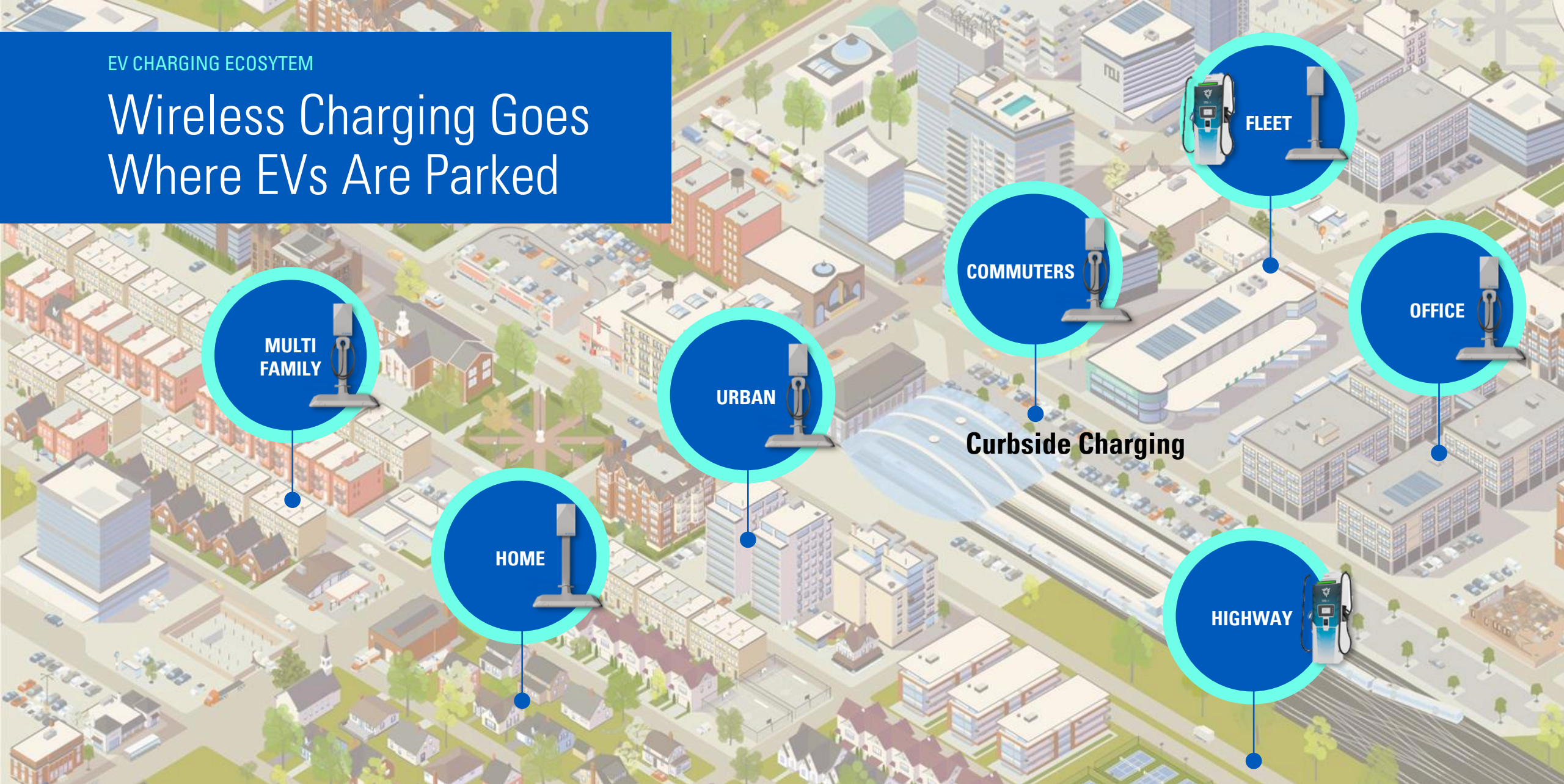
AC EV Charger



Wireless EV Charger



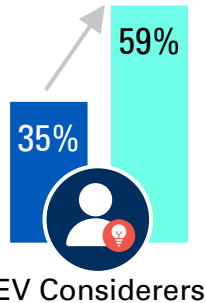
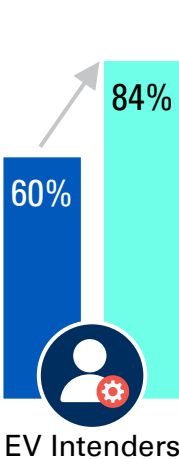
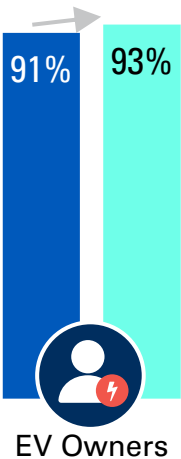
Wireless Charging Goes Where EVs Are Parked



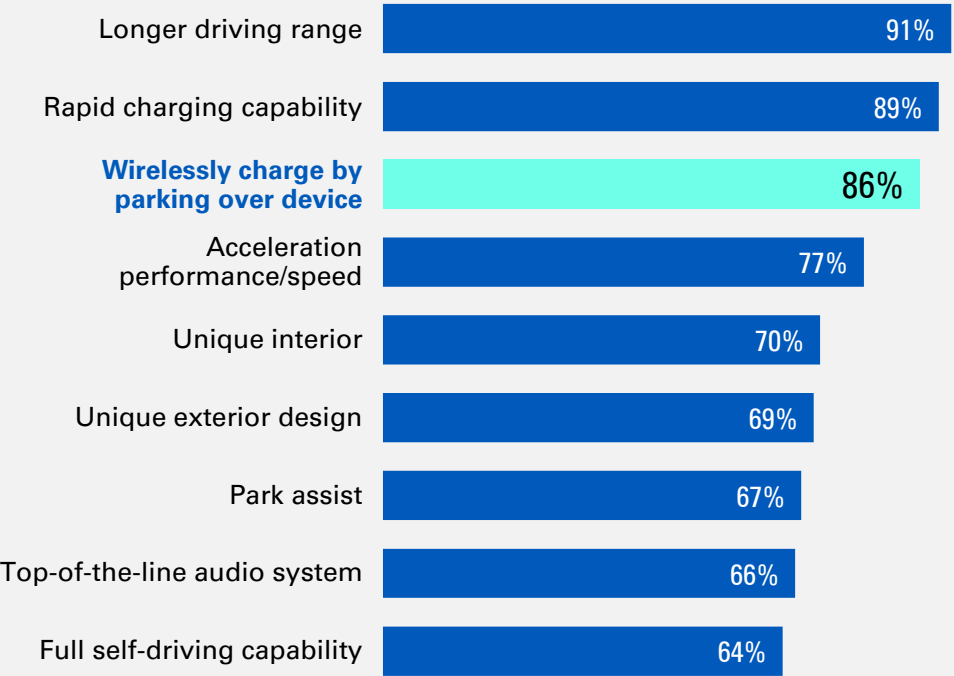
WHY WIRELESS CHARGING?

Consumers Want Wireless Charging

Likelihood to purchase an EV increases by up to **68%** if wireless charging available



Extremely Interested/Very Interested In...




Interest in wireless charging far exceeds other key automotive features like interior design, parking assist, self-driving, and high-quality stereo


Data drawn from commissioned research conducted by TideWatch Associates, an independent research organization, in September 2021 and Qualtrics in March 2022.



Consumer Preference Data

WiTricity partnered with Qualtrics and surveyed 1,053 Americans interested in purchasing an EV

98% 
of Millennials find the
technology appealing

95% 
of Gen X are interested
in wireless charging

Benefits that resonate the strongest vary by demographics



Baby Boomers appreciate not dealing with cords: not plugging in (72%), not unplugging (62%)



Millennials like having access to the latest tech (46%)



People are willing to pay for it

Consumers expect to pay a premium¹ for a new EV that offered wireless charging capability (not the charger)

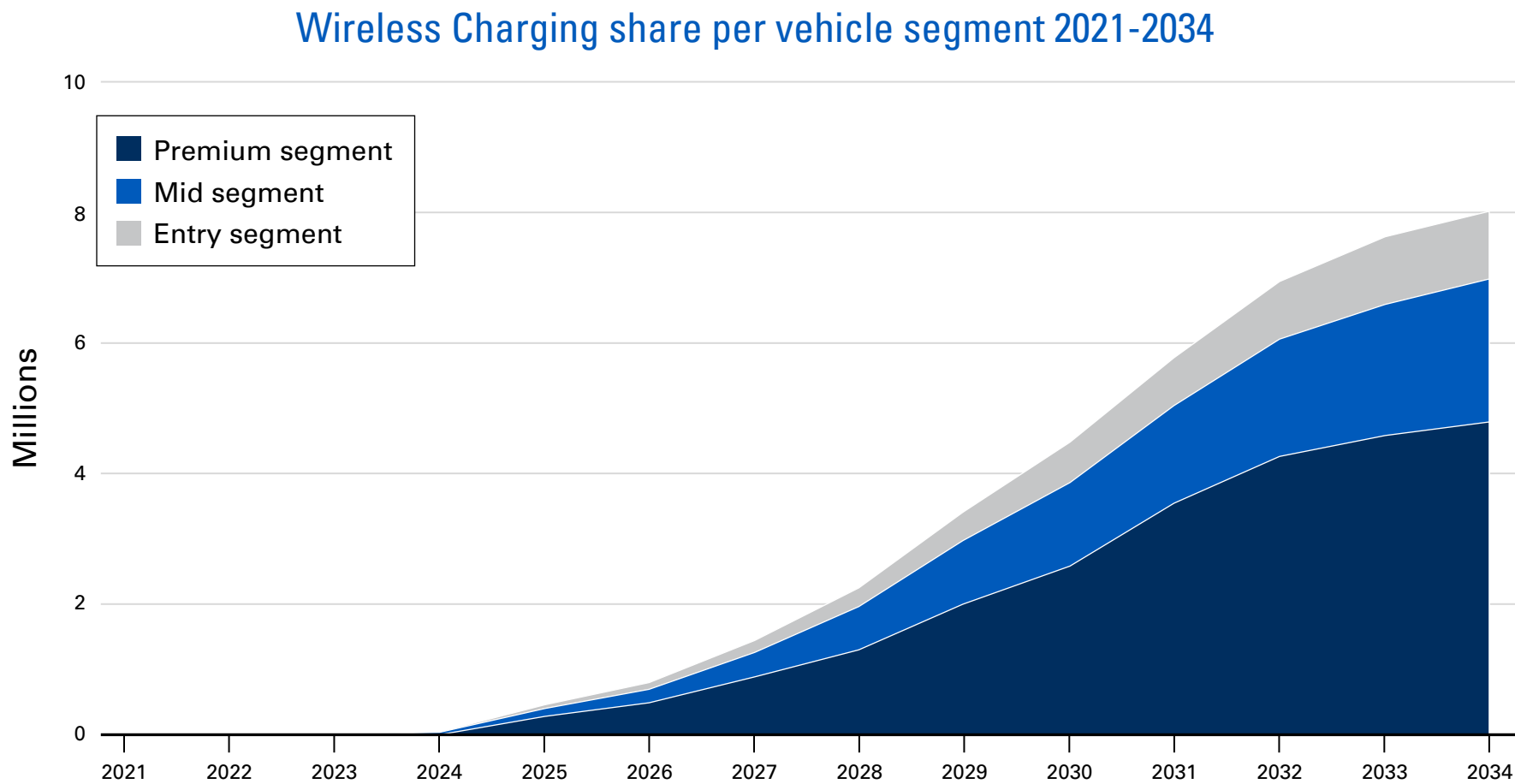
Compare to these upgrades – all **ranked lower in desirability** than wireless charging

- \$20,000 to upgrade Lucid Air to the “Grand Touring” performance
- \$10,000 plus \$15/month for Tesla’s full self-driving capability
- \$8,170 to upgrade to 21” Mission E wheels on Porsche Taycan
- \$6,000 for a Lucid Air “stealth” paint job
- \$3,150 for special “carmine red” paint job on Porsche Taycan
- \$1,250 for Polestar over-the-air upgrades
- \$1,500 for remote parking
- \$800 for eco-friendly interiors

¹Data drawn from commissioned research conducted by Qualtrics, an independent research organization, in March 2022.



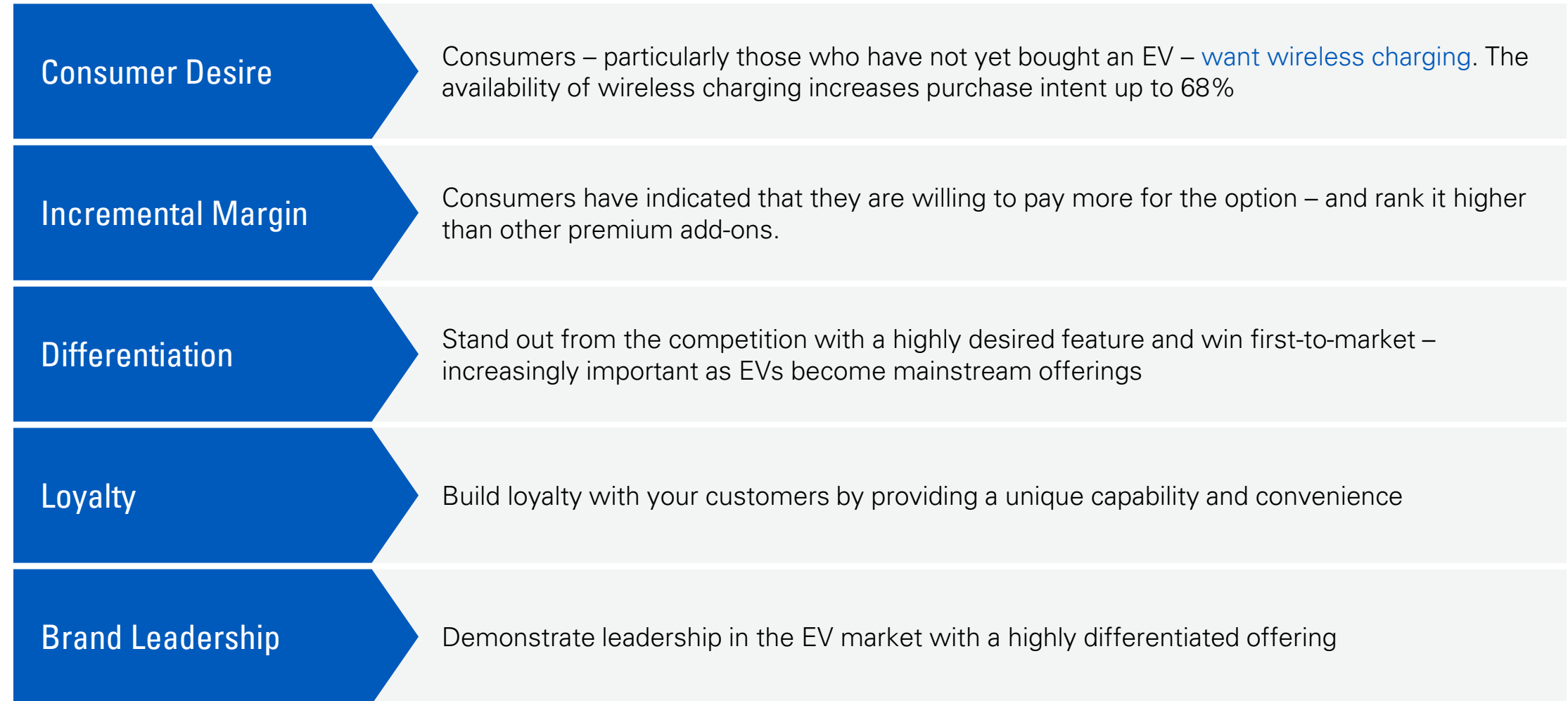
Wireless charging to grow substantially, in premium vehicles



Source: S&P Global Mobility, Vehicle-side Charging Forecast level 3 extended – September 2022 Data



Why Offer Wireless Charging?



Wireless Charging Advantages Over Automated Approaches

1 Effortless and Efficient

- Effortless charging, charging certainty
- As efficient and as powerful as ACD
- Reliable

2 No moving parts

- Impervious to water, dirt, snow, leaves, corrosion
- Charging System will remain intact for years without cleaning or repair
- Highly Developed Foreign Object and Living Object Detection

3 WiTricity's vast charging Eco-System

- Ground Unit Contract Manufacturers
- Vehicle Unit Tier 1 Partners
- Infrastructure/Installation Partners



4 Standards Compliance provides Interoperability and Multiple Competitors

- Municipality and Infrastructure customers

5 Future-Proof Technology



EV Wireless Charging Global Update

Passenger Vehicles & Light Trucks



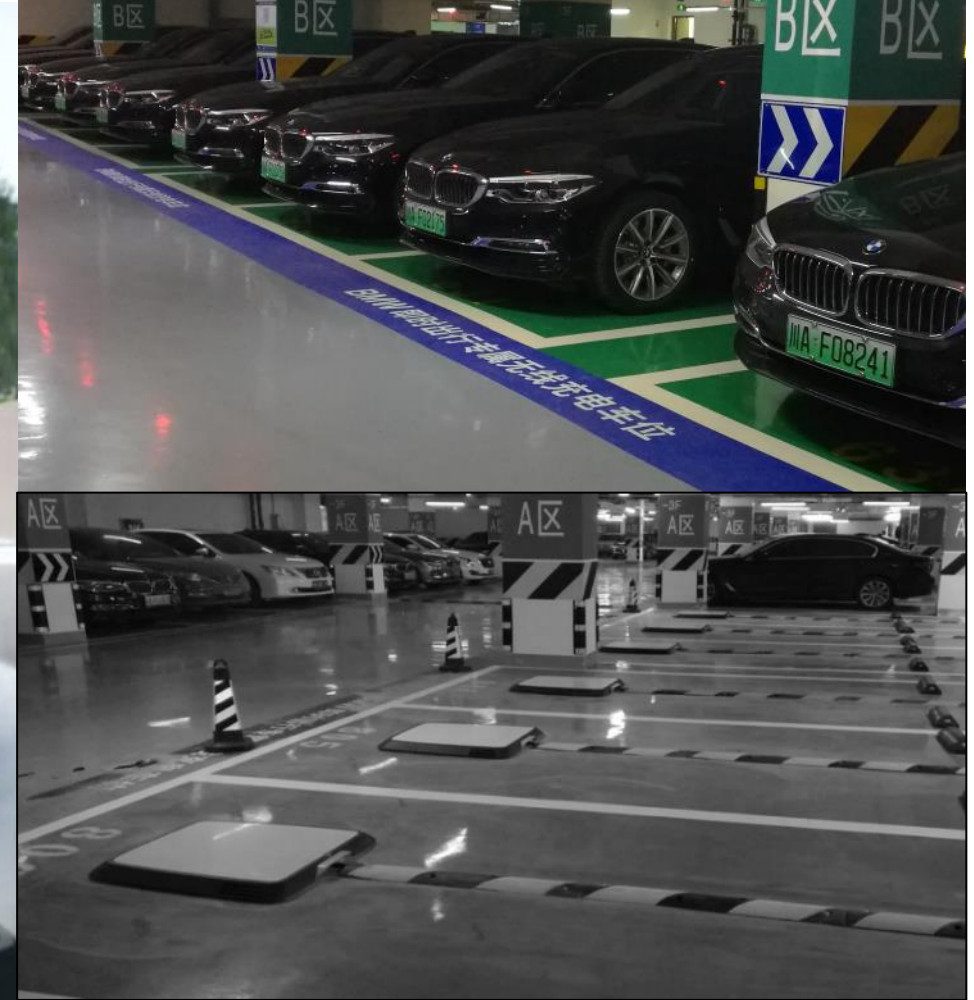
Autonomous Vehicles



Launching in production



EV Wireless Charging: 2018/19 BMW 530e



EV Wireless Charging: 2020 McLaren Speedtail



EV Wireless Charging: 2021 Genesis GV60/70



EV Wireless Charging: 2021 FAW HongQi E-HS9



EV Wireless Charging: 2022 IM Motors Zhiji L7



WiTricity Retrofit – Tesla Model 3



WiTricity Retrofit – Mustang Mach-E at the DSPL



Approaching the charger



We've added an additional screen in the cockpit



Showing 10.2 kW – 93% efficiency



WiCET Wireless Charging of Electric Taxis



<https://wicet.co.uk/2022/08/08/first-look-video-for-taxi-wireless-charging-area-will-look-and-work/>

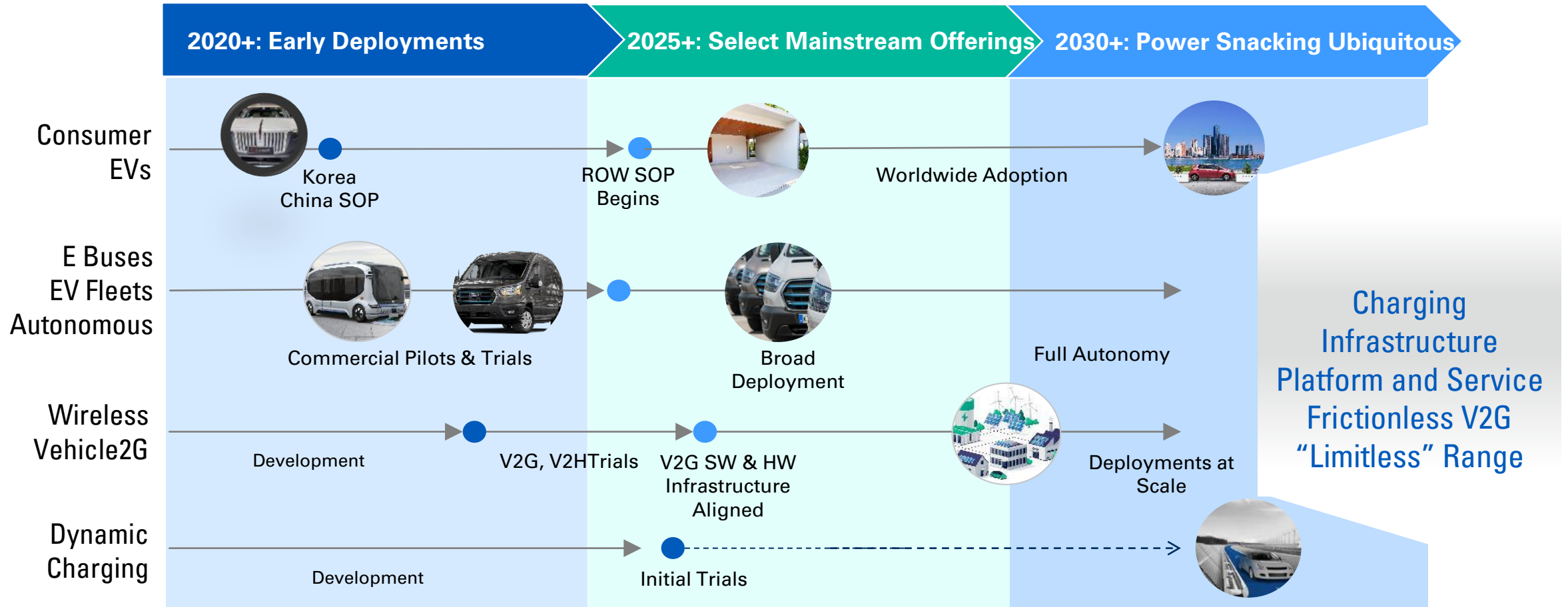


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EV Wireless Charging: 2023 Yutong Autonomous Shuttle



The Road to Autonomous Charging



Adaptable to Future Market Requirements

Enhanced Power Ranges

- Just like the plug, passenger and light duty vehicle charging can scale up to higher kW
- Higher power solutions for larger vehicles like mass transit, trucks 75kW-450kW

Cost Reductions

- Component consolidation, deeper vehicle integration, scale of product

Home Charging and Public Infrastructure

- Flush Mount
- Bidirectional (V2H, V2G)

Dynamic Charging (Charging-in-Motion)

- Most economically viable will be in taxi or truck queues



Meet WiTricity

The leader in bringing wireless EV charging solutions to the mainstream market

- More than \$200 M of capital raised
- Driver and basis of key industry standards necessary for widespread adoption
- Implemented at early-adopting automotive OEMs
- Production systems available starting in 2023

Established technology leadership

- Product deployed and in market
- Strong IP portfolio of 1,300 patents globally
- Full suite of automotive grade software
- Market-ready solutions for fleets and consumers
- Fully standards compliant

Global development footprint

- Watertown, MA, USA headquarters
- Zurich, Seoul, Hong Kong, Auckland, Shanghai



WiTricity Halo™ Wireless Charging System

Wall Box

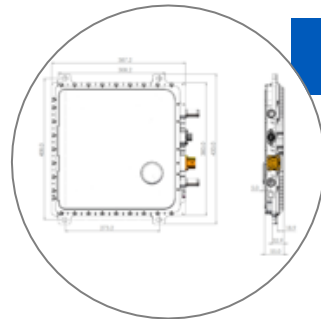
- Pedestal or wall mount
- IP Rated for indoor & outdoor installation
- Lowest EMI & EMF meets FCC, CISPR, ICNIRP
- 1-phase 240V for public and private use
- Typically, 90%-92% End-to-End Efficiency
- Global Standards Compliant: SAE, GB, ISO-IEC
- OCCP 2.0.1 to connect to OEM or CPO cloud

Ground Pad

- Drive-over capable
- IP Rated for indoor & outdoor installation
- FOD, LOP, PD

Receiver

- Delivers energy to 400V or 800V EV battery
- 387 x 383 x 55mm pkg / 13kg
- Seamless interoperability with WiTricity Halo™ charger



Let's make this happen!



WiTricity®

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