



WIRELESS EV CHARGING

Infrastructure, Innovation & Competitive Positioning -
Next Era of Mobility

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Industry Context

Infrastructure shifts are rarely loud but they redefine everything built upon them.

Every so often, a technology stops being a feature and becomes infrastructure. Wireless EV charging is entering that moment.

EV sales hit 14 million units in 2023, 18% of new cars sold worldwide (IEA). The plug, fine for early adoption, is starting to buckle under that scale. For a decade, wireless charging was a convenience: no cable in the garage, no cord at the depot. That framing is now obsolete. It's being built as a structural layer of transport infrastructure, not an accessory to it.

The physics were never the hard problem. Sending power across an air gap through coupled coils is well understood, and SAE's J2954 standard has already settled the light-duty case, three charging classes up to 11 kW, one common way for a car and a pad to talk to each other. What's unsettled is everything stacked on top: coil design, magnetic shielding, silicon carbide power electronics, alignment, foreign-object detection, grid interface. Every layer is its own patent fight. Plug-in charging is drifting toward commodity hardware. Wireless isn't, no one's won the stack yet.

That's closing faster than it looks. Acquisitions, cross-licensing, national-lab tech transfers, ownership is consolidating. And as J2954 hardens into a true global standard, some of these patent families are becoming standards-essential: the kind no competitor designs around, only pays to license.

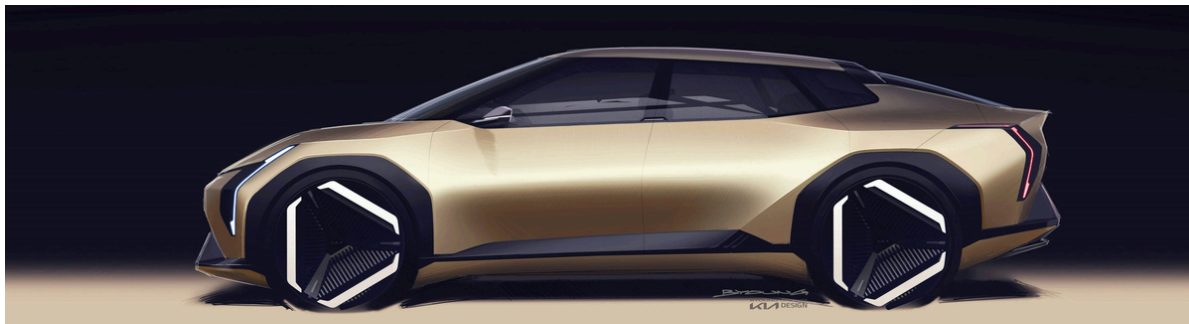
Three shifts are defining this phase:

- Power escalation. SAE's heavy-duty companion standard, J2954/2, pushes wireless transfer to 500 kW for trucks and buses, an order of magnitude past passenger vehicles, already clearing 92%+ grid-to-battery efficiency in field trials. New power class, new materials problem.
- Dynamic electrification. In-road charging moves the fight from the vehicle to the road itself from a company's R&D budget to a government's infrastructure budget. The patent surface now includes pavement, segmentation, grid coordination. No single OEM controls that alone.
- Autonomy integration. A fleet with no human in the loop needs a charging method with no human in the loop.

This isn't a new way to charge a car. It's an energy layer being built into the architecture of transportation itself and whoever owns its core patents won't just win a product category. They'll set the terms everyone else builds on.

This report maps that landscape through a patent lens: where innovation concentrates, how ownership is consolidating, which jurisdictions are filing hardest, and where standards are quietly turning private IP into shared infrastructure to find where real, defensible advantage is still being built, and how much longer that window stays open.

Executive Summary



- IP leadership is concentrated, with WiTricity holding the strongest multi-jurisdictional footprint (US 817, China 638, Japan 511, South Korea 419, India 406), indicating foundational technology control across major automotive markets.
- The United States and China are the primary competitive battlegrounds, as all major players maintain significant filing volumes in both jurisdictions.
- Qualcomm demonstrates the most balanced global portfolio (US 477, China 447, Japan 404, India 428, Korea 339), signaling technology-platform positioning rather than OEM-centric protection.
- Hyundai Motor Group dominates its home jurisdiction (South Korea 495) while maintaining strong US and China presence, reflecting OEM-driven integration strategy.
- Toyota's portfolio is concentrated in Japan and the US (357 each), indicating dual-market protection aligned with core automotive production hubs.
- India filings are led primarily by technology licensors (Qualcomm and WiTricity), suggesting strategic positioning for emerging manufacturing and market growth rather than OEM protection.
- Japan remains a critical protection market, with strong participation from WiTricity, Qualcomm, Toyota, Panasonic, and Auckland.
- Remaining patent life trends indicate that enforceable protection remains dense through the early 2030s, with larger expiry waves emerging post-2033, signaling gradual easing of foundational IP barriers in the long term.
- The competitive structure suggests foundational wireless power transfer IP is centralized, while OEMs focus more on integration and regional market protection.

Market Overview



EV sales hit 14M units in 2023, roughly 18% of global car sales. Wireless charging has moved from lab concept to a standardized, commercializing category, with most forecasts putting CAGR at 35–40% through the early 2030s. The question is no longer if it works, but which version wins first.

The bottleneck just cleared. SAE J2954 now sets the interoperability, safety, and efficiency benchmarks for wireless power transfer, including foreign object detection and EMF limits. A published cross-industry standard is usually what separates a real deployment curve from permanent pilot purgatory. The architecture question is also settled: magnetic inductive coupling is the dominant, commercial approach per the IEC, not the only option, but the one that ships.

Two different products are being sold under one label, on two different timelines. Static, pad-based charging is commercial today, constrained mainly by cost versus plug-in systems, and is the near-term market. Dynamic, in-motion charging is still pilot-stage, and per the European Commission's own pilots, its limit isn't engineering, it's the balance sheet, grid integration and infrastructure cost. That makes it a long-dated option, not a near-term bet.

The competitive field splits into three separate races rather than one. Technology leaders like WiTricity and Electreon are racing to own the IP and platform stack. Tier-1 suppliers like Bosch, Continental, and HELLA are racing on automotive-grade reliability and integration. Challengers like Mercuso, Up&Charge, and Plugless are racing to prove real-world adoption first, in narrower use cases. Each is playing a different game, which matters when benchmarking one against another.

The growth case rests on three drivers: EV parc growth, which is mechanical rather than speculative; active infrastructure investment across the US, EU, and China; and standardization removing the interoperability risk that has stalled comparable technologies before. Estimates from Allied Market Research, MarketsandMarkets, and Persistence Market Research put the market moving from the mid-hundreds of millions today to several billion USD by 2032–33, led by Asia Pacific and North America.

The technology risk is gone. What's left is a sequencing decision: static charging is the commercial opportunity now, dynamic charging is a longer-dated option waiting on infrastructure economics rather than further R&D. The next edge goes to whoever owns the interoperability layer as the market consolidates around J2954.

Key Players



WiTricity AI Tech, LLC.

MR/1 Wireless Charger

Current Status: Pilot Commercialization

Future Goal: V2G integration,
Bidirectional grid intelligence



- Wireless charging debuts commercially in Yutong's e-buses in Zhengzhou, China, on the Xiaoyu 2.0 autonomous minibus.
- The REFLECTIVE Autonomous Mobility Project operates as an EU-funded initiative advancing wireless EV integration.
- 75 kW+ wireless charging systems are engineered for heavy vehicles, commercially marketed, and deployed in pilot programs.



electreon

Electreon

Stationary & wERS Charging

Current Status: Pre-Scale Infrastructure
Deployment

Future Goal: Nationwide ERS Scale &
V2G Enablement



- Rapid-deployment wireless charging with copper coils embedded beneath road surfaces for seamless EV charging across highways and transit hubs.
- 30+ live global deployments across transit and freight.
- World's first live-traffic dynamic charging highway (A10, France).
- Heavy-duty integration validated (50-ton GINAF truck).
- Patent pending V2X (EP3898314A4).
- Aligned with France's national ERS scale-up plan (5,000 km+).

Key Players



Qualcomm

Halo Wireless Electric Vehicle Charging (WEVC)

Current Status: Technology Acquired / Integrated into WiTricity Portfolio

Future Goal: Scalable Dynamic Charging & Global Standardization



- Developed dynamic EV charging (DEVC) delivering up to 20 kW in-motion charging at highway speeds.
- Demonstrated system on the 100-meter FABRIC test track (VEDECOM, Satory Versailles).
- Advanced wireless power transfer for stationary and dynamic applications.
- Halo technology acquired by WiTricity to accelerate commercialization.



InductEV, Inc.

In-Ground Charger, On Vehicle Receiver, Power

Current Status: Commercial Fleet Deployment

Future Goal: Scalable Fleet Electrification & Grid Integration



- Provides in-ground wireless charging systems designed for high-utilization EV fleets.
- Integrates on-vehicle receivers for seamless, automatic charging.
- Deploys modular power cabinets to support scalable fleet operations.
- Focuses on reliable, cost-effective charging for transit buses and commercial vehicles.
- Enables opportunity charging to reduce battery size requirements and operational downtime.

Key Players



Hevo

Rezonant™ E8 Wireless Charging Pad

Current Status: Commercial Product Deployment

Future Goal: Scalable Residential & Public Infrastructure Integration



- Surface/flush-mounted pad operating within SAE J2954.
- Automated alignment with autonomous integration capability.
- Reinforced, water-tight design rated up to 20,000 GAWR.
- Infrared, motion, and thermal safety detection with auto shutoff.
- LED display alerts for safety interruptions.
- IoT-connected with cloud sync and Journey app alerts + alignment guidance.



Plugless Power Inc

Parking Pad, Vehicle Adapter Systems

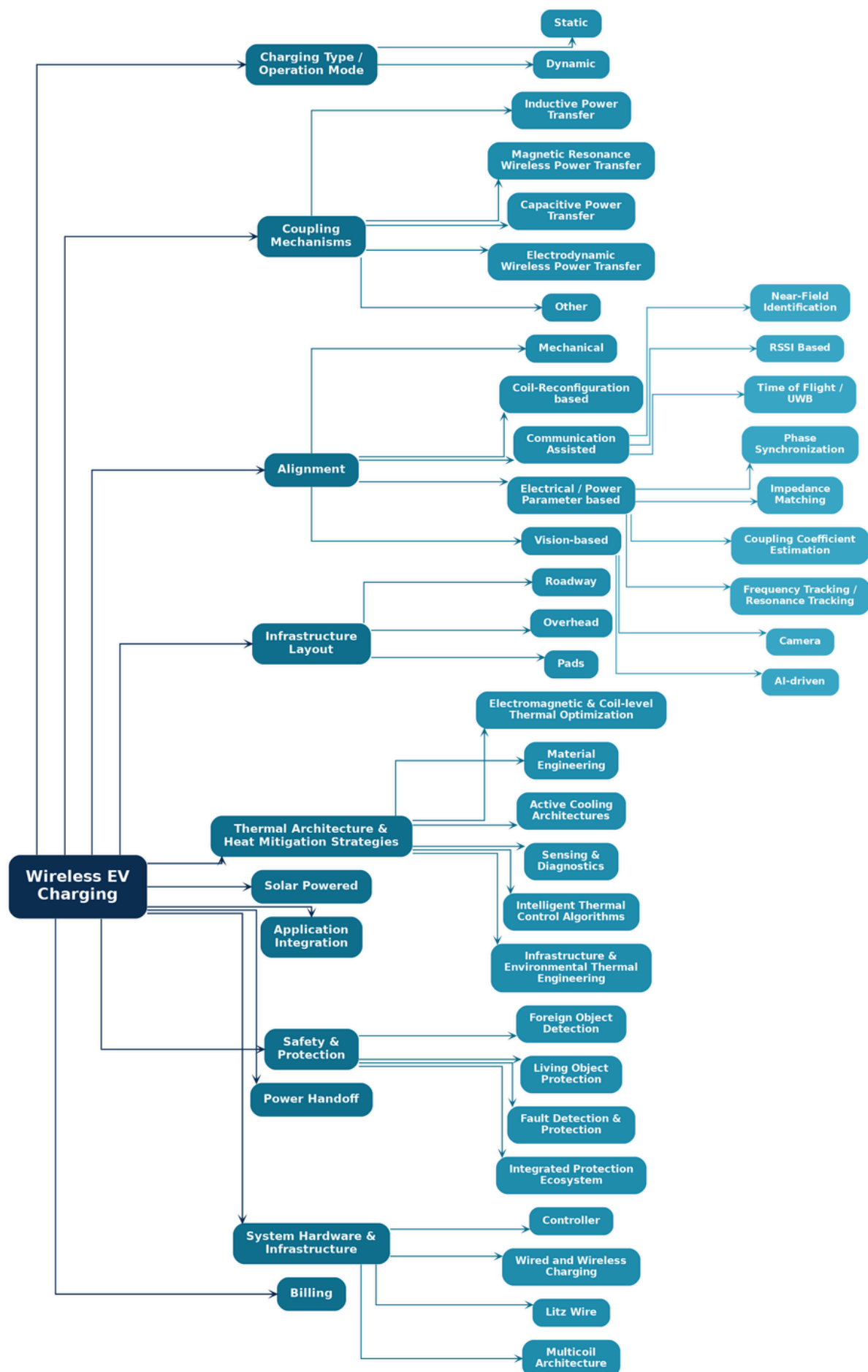
Current Status: Commercial Product Deployment

Future Goal: Scalable Residential & Fleet Wireless Adoption

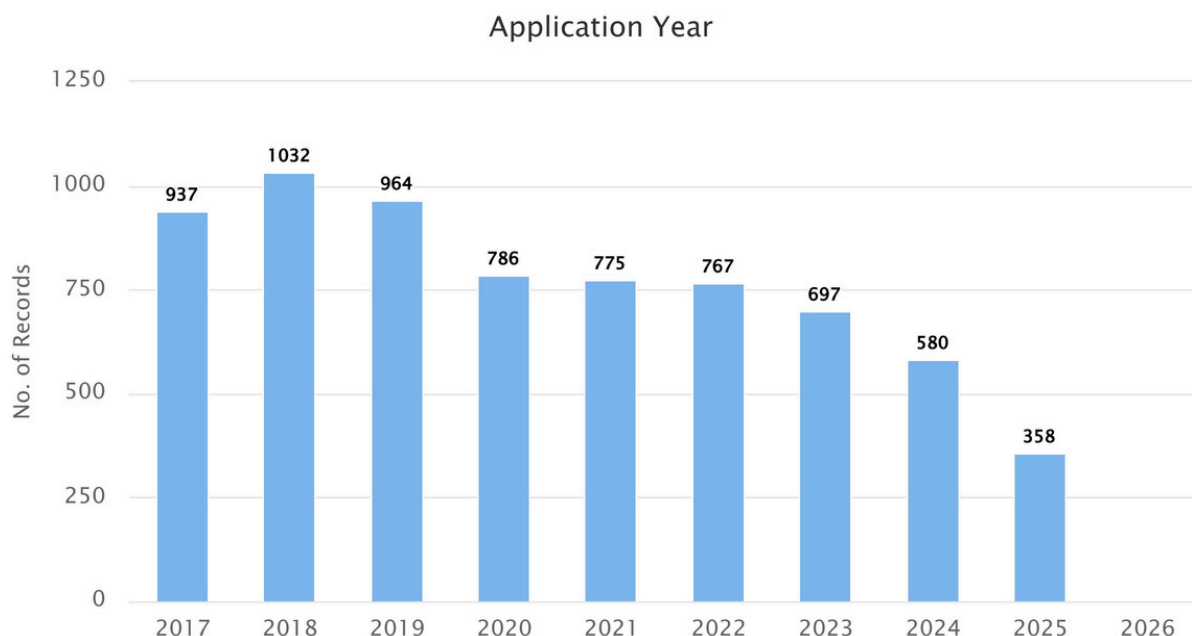


- Inductive wireless EV charging using aligned magnetic coils across an air gap.
- Commercial 3.3/3.6 kW and 7.2 kW production systems for consumer EVs.
- Early production compatibility with Tesla Model S and other EV models.
- Surpassed 1 million cumulative charge hours across installations.
- Deployed in residential, fleet, and commercial sites, including pilot programs with major enterprises.
- Provides turnkey installation and support services.

Taxonomy

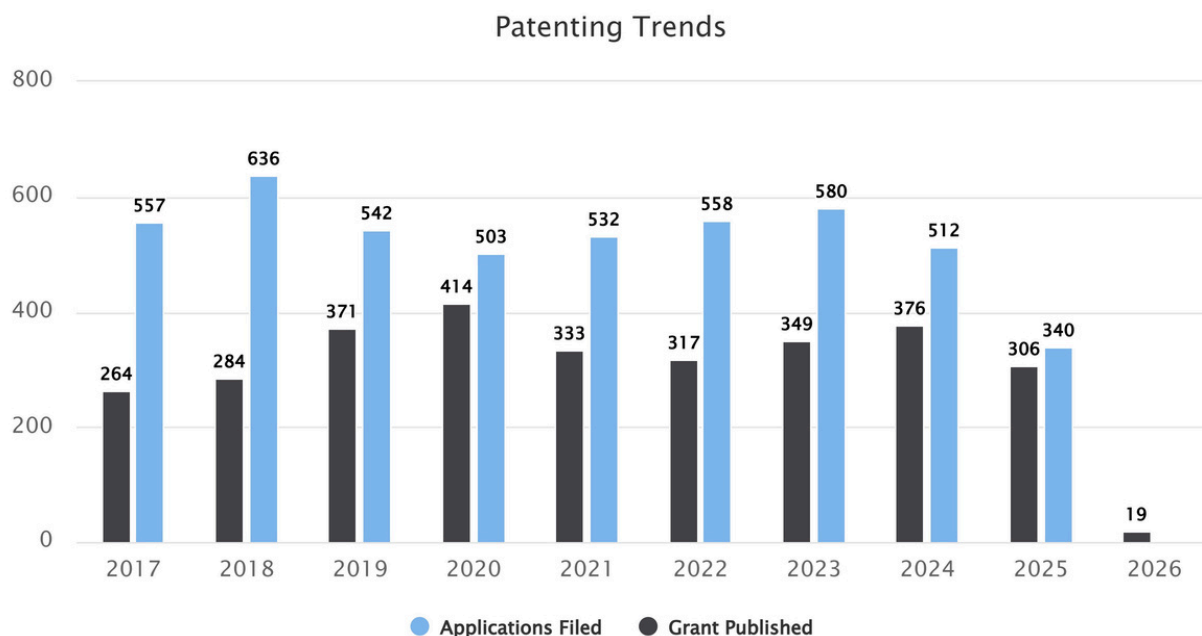


Overall Filing Trend



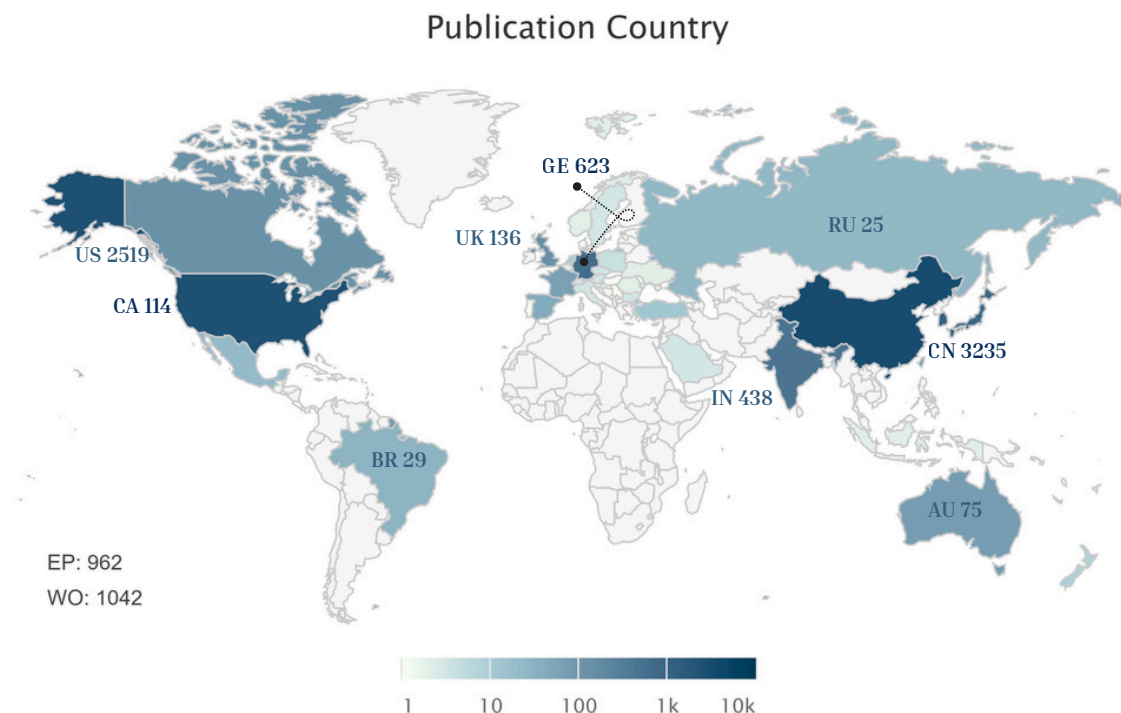
- 2018 marks the filing peak at 1032 applications, representing ~10% growth from 2017 (937 → 1032).
- Post-2018 decline is structural, not temporary ~24% drop from 2018 to 2020 which suggests correction after an initial expansion phase.
- 2020–2022 shows stabilization rather than collapse. Indicates controlled R&D continuation by core players.
- Cumulative decline from peak to 2024 is significant (~44% decrease) which signals sector rationalization and capital discipline.
- 2023–2024 shows renewed acceleration in decline, Possible tightening of investment or shift toward selective filings.
- 2025 data (358) should not be overinterpreted. Application-year datasets for recent years are typically incomplete due to publication lag.
- When filing counts decline gradually yet persist over multiple years, it typically signals consolidation by dominant players, a shift toward commercially viable incremental improvements, and increased focus on standardization-driven IP rather than exploratory volume filing.

Filing Trend



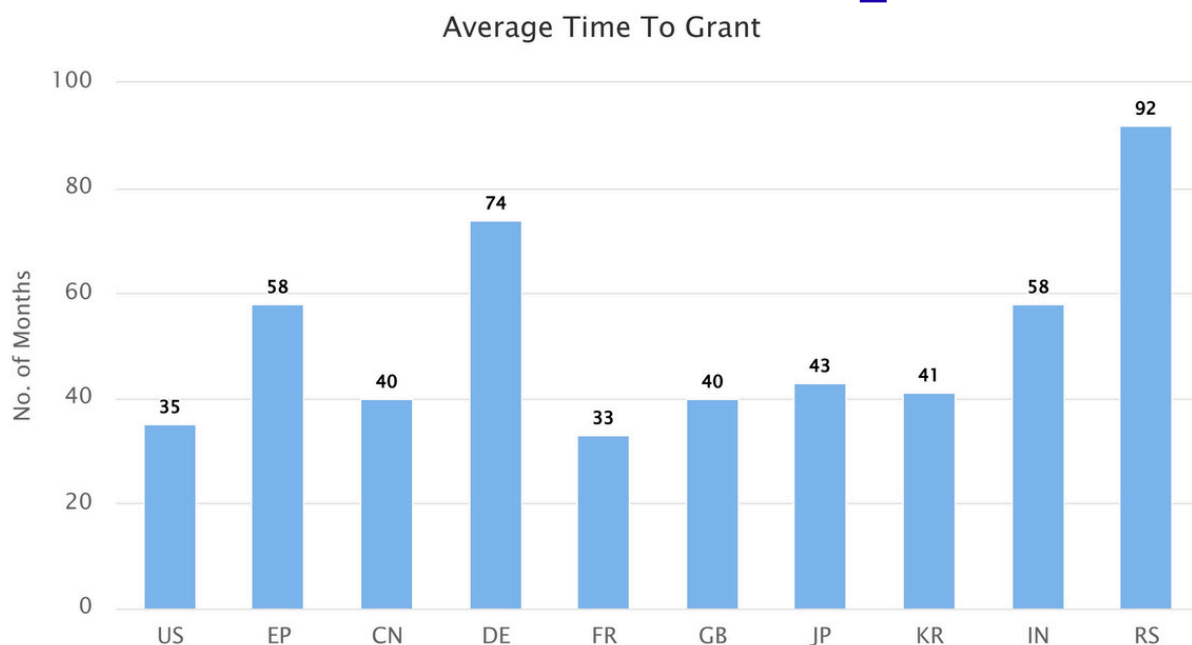
- 2018 records the highest application filings (636), marking the first major expansion peak in the dataset.
- Filings remain structurally strong from 2019–2023, indicating sustained R&D intensity rather than a one-time surge.
- 2023 shows renewed acceleration (580 applications), indicating strategic scaling aligned with high-power freight charging, dynamic roadway pilots, and infrastructure integration.
- Grant publications peak in 2020 (414 grants), reflects maturation of earlier filing waves.
- Grants remain elevated through 2024 (376 grants), confirming steady conversion of applications into enforceable rights.
- The 2025 decline (340 applications) likely reflects publication lag and data completeness rather than a real drop in innovation activity.
- Overall trend shows cycle progression: expansion → stabilization → renewed growth → portfolio maturation, consistent with an infrastructure technology entering commercialization phase.

Top Jurisdictions



- WO publications lead at 1,042, indicating many applicants are using the PCT route to delay country-specific costs while evaluating commercialization pathways.
- EP publications rank second-highest, indicating strong strategic focus on centralized European coverage through the EPO rather than fragmented national filings.
- The strong EP and WO counts together imply structured multi-jurisdictional protection planning rather than opportunistic national filings.
- The U.S. appears among the darkest-shaded jurisdictions, indicating high publication volume and reinforcing its role as a key commercialization and enforcement market.
- Lighter shading in Africa, Latin America, and parts of Southeast Asia indicates protection is concentrated in high-value industrial economies rather than universal geographic expansion.
- Strong global coverage alongside heavy PCT use reflects technologies approaching infrastructure-scale deployment, where enforceable rights are secured ahead of commercialization.

Average Time to Grant (Jurisdictional Impact)



- France (33 months) and the U.S. (35 months) offer the fastest paths to enforceable rights, enabling earlier litigation and licensing leverage, though shorter prosecution cycles may lead to narrower claims.
- The European Patent Office (58 months) and Germany (74 months) reflect materially longer grant cycles, suggesting procedural rigor and multi-jurisdictional complexity that can delay enforceability.
- For infrastructure-heavy tech like wireless EV roads, German grants often signal strong defensibility.
- India (58 months) and especially Russia (92 months) show prolonged prosecution timelines, potentially widening pre-grant vulnerability windows in infrastructure-heavy sectors.
- With timelines ranging from 33–92 months, jurisdiction choice directly affects when patent rights become actionable, influencing competitive positioning, cross-licensing timing, and commercialization sequencing in wireless EV infrastructure markets.
- China (40), UK (40), Korea (41), and Japan (43) cluster within a narrow 3-month range, indicating predictable mid-cycle examination timelines across major industrial economies.

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