

From Land to Sea to Air – DAIHEN Powers the World Wirelessly

The world has never witnessed change as explosive as it did in the 100 years between 1919 and 2019. From 1.8 billion people in 1919 to 7.7 billion in 2019, global growth has been extraordinary. During this time, our focus on technology and innovation has fueled transformation in transportation, manufacturing, and every business we have today. It's this type of focus that led DAIHEN, a Japanese electrical infrastructure company, to ship the world's first magnetic resonance wireless charging system for industrial applications under a WiTricity license—revolutionizing the modern factory. It's also this focus that's brought DAIHEN's wireless charging systems from the factory to our roads, to the air and to the sea.

Begun in 1919, DAIHEN has evolved its business to focus on three business areas: power distribution, welding/factory automation robots, and semiconductor and Flat Panel Display-related business. While exploring other areas of growth, the company developed its magnetic resonance wireless power transfer (WPT) system—D-Broad—in 2016.



DAIHEN Corporation began manufacturing pole-mounted transformers in 1919 by instituting a dedicated mass production system, specializing in the production and distribution of electric power transmission products, dispersed power systems, welding machines, industrial robots, power supply for plasma applications and clean transfer robots. Since then, the company has focused on creating new and innovative products to help customers address today's needs and prepare for tomorrow's opportunities.

Today, the DAIHEN Group includes 32 companies worldwide, working actively to advance business in their specific areas while applying energy innovations and control technologies to additional markets.

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—Yoshinori Tsuruda
GENERAL MANAGER, DAIHEN



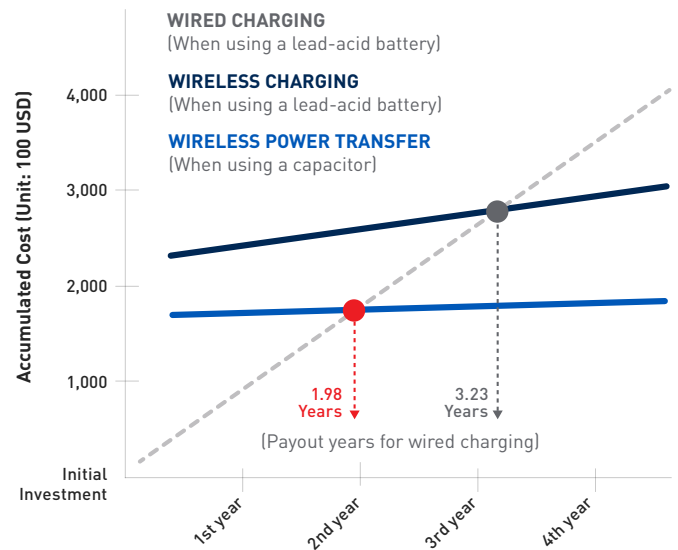
By providing wireless charging with a 100% charging rate success, unparalleled charging speed and long-distance power transfer, D-Broad helps factories and warehouses realize 24-hour operations without any labor needs.

WIRELESS POWER TRANSFER OPENS OPPORTUNITIES

With WPT—licensed through WiTricity—DAIHEN quickly discovered a wide range of relevant applications that would benefit from it.

“Daihen saw an immediate positive response to our wireless power offering,” commented Yoshinori Tsuruda, General Manager, Wireless Power Transfer System Development, DAIHEN. “It was clear that there was a pent-up demand for this technology and companies were excited to bring it into their factories and workstreams.”

Autonomous Guided Vehicles (AGVs)—powered wirelessly—became fully autonomous, no longer requiring a human to plug them in to charge. This led to warehouses and factory managers realizing that, not only could their operations run 24/7, but the technology could be used inside and outside the warehouse for both small autonomous robots and ultra-small EVs. DAIHEN discovered that one of the most popular uses of wireless AGVs is the transferring of parts from one area of the factory to another throughout the production of automobiles. One major Japanese car manufacturer found the Return on Investment (ROI) using the D-Broad WPT was just two years.



In addition to realizing reducing labor costs with complete automation using wireless charging, the manufacturer was also able to cut energy-related costs due to WPT's efficiency. By using a capacitor unit to store electrical energy in an electric field, together with the power storage device, a reduction in energy loss of only 26% was possible. Some customers achieved a yearly reduction in electricity costs and CO2 emissions of up to 60%.

They also benefited from not having to purchase specialized AGVs; DAIHEN could retrofit AGVs by simply attaching its technology to the AGV to be charged, as well as install a charging point at the AGV's stopping area. Instant charging!



Taking wireless power transfer one step further, DAIHEN began testing dynamic charging (charging while in motion) in a factory setting. By staying on a prescribed route, AGVs can continually charge throughout the day, without ever having to return to a charging point.

Based on the success companies are realizing from DAIHEN's WPT, more than 1,500 systems are currently in use globally.

PLANNING FOR THE FUTURE

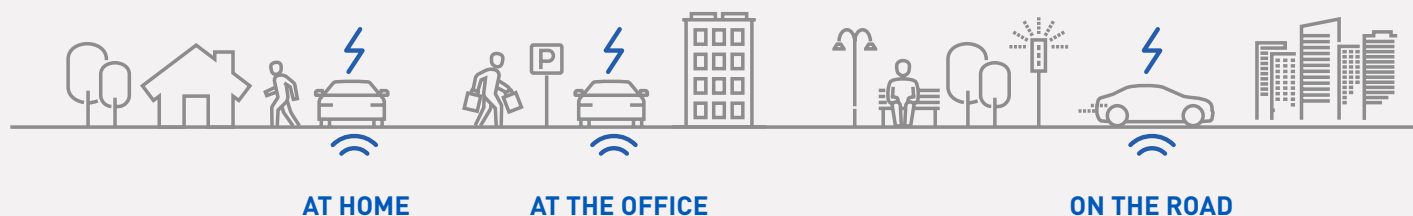
As DAIHEN began its second century of business, it continued to look for new opportunities for wireless power transfer technology. The next development beyond AGVs was electric vehicles (EVs). From electric golf carts to ultra-small EVs, WiTricity wireless charging enabled DAIHEN to expand its offerings to capture a new market. One project in Sakai City, Osaka Prefecture used wireless charging as part of a community revitalization project in Senboku New Town. It was aimed at making the elderly and other nondrivers more mobile and, subsequently, encouraging them to get out and about on a regular basis.

Another offering was a mobility service in Expo'70 Commemorative Park with the Kansai Electric Power Co., Inc. and the Road Test Promotion Team Osaka. The tests involved shuttling visitors from their present location to a desired destination that they input into a dedicated app. Upon receiving the information, a 5-person autonomous electric cart picked up and dropped off the riders. The cart featured a mounted WPT system that enabled wireless charging by simply parking at a charging dock.



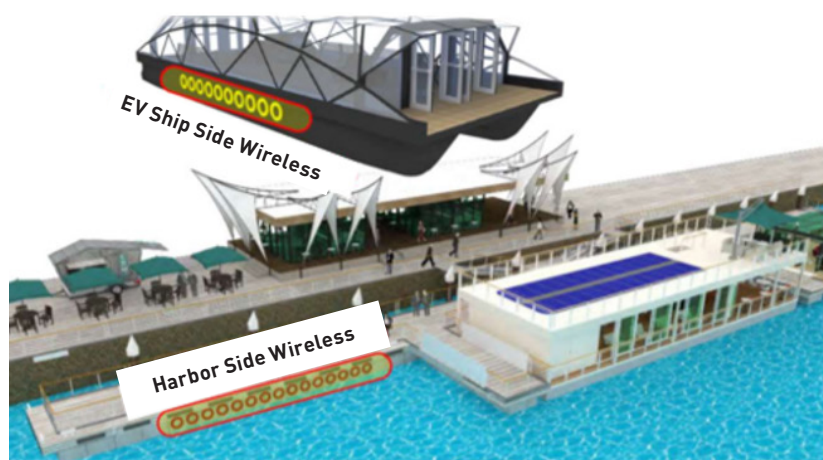
In 2020, DAIHEN began working on integrating wireless charging to a Toyota ultra-small EV.

“Although we’re excited about the work we’re doing to help factories and warehouses be more efficient, we’re thrilled about what lies ahead with EVs,” commented Yoshinori Tsuruda. “With more manufacturers creating more electric vehicles, it’s critical that drivers have the option to charge wirelessly—at home, at the office, and on the road.”

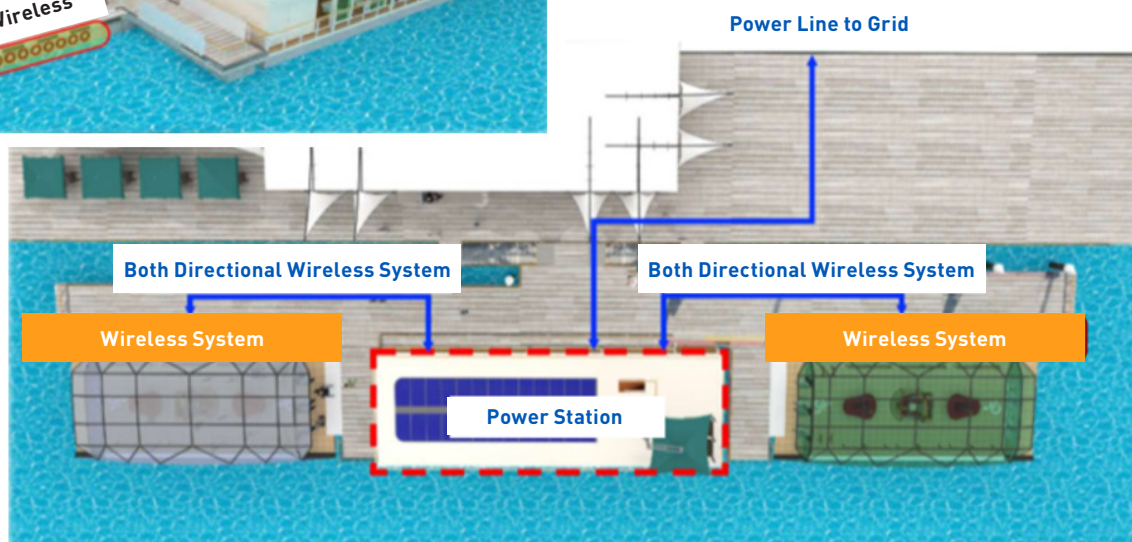


FROM LAND TO SEA TO AIR

Japan's shipping industry is grappling with a number of challenges, including the need to curb greenhouse gas emissions, resolve labor shortages, and identify ways to effectively harness autonomous shipping technologies to promote safe, reliable, and efficient operations.



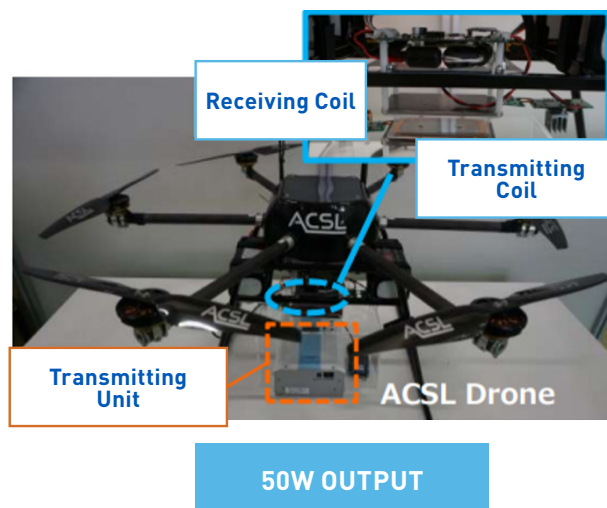
In response, Tokyo-headquartered e5 Lab, Inc. has created the e5 Tanker—the first fully electric oil tanker. The ship will include a high level of automation and will be charged using wind and solar energy to further reduce emissions that would be incurred in charging the ship. It will be charged with DAIHEN's high-power wireless power transfer system.



Not content to stay on land or sea, DAIHEN is exploring opportunities in the sky—specifically with drones.

Drones are being built to assist in a variety of applications, including remote sensing; commercial aerial surveillance; oil, gas, and mineral exploration; disaster relief; deliveries and cargo transport; geographic mapping; law enforcement; storm forecasting; and more.

DAIHEN is responding to demand by using high-frequency technology (13.56MHz) with its wireless power transfer system to reduce the weight and size of the drone.



SMART ENERGY MANAGEMENT FOR SMART CITIES

Through its business activities, DAIHEN is making concerted efforts to solve a diversity of social issues and shape a sustainable world. As part of these efforts, the company is committed to helping communities shrink their carbon footprint, while also offering eco-friendly means of transportation for covering the last mile in an aging society. It is working toward maintaining the EV charging infrastructure with various plug-in charger and wireless charging systems for EVs and ultra-small EVs. In addition, it is developing dynamic control chargers for energy management.

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>

WIRELESS CHARGING POWERS THE WORLD

Not content to sit on its laurels, DAIHEN—and its customers—are at the forefront of discovering creative and groundbreaking uses for WiTricity's wireless charging technology. With efficient, hands-free, and connector-free charging, industries and manufacturers are realizing the power of freedom and the power of autonomy.

The efficiency of today's modern factory relies on complete autonomy. Companies are quickly realizing that WiTricity enables autonomy by eliminating human intervention and physical docking. They're also discovering, as DAIHEN has shown, the ability to enable opportunity charging for mobile systems that move throughout a factory or warehouse. From tiny drones to full electric oil tankers, and everything in between, the flexibility of wireless technology is being proven over a wide range of power levels—from a few hundred watts to hundreds of kilowatts. And, as evidenced by the work DAIHEN is doing with EVs, it's easy to imagine how WiTricity is making EV charging easier than refueling. By unplugging the way we think about charging, we can rethink the way today's drivers think about refueling their vehicles: just park and charge.

For more information about WiTricity's wireless charging solutions, contact: customercommunications@witricity.com

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.