

due to the large number of abandoned mines. This introduction into our energy system will bring stability and proper energy distribution. In the future, critical infrastructure will always be provided with electricity, due to its reserves. Storage technologies can form a sustainable energy system that will meet needs and standards.

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WIRELESS POWER TRANSFER FOR SMART HOMES AND INDUSTRIAL AUTOMATION

The rapid rate at which smart technologies change requires high power transfer efficiency solutions, so Wireless Power Transfer (WPT) is a revolutionary technology. Without physical connectors, WPT offers enhanced convenience, safety, and automation, changing residential and industrial environments and enabling innovative device connection and system configurations. This article explores WPT's use in smart homes and industrial automation, examining its basic principles, current implementations, advantages, and the barriers to widespread adoption.

WPT transmits electrical power wirelessly using various electromagnetic methods. Like current wireless telephone charging, electromagnetic induction employs coils to establish a magnetic field for energy transmission nearby. While efficient for small electronics, it faces limitations in range and alignment sensitivity. Resonant magnetic coupling enhances this by matching transmitter and receiver resonant frequencies, enabling more efficient power transfer over greater distances. Far-field techniques, employing radio frequency (RF) or microwave transmission for longer ranges, suffer from reduced efficiency due to energy dispersion. Each method presents

unique trade-offs between transmission distance, power capacity, and efficiency, crucial considerations for application-specific WPT system design.

WPT is emerging in smart home environments. As an extension to daily wireless charging plates, the technology is being pushed further toward powering combined systems and entire devices. Next-generation kitchens may have WPT-infused countertops that wirelessly charge blenders, coffee machines, and induction cooktops, adding convenience and elegance. Similarly, home furniture businesses are integrating WPT coils to simultaneously charge several devices, saving space. WPT for home lighting facilitates wire-free LED installations, encouraging creative lighting designs and simplified installations. Wireless charging points can be utilized independently by home automation systems, such as robot vacuum cleaners and smart assistants. But to obtain these applications takes overcoming technological barriers like creating more alignment-resistant systems, improving efficiency across various distances, and being universally compatible.

Industrial environments provide tremendous opportunities and challenges in the application of WPT. With the age of Industry 4.0 and smart factory, WPT can replace maintenance-power consuming power cables and batteries for sensors, actuators, and mobile robots. Industrial IoT sensors, especially condition monitoring sensors in inaccessible locations, can be significantly improved by constant operation by WPT without battery replacement and cabling. AMRs can be operated continuously with wireless charging stations placed strategically, enhancing productivity with less downtime. Moreover, WPT facilitates deployment in hostile environments that are not compatible with traditional power solutions. However, industrial applications must address major technological challenges such as electromagnetic interference caused by equipment, power loss in metal-rich environments, and the need for high-power WPT systems for heavy loads. In addition, stringent safety and reliability requirements, above consumer-grade, must be attained.

Future R&D are the solution to overcome current WPT limitations and extend its applications. Dynamic electric vehicle charging would enable continuous usage, and

RF-based wireless power transmission would enable room-wide wireless power transfer. Technologies for more efficient power conversion and adaptive tuning will drastically increase power transfer efficiency regardless of distance and alignment differences. However, for this potential to be attained, technology should evolve, and safety standards and regulations should be formulated in an all-encompassing manner. The economic benefits of mass production and technological maturity will determine extensive adoption in consumer and industrial markets.

As society evolves towards more networked and automated environments, WPT is poised to influence the future significantly. By freeing designers from the constraints of wired power, WPT enables innovative product designs, system architectures, and energy paradigms. While efficiency, standardisation, and implementation cost issues remain unresolved, advantages for smart homes and industrial automation make WPT a promising technology. When the technology matures and systems are optimized to the best of their capabilities, we can expect living and working areas where energy is as present as air, remaking the basic interface with electrical power and devices it enables.

The mass adoption of WPT will call for a joint effort by manufacturers, producers, and researchers, but the benefits are more than worthwhile. In the home, WPT ensures unparalleled design freedom and convenience, and commercial applications are apt to enjoy increased reliability, reduced maintenance costs, and enhanced efficiency. With the continuing development of such technologies, intersection with other future trends, such as energy harvesting and smart grid integration, could lead to comprehensive wireless power ecosystems, redesigning the map of power delivery in personal and public spaces. The future of wireless power isn't just cordlessness; it's about power for a generation of completely standalone smart devices and systems.

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UKRAINE'S SHIFT TOWARDS A LOW-CARBON ENERGY SYSTEM

Decarbonisation of the energy sector in Ukraine is a difficult but unavoidable transition in accordance with global efforts to contain climate change, while ensuring energy security and economic stability. As a country with a historically coal-based energy system and high reliance on imported fossil fuels, Ukraine faces challenges and opportunities for a transition towards a cleaner energy future. The decarbonisation trajectory is determined by national policy decisions, international cooperation, technological innovation, and geopolitics.

Ukraine has been historically dependent on nuclear energy, gas, and coal for power generation. Even though nuclear power is utilized for the production of low-carbon electricity, power plants based on coal remain a significant source of carbon emissions. Detoxifying Ukraine from coal is not merely an environmental priority but also an economic and social necessity because a large part of the nation relies on coal mining as a means of livelihood. Phasing coal gradually out to give way to renewable energy sources would mean colossal investment in infrastructure, retraining the workforce, and regional development initiatives for equitable transition.