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**Wireless electric vehicle charging stations based on the
resonant inductive power transformers**

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Abbreviations

| | |
|-------|--|
| AAMI | American Association of Medical Instrumentation |
| AC | Alternative Current |
| AFE | Active Front End |
| ANPR | Automatic Number Plate Recognition |
| BEV | Battery Electric Vehicle, also known as all electric vehicle |
| BP | Bipolar |
| CAN | Controller Area Network |
| CAPEX | Capital Expenditure |
| DC | Directive Current |
| DD | Double D |
| DDQ | Double D Quadrature |
| DSO | Distribution System Operators |
| DSRC | Dedicated Short Range Communications |
| EC | European Commission |
| ECU | Electronic Control Unit |
| EMC | Electro Magnetic Compatibility |
| EMI | Electro Magnetic Interference |
| EV | Electric Vehicle |
| EVSE | Electric Vehicle Supply Equipment |
| FCC | Federal Communications Commission |
| FEM | Finite Element Method |
| FMA | Fundamental Magnetic Analysis |
| GHG | Greenhouse Gases |
| GPS | Global Positioning System |
| GV | Gasoline Vehicles |
| HEV | Hybrid Electric Vehicle |
| HF | High Frequency |
| HMI | Human Machine Interface |
| IEC | International Electro Technical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IGBT | Insulated Gate Bipolar Transistor |
| IPT | Inductive Power Transformer |
| LPG | Liquefied Petroleum Gas |
| MPE | Maximum Permission Exposure |
| NPPs | Non-Polarized Pads |
| OBC | On-Board Charger |
| OECD | Organization for Economic Co-operation and Development |
| OEM | Original Equipment Manufacturer |
| OPEX | Operating Expense |
| PEV | Plug-in Electric Vehicle |
| PFC | Power Factor Correction |
| PHEV | Plug-in Hybrid Electric Vehicle |
| PM | Particulate matter term to describe solid particles and liquid droplets found in the air |
| PP | Parallel-Parallel |
| PPs | Polarized Pads |
| PS | Parallel-Series |

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| PSSF | Power Source Sizing Factor |
| PUMLC | p.u. Magnitude of the Load Current |
| PV | Photo Voltaic |
| QDQ | Quad D Quadrature |
| RCSF | Receiver Coil Sizing Factor |
| SAE | Society of Automotive Engineers |
| SAR | Specific Absorption Ratio |
| SP | Series-Parallel |
| SS | Series-Series |
| SUV | Sport Utility Vehicle |
| UL | Underwriters Laboratories |
| V2I | Vehicle to Infrastructure. |
| WCS | Wireless Charging System |
| WEVCS | Wireless Electric Vehicle Charging System |
| WPTS | Wireless Power Transfer System |
| ZCS | Zero Current Switching |
| ZVS | Zero Voltage Switching |

Abstract

Development in E-mobility is rapidly increasing. Electric vehicles and their charging stations are such important applications in today's world. The E-mobility industry is changing day-to-day with new ways to reduce charging time of electric vehicles, ease of use in charging process, increasing the efficiency and sometimes remote control access of the charging system.

To accomplish this, resonant inductive power transfers is one of the method that can be hired to transfer power to electric vehicles (EVs) over an air-gap and can remarkably improve the range, safety and convenience of the EV battery charging. This technology has been studied in many universities and even used at least for local scale to install in household application within the power range of 3.7 to 7.3 kW. However, implementation of a large scale wireless charging infrastructure of electric vehicles (e.g. for taxi fleet in a city) is still one of the major difficulties of such technology. Issues related to determining the physical sizes of the coil pads, standardization, technical interoperability, safety and designing the appropriate wireless charging system to be used for different EVs are among those difficulties.

This dissertation discusses inductive wireless charging technology, different type of WPTs, compensation method and different types of coil structure. The important target of doing this study is to understand the feasibility of installation of wireless charging stations for electric vehicle in terms of technical and financial issues, and understanding that which size of chargers are needed to install for electric vehicles. Electrical synchronization and interoperability of primary and secondary coils which are known as transmitter and receiver, are other issues investigated in this article. In the following chapters, financial and economic analysis of implementation of the wireless charging infrastructure for the taxi and van fleet in an urban area are discussed.

It can be concluded that implementation of wireless charging infrastructure for electric vehicles in urban areas for taxi fleet and delivery van drivers could bring many advantages because of specific working routine and stop time that they have during each working day. Increment of anxiety range, and reduction of charging time (which also results directly in reduction of battery size and final price of electric vehicle), convenience and ease of use, being needless of tedious conventional charging cables, saving money are among major advantages that EV driver will take benefit of them by using wireless charging infrastructure.