

# Wireless Power Transmission “A Potential Idea for Future”

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**Abstract**—In this paper, we have presented the idea of cable-less power transmission. It is also stated that power can also be transmitted by wireless power transmission without using any kind of electrical conductors or wires. We have presented the idea of Microwave Power Transmission (MPT), which discussed that how power can be transmitted as microwaves. In our paper, we also included the introduction, brief history and recent work and developments in the field of wireless power transmission. The merits, demerits and applications of wireless power transmission (WPT) are also included. Many research papers and concepts on wireless power transmission are available but this technology is yet to be materialized for commercial use.

**Index Terms**—Microwave Power Transmission (MPT), Solar Power Transmission (SPT), Wireless Power Transmission (WPT), Rectenna, Nikola Tesla, Laser beam transmission, Electromagnetic waves.

## 1 Introduction

Wireless Power is literally transmission of electrical energy without wires. Often compare the wireless transmission of electrical energy from the transmission of information, for example, radio, cell phones, or Wi-Fi Internet access. The main difference is that a radio or microwave transmissions - is a technology for recovery and transport information, rather than the energy that was originally issued for starting. Wireless electricity is a relatively new field of technology, but dynamic. We developed methods to deliver energy effectively and safely to a distance without interruption.

The concept of wireless power transmission (WPT) goes back to the days of Heinrich Hertz and Nikola Tesla, who discovered that energy could be transported by electromagnetic waves in free space. Tesla as the use of wireless energy transmission employs low-frequency transmission, supported by natural electromagnetic resonance of the earth. His concept is important in order to later study of electromagnetic wave propagation. It has been around for a number of applications, intense interest in WPT recently. These include long-distance driving vehicles, the transmission of solar power from space and wireless battery charging. A related area is energy harvesting, where stray electromagnetic fields from the many systems in the environment are collected and used as a free source of energy.

Micro- Air - Vehicle (MAV) drive is the main application of interest in this research. Mavs are a category of unmanned aerial vehicles (UAV), developed around the world. The

definition of a MAV, according to the Defense Advanced Research Project Agency (DARPA), is a fully functional UAV is not greater than 15 cm in length, width and height. The main reason for the use of wireless power transmission for military ground - surveillance applications it is unnecessary to reach unlimited flight duration, on board fuel supply. An application that remotely a MAV is busy powered by a small ground station illustrated in Figure 1.

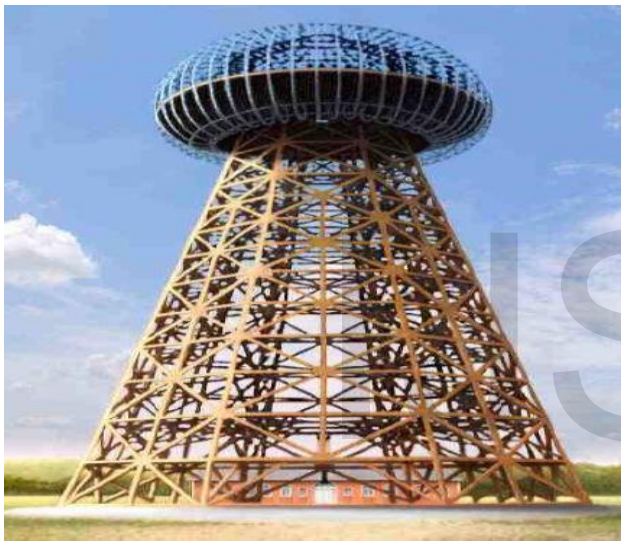


**Fig. 1 Conceptual powering of MAV by ground station**

In this paper, a rectifying antenna (rectenna) system during studies conducted by Tan and Toh reassessed based, simulated and refined. This study also deals with a new antenna design, and a full-wave rectifier concept. To verify, validate and design the rectenna model were made many compromises. Various designs have been investigated rectenna, and an improved design has been implemented in hardware.

## 2 History

Wireless energy transfer as an alternative to electric transmission and distribution lines, was first proposed and demonstrated by Nikola Tesla. In 1899 Tesla presented a wireless transmission field powered fluorescent lamps located twenty-five miles from the power supply without the use of wires. But at the time it was cheaper to do the wiring of copper wires 25 miles rather than build special generators, which requires experience Tesla. Patent, he had not given out, and the invention of science left in the bins. While Tesla was the first person who was able to demonstrate the feasibility of wireless communication in 1899, today, there is quite a bit of selling devices are wireless headphones brushes, charging for mobile phones and so on.



**Fig. 2 Wardencliffe (Tesla) Power**

In the late 1930s, further progress in the WPT occurred with the invention of the klystron tube, the microwave energy into DC using microwave power tube converted one end and DC diode tubes at the other. Advances in microwave - cavity magnetron led to higher efficiency for applications in the WPT World War II. In the 1950s, two improvements by the invention of the intensifier tube, were a major amount of transmit power to drive generates an electromagnetic beam and allows the focusing of the electromagnetic energy in a beam of high efficiencies. In May 1963, Raytheon demonstrated the first microwave - power transmission system, which converted 400 W CW power at the transmitter to 100W DC power to drive a motor. In October 1964 a demonstration of microwave -powered helicopter flight was presented up to 60 meters via a transmitting antenna.



**Fig. 3 A Helicopter powered by WPT**

The concept of a solar power satellite (SPS) was introduced in the 1960s also relies on WPT, as illustrated in Figure 3. In the PLC concept collected in orbit solar energy into microwave energy for transmission is converted into a large antenna on the ground. With rising oil consumption in recent years, WPT technology has become an alternative source of energy by transferring the collected solar power from satellites to an earth rectenna station. Solar energy transmitted by the WPT is environmentally clean and available 24 hours a day from space using satellites as collection stations. Although the PLC program ended in 1980, redirected, it's the design of the transmitter antenna to an active, phased-array of a large number of microwave generators instead superpower pipes. For ground arrays, the low-cost, microwave can - oven magnetron be used directly in the PLC. Pacific Gas and Electric (PG & E) recently funded a study to design a commercial PLC system.



**Fig. 4 Satellite Solar Power Model**

## 3 Classifications

Wireless energy transfer to classify on the basis of the distance between transmitter and receiver.

### 3.1 Short Range

These methods can achieve more than a few inches.

#### 3.1.1 Transformer Coupling

Energy transfer between the two coils by magnetic fields, but in this method, the influence of an electric transformer

is the simplest example of the wireless power transmission. The primary and secondary circuits of the transformer are electrically isolated from each other. The transfer of energy takes place by electromagnetic coupling through a process known as mutual induction. (An additional advantage is the ability to contact the primary voltage either up or down). The electric toothbrush charger is an example of how this principle may be used. A toothbrush daily contact with water is a traditional plug-in fee potentially harmful dangerous. We can use the same principle to charge multiple devices simultaneously. Ordinary simple and good electrical connections could seep into the toothbrush, damage to the components. For this reason, most toothbrushes are charging by inductive coupling.

### 3.2 Moderate Range

These methods achieve up to several meters.

#### 3.2.1 Resonance Induction Coupling

Is brought electromagnetic wave in a high angle waveguide as the evanescent wave, which called carry no energy, as if a proper resonant waveguide is in the vicinity of the transmitter then a tunnel to the power drawing waveguide in DC can be converted with rectifier circuits are formed.

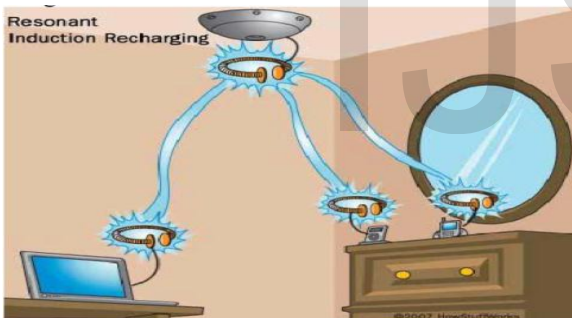


Fig. 5 Resonant Induction Recharging

#### 3.2.2 Electrical Conduction Method

In this method, during the transmission of energy through wires or conductor when the voltage reaches the breakdown voltage, operates the surrounding medium start in this manner can be transmitted energy through the medium of air.

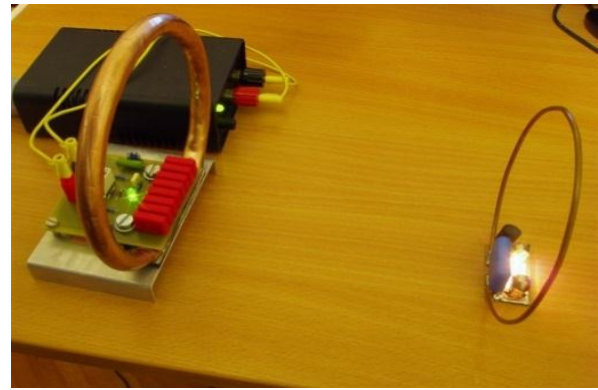


Fig. 6 Electrical Conduction Methods

#### 3.2.3 Laser Beam Transmission

In this method, laser is the photovoltaic cells, the radiated to extract electrical energy. This very difficult to implement and manage.

### 3.3 Long Range

These methods are for kilometers.

#### 3.3.1 Radio and microwave Energy Transfer

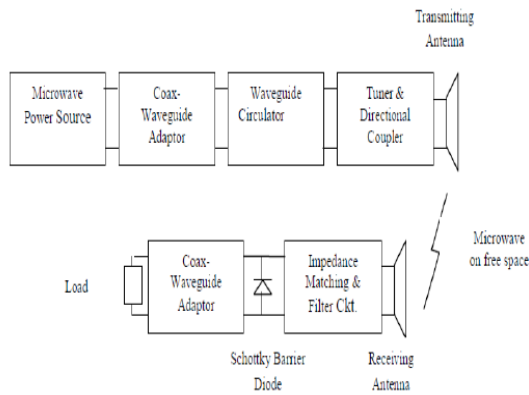
With this method, a long series is possible. In this procedure will be sent to the microwave long distances and can be received again to extract into electrical energy by the rectenna microwave energy. However, the problem with this method is that the diameter of the antenna should be of the order of kilometers.

#### 3.3.2 Solar Power Satellites (SPS)

The research areas most documented is done with the goal of implementing solar power generating satellites into space and transmits power to the ground stations. The idea was first proposed in 1968 and all SPS satellites would be placed in high orbit a geosynchronous locations.

## 4 Basic Block Diagram and Implementation





**Fig. 7 Basic Design of WPT**

Wireless power transmission can be explained by functional diagram of WPT. The block diagram describes that in transmitting side, microwave power source generates microwaves. Waveguide circulator prevents the microwave source from reflected power and it is connected with microwave power source through Coax - waveguide adaptor. The tuner and matches the impedance between microwave source and transmitting antenna. Then antenna spreads the generated microwaves in specific direction with the help of directional coupler. Thus, antenna radiates power in form of microwaves through free space towards rectenna.

In receiving side, rectenna receives the transmitted power and converts it into. To match the output impedance of signal source equal to the rectifying circuit, impedance matcher and filter is used. The rectifying circuit consists of schottky barrier diodes which converts microwaves power into DC power.

## 5 Merits

1. An electrical distribution system depending on this method would remove the need for an incompetent, expensive, and capital intensive grid of cables, towers and substations.
2. System would shrink the charge of electrical energy used by the customer.
3. It will rid the scenery of wires, cables, and transmitting towers.
4. The electrical energy can be economically transmitted without wires to any earthly distance, so there will be no transmission and distribution loss.
5. To conduct wireless power to any distance without limit. It makes no difference what the distance is.
6. Power theft would be not possible at all.

## 6 Demerits

1. Capital Cost for practical application of WPT is very high.
2. The other disadvantage of the concept is interference of microwave with present communication systems.
3. Common belief terror, the effect of microwave radioactivity.
4. But the studies in this domain repeatedly proves that the microwave radiation level would be never higher than dose established while opening the microwave oven door, meaning it is slightly higher than the releases created by cellular telephones.

## 7 Applications

1. Producing power by placing satellites with huge solar arrays in Geosynchronous Earth Orbit and transmitting the power as microwaves to the earth known as Solar Power Satellites (SPS) is the largest application of WPT.
2. Flexibility - user device can be moved easily within the wireless range.
4. Neat and easy Connection - since no cable running here and there, just start up the wireless device and you're ready to boom.

## 8 Recent Development

Many firms and electric companies are working on making wireless based electrical equipment.

### 8.1 Wireless Charging Electric Vehicles

Qualcomm Incorporated in recent years is working on the implementation of wireless charging - and not only the batteries of mobile gadgets (development Qualcomm own solution for charging smartphones called WiPower), but also the electric battery. Project to create a commercially attractive system of wireless power transmission from the car charger, called Qualcomm Halo, and the technology in the performance was named Qualcomm Wireless Electric Vehicle Charging (WEVC). It involves the use of two induction coils: first installed inside the electric vehicle, and the second - under the roadway in places marked as charging pad.

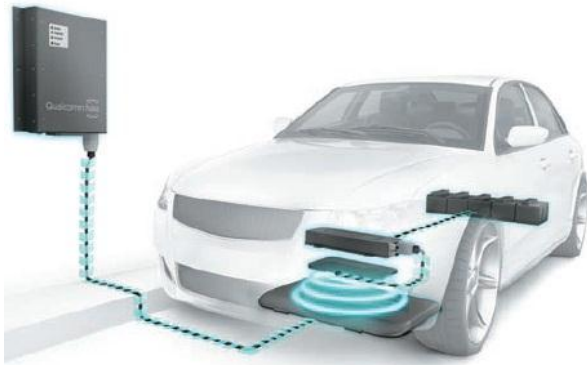


Fig. 8 Wireless Charging of Vehicle.

## 9 Conclusion

This concept offers more ways of transferring energy (by increasing frequency) with negligible losses and ease of transmission than any invention or discovery here before. The power transmission without wires is not a theory or a mere possibility, it is now a reality. Many researchers have qualitative and quantitative established in numerous observations, experiments and measurements.

Dr. Neville NASA says: "You do not need to get to the power cables, pipes or copper wires where you want it, when you want it, in real time". We can send it as a cell phone call for you.

It is assumed that the wireless energy actually advantageously simple and cost-effective implementation.

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