

Wireless Power Transmission Via Solar Power Satellite

Nehal Sahu¹, Narendra Kumar Verma², Md. Asif Iqbal³

Student, Electrical Engineering, Poornima College of Engineering, Jaipur, India^{1,2}

Assistant Professor, Electrical Engineering, Poornima College of Engineering, Jaipur, India³

Abstract: Right now, present the idea of transmitting power without utilizing wires. Wireless Power Transfer (WPT) has been made doable as of late because of advances in technology and better executions of transfer techniques, for example, Microwave Power Transfer (MPT). So as to lessen the transmission and distribution misfortunes. The MPT framework works by changing over microwave into power by utilizing extraordinary gadgets called as rectenna. The utilizations of MPT are various, not exclusively to change the manner in which existing advancements work, yet additionally as hypothetical builds for future development. While the advantages are extraordinary, there are numerous restrictions and downsides of MPT. We likewise talked about the innovative advancements in Wireless Power Transmission (WPT). The focal points, inconveniences, organic effects and uses of WPT are likewise introduced.

Keywords: Microwave Power Transmission (MPT), Wireless Power Transmission (WPT), Wireless, Power Transmission, Space Solar Power Satellite.

I. INTRODUCTION

The interest for power on Earth is developing exponentially, and related natural outcomes are getting critical. Right now, Space Solar Power (SSP) may give a perfect, safe energy source, mitigating a portion of the issues we would some way or another anticipate from expanding atomic and non-renewable energy source use. Solar energy arriving at Earth's circle is 144% of the greatest found on the outside of Earth, and incorporates frequencies that don't arrive at the surface because of the atmosphere.

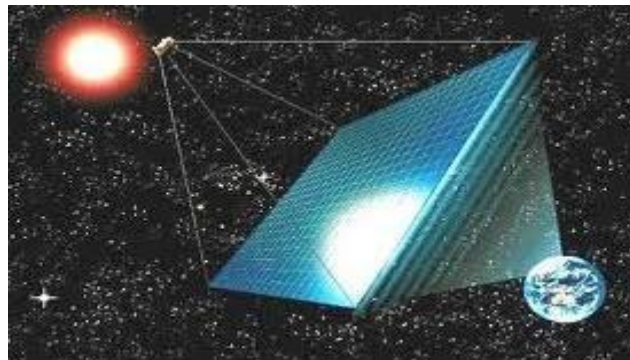


Fig. 1 Resent Designed Japanese SPS, USEF2002 model

The time span the solar assortment boards can be presented to a reliably high measure of solar radiation is additionally any longer in orbit: For the vast majority of the year, a satellite-based solar board can gather power 24 hours out of every day, while an earthbound station can gather for, probably, 12 hours out of each day. Collection at Earth's shafts can occur for 24 hours of the day, yet not reliably, and just for a half year of the year. And accomplish for the capacity of the solar exhibits to stay in daylight 24 hours per day. The capacity to convey power on demand without the requirement for complex or huge terrestrial infrastructure.

A. Conventional Power System

One of the serious issues in existing power framework is the misfortunes happening in the transmission and distribution of energy to the end clients. Since demand radically expands every day, the power generation increments and furthermore the power loss can be expanded. The level of loss of power during transmission and distribution is approximated as 26%. The essential purpose behind power loss during transmission and distribution might be the resistance of wires utilized for network. The efficiency of power transmission might be improved to a specific level by utilizing high quality composite over head conductors and underground cable who utilize warm super conductor. But, the transmission is insufficient.

B. Radio/ Microwave Energy Transfer

It is conceivable to accomplish a long range utilizing this technique. Right now, microwave is sent to the long separations which are gotten through rectenna. Rectenna removes microwave energy back to electrical energy. The principle issue with this specific procedure is the means by which the diameter of antenna should be structure of kilometer. Transmission of energy through radio waves can occur in a more directional manner, allowing for longer distance energy transmission, with shorter wavelengths of electromagnetic radiation, typically in the microwave range. Rectenna conversion efficiencies in excess of 95% are actually realized.

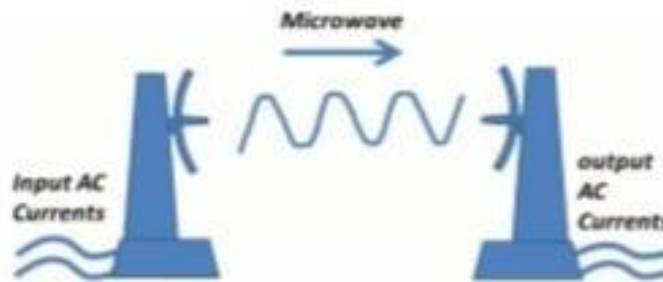


Fig2: Radio/microwave transfer

II. BACKGROUND

In 1864, James C. Maxwell anticipated the presence of radio waves by methods for scientific model. In 1884, John H. Poynting understood that the Poynting Vector would assume a significant job in measuring the electromagnetic vitality. In 1888, supported by Maxwell's hypothesis, Heinrich Hertz originally prevailing with regards to indicating exploratory proof of radio waves by his sparkle hole radio transmitter. The expectation and Evidence of the radio wave toward the finish of nineteenth century was beginning of the remote force transmission. Nikola Tesla has been the pioneer in the field of remote transmission of electrical force Nikola Tesla he is who concocted radio and given us he is without a doubt the "Father of Wireless". Nikola Tesla is the person who initially considered the thought Wireless Power Transmission and illustrated "the transmission of electrical vitality without wires" that relies on electrical conductivity as right on time as 1891. In 1893, Tesla showed the enlightenment of vacuum bulbs without utilizing wires for power transmission at the World Columbian Exposition in Chicago. The world's first fuel free plane controlled by microwave vitality from ground was accounted for in 1987 at Canada. This framework is called SHARP (Stationary High – Altitude Relay Platform). A material science investigate gathering, drove by Prof. Marin Soljatic, at the Massachusetts Institute of innovation (MIT) exhibited remote driving of a 60 W light with 40% effectiveness at a 2 m (seven ft) separation utilizing two 60 cm-width curls in 2007 .

In 2008, Intel repeated the MIT gathering's trial by remotely fueling a light with 75% effectiveness at a shorter separation. MIT group experimentally shows wireless power transfer, conceivably valuable for powering workstations, laptops mobile phones without any cords. Imagine a future where wireless power transfer is possible: phones, family robots, mp3 players, PCs other convenient gadgets fit for charging themselves while never being connected, liberating us from that last, ubiquitous power wire. Utilizing this system, up to 60 Watts of electrical energy can be transferred over a distance of 50cm (at an effectiveness of roughly 80%, around 60% including rectifier). This new wireless power transfer system incorporates a type of contactless electrical energy transmission innovation dependent on magnetic resonance. With magnetic resonance, electromagnetic energy is just transferred to beneficiary gadgets that share the identical resonant frequencies the energy source, so energy transfer productivity is kept up, in any event, when misalignment happens. Moreover, regardless of whether there are metal objects situated between the transmitter and collector, no heat induction happens. With the development in networked products, the number of cables used to associate these items has additionally expanded. While information cables are quickly being replaced with wireless communication systems, for example, Wi-Fi, the demand for wireless power transfer systems is additionally continuing to develop. Sony will continue with its endeavors to grow further advancements that address client issues for the wireless transfer of power over a wide scope of items, separations and energy levels.

III. PROPOSED METHODOLOGY AND DISCUSSION

William C. Dark colored, the pioneer in wireless power transmission technology, has designed, built up a unit and exhibited to show how power can be transferred through free space by microwaves. The idea of Wireless Power Transmission System is clarified with practical square chart appeared in Figure. In the transmission side, the microwave

power source creates microwave power and the yield power transmitted by antenna. The transmitting antenna emanates the power consistently through free space to the rectenna. In the getting side, a rectenna gets the transmitted power and changes over the microwave power into DC power.

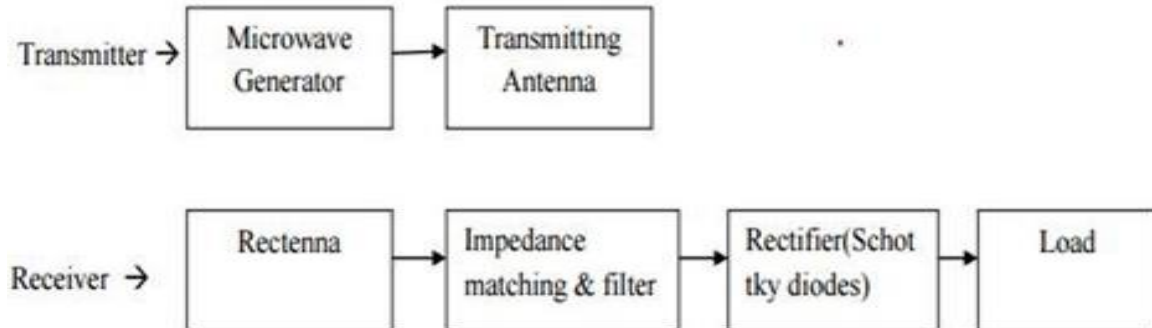


Fig 3: Functional Block Diagram Of Wireless Power Transmission System

The impedance coordinating circuit and filter is given to setting the yield impedance of a sign source equivalent to the correcting circuit. The correcting circuit comprises of Schottky obstruction diodes changes over the got microwave power into DC power.

IV.COMPONENTS OF WPT SYSTEM

The Primary parts of Wireless Power Transmission are Microwave Generator, Transmitting antenna and Receiving antenna (Rectenna).

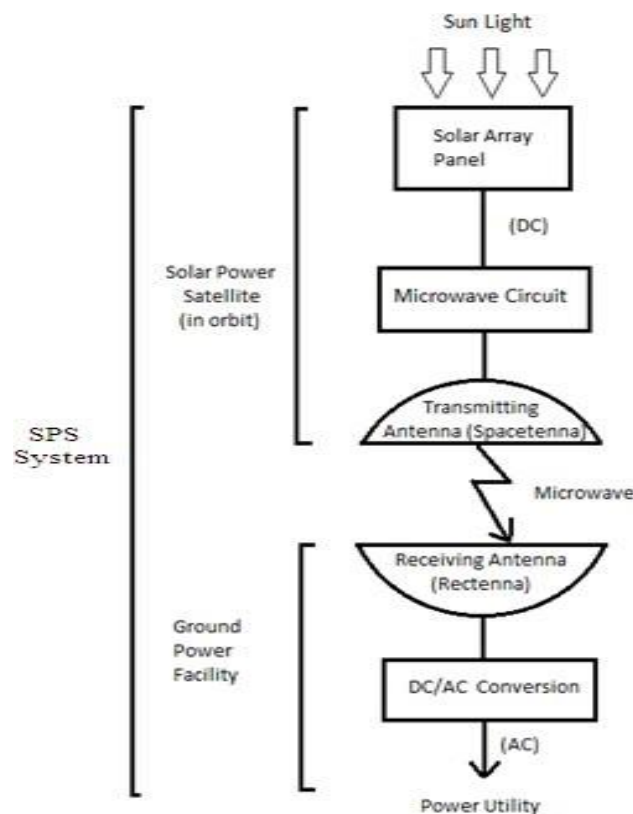


Fig 4 : SPS System

- **MICROWAVE GENERATOR:** It might be a transmitter which emanates microwave for cell phone communication. Or on the other hand a converter which changes over electrical energy into microwave.
- **TRANSMITTING ANTENNA:** The opened wave manage antenna, micro scale strip fix antenna, and parabolic dish antenna are the most well known kind of transmitting antenna. The opened waveguide antenna is perfect for power transmission as a result of its high gap efficiency (> 95%) and high power taking care of ability.

- **RECTENNA AND FILTER:** The rectenna is utilized to harvest electric energy from the RF signals that have been radiated by correspondence and broadcasting systems at ISM band focused in 2.45 GHz., Schottky barrier diodes (GaAs-W, Si, and GaAs) are typically utilized in the redressing circuit because of the quicker switch recuperation time and much lower forward voltage drop and great RF qualities. The rectenna efficiency for different diodes at various frequency.

A. ENERGY HARVESTING CIRCUIT

In the context of wireless power, energy harvesting, also called power harvesting or energy scavenging, is the conversion of ambient energy from the environment to electric power, mainly to power small autonomous wireless electronic devices. The ambient energy may come from stray electric power, mainly to power small autonomous wireless electronic devices.

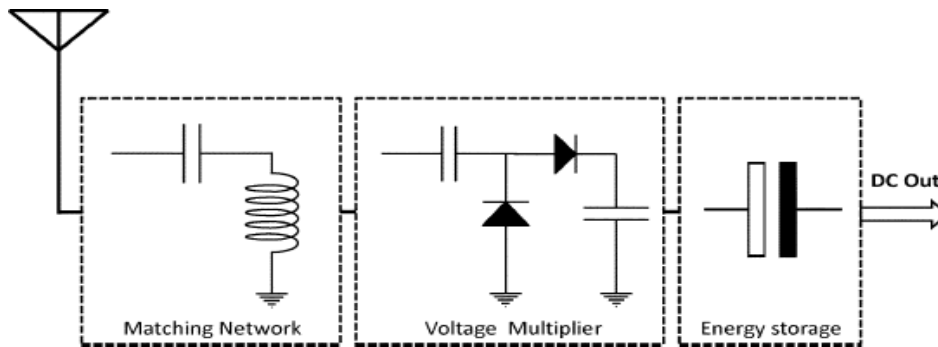


Fig 5: Energy Harvesting Circuit

Although the efficiency of conversion is usually low and the power gathered often minuscule (mill watts or microwatts),it can be adequate to run or recharge small micro power wireless devices such as remote sensors, which are proliferating in many fields. This new technology is being developed to eliminate the need for battery replacement or charging of such wireless devices, allowing them to operate completely autonomously.

IV. RESULTS

Description: In our work we involved voltage multiplier which is one of the part of rectenna. In this circuit antenna receives A.C. signals and feeds it to voltage multiplier. This multiplies the input voltage and converts it into D.C. voltage. This circuit involve capacitor and diode network. Above table indicates the value of D.C. output which obtained by using different value of diodes and capacitors.

Table 1: Performance of Energy Harvesting Circuit

Value of capacitor	Value of diode	Output voltage (D.C.)
100uF	1N4001	120mV
100uF	Schottky Diode(GaAs-W)	200mV

Description: In our work we involved direct rectenna for comparative study with antenna with voltage multiplier. This gives directly D.C. converted output after receiving antenna signals. Above table shows maximum operating frequency of rectenna and efficiency of rectenna according their type.

Table 2: Performance Of Printed Rectenna

Type of Rectenn a	Operating Frequency(GHz)	Measured Peak Conversion Efficiency (%)
Printed diploma	2.45	85
Circular Patch	2.45	81

V. ADVANTAGES AND DISADVANTAGES

A. ADVANTAGES:

- Different methods for transmitting power wirelessly have been well known for a considerable length of time. The most widely realized model is non- particulate radiation, for instance radio waves. While such radiation is very useful for wireless transmission of information, it's not under any condition plausible to apply it for power transmission.

Since radiation spreads every which way, an enormous wastes power would get squandered into free space.

- Wireless Power Transmission system would totally wipes out the past high- strain power transmission line cables, towers and sub stations including the producing station and shoppers and encourages the interconnection of electrical generation plants with a worldwide scale.
- It's more opportunity of both beneficiary and transmitters. Indeed, even portable transmitters and collectors may be picked to the WPT system
- The power might be transmitted towards places the area where the wired transmission isn't feasible. Diminishing of transmission is negligible level from the Wireless Power Transmission; hence, the efficiency with along these lines is significantly higher than the wired transmission.
- Power can be bought with the rectenna given that the WPT is working. The power failure as a result of short and fault on cables couldn't exist from the transmission and power robbery will be unrealistic in any regard.

B. DISADVANTAGES:

- High capital expense for pragmatic execution of wireless power transmission.
- Another potential disadvantages is the interference of the microwaves with the present wireless communication system.
- The effects of microwave radiations at high portions received isn't reasonable to human health.

VI.APPLICATIONS OF WIRELESS POWER TRANSMISSION

- Moving focuses for instance fuel free planes, fuel free electric vehicles, moving robots and fuel free rockets. Another applying WPT are wireless power source, wireless sensors and RF power versatile amending circuits (PARC).
- Portability - client gadget may be moved effectively in the wireless range.
- Neat and simple Installation - since no link running once in a while, simply fire up the wireless gadget and you're prepared to thunder.
- Producing power by setting satellites with giant solar exhibits in Geosynchronous Earth Orbit and transmitting the power as microwaves on the earth called Solar Power Satellites (SPS) will be the biggest use of WPT.
- Automatic wireless charging for portable robots, cordless apparatuses and instrument which wipes out complex systems, and work concentrated manual reviving and battery substitution.
- Another use of WPT are solar power satellites, energy to remote territories, communicate energy globally.

VII. CONCLUSION

The ideas of Wireless Power Transmission (WPT), its history, mechanical improvements, benefits, bad marks and applications are examined right now. By this, we can know the more prominent opportunities for transmitting power with unimportant losses and basic transmission from quite a while. It truly is conceived that wireless energy would be truly cultivated utilizing a preferred position of simple execution and more affordable i.e., tariff of transmission and distribution overhead would dwindle and in addition it is pivotal the tariff of electrical power on the customer would even be decreased when contrasted and existing systems.

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