

# Wireless Power Transmission Using Solar Power Satellite

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**ABSTRACT:** One of the major drawbacks for developing nation is energy generation. Non-Renewable energy sources (Non-RWES) is able to meet the demands but it acts as a slow poison to the world. It's time to switch on to the solar energy, a kind of RWES to meet the demands of the world. Solar satellite is a technology for harnessing solar energy for electrical energy. Nowadays transmission of power is less efficient on compare to generation of it. So our concept is dealing with generation as well as with efficient transmission which is called microwave transmission.

## I. INTRODUCTION

The installed capacity of an electricity sector in INDIA is 229.251GW as of October 2013. As of above capacity that the 87.5% is generated from the non-renewable sources and 12.5% is coming from the renewable sources. Although we are the fifth largest electricity sector still about 87% of people in rural areas access only to unreliable electricity. Sun is producing light for 24/7 days. In satellites, we place a solar panel on that it revolves a particular orbit of earth. The satellite is near to the sun so the satellite absorbs large amount of light energy and it converted into electrical energy because solar panel consists of photovoltaic cell by using these we produce electricity.

We can transfer generated energy in efficient manner using wireless. About 30% energy is lost in traditional power transmission but 95% of power is transmitted using Electromagnetic waves for wireless power transmission. HVDC uses direct current for power transmission. In this system about half of the losses and the cost is also minimized.

## II. HISTORY

Nicola Tesla suggested an idea of the wireless power transmission and carried out the first WPT experiment in 1899. Unfortunately, he failed. To concentrate on transmitting power and to increase transmission efficiency, we have to use higher frequency than that used by Tesla. In 1930s, much progress in generating high-power microwaves, 1-10 GHz radio waves, was achieved by invention of the magnetron.

We call the wireless power transmission with microwaves as microwave power transmission (MPT). W. C. Brown started the first MPT research and development in 1960s. First of all, he developed a rectenna, rectifying antenna which he named, for receiving and rectifying microwaves.

### COMPONENTS OF SPS:

The SPS consists of four major parts are

- Solar collector
- Microwave Converter
- Transmission
- Rectifying Antenna
- HVDC Power Transmission

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### SOLAR COLLECTOR

Solar panel is placed on the satellite. The solar panel consists of the solar cells. It had a series connection of solar cells.

The sun light will incident on the surface of solar panel where the light energy is converted into the electrical energy by photovoltaic concept.

The operation of a photovoltaic (PV) cell:

- The absorption of light, generating either electron-hole pairs or excitons.
- The separation of charge carriers of opposite types.
- The separate extraction of those carriers to an external circuit.



In contrast, a solar thermal collector supplies heat by absorbing sunlight, for the purpose of either direct heating or indirect electrical power generation from heat. A "photo electrolytic cell" (photo electrochemical), on the other hand, refers either to a type of photovoltaic cell (like that developed by Edmond Becquerel and modern dye-sensitized solar cells), or to a device that splits water directly into hydrogen and oxygen using only solar illumination.

### III. MICROWAVE CONVERTER

It is otherwise called as magnetron. The output of the solar collector is DC power. We convert those dc power into microwaves for transmission purpose.

There are so many types of the microwave converter. Cavity magnetron is the main and easy method. Its operation is

The magnetron cannot function as an amplifier, increasing the power of an applied microwave signal, it serves slowly to an oscillator, generating a microwave signal from direct current power supplied to the tube.

### HISTORY OF MAGNETRON

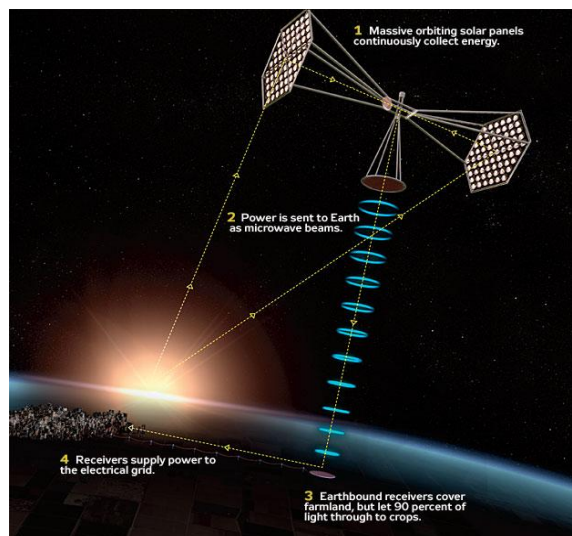
The first form of magnetron tube, the split-anode magnetron, was invented by Albert Hull in 1920, but it wasn't capable of high frequencies and was little used. Similar devices were experimented with by many teams through the 1920s and 30s. The modern 'resonant' cavity magnetron tube was invented by John Randall and Harry Boot in 1940 at the University of Birmingham, England.

### IV. OPERATION

In a conventional vacuum tube, electrons are emitted from a heated cathode and are attracted to the anode due to the different electrical charge placed on the two plates. The components are normally arranged in line, at opposite ends of the tube, giving them their traditional cylindrical shape. In a diode the current can flow only from the cathode to the anode, providing rectification. A triode adds a control grid which allows the flow of current to be further controlled in magnitude as well as direction, and thereby provides an amplification function.

This led to experiments with tubes using magnetic fields instead of electrical ones, including the original magnetron. In this case the tube was arranged in the form of two concentric electrodes, typically with the cathode in the form of a metal rod in the center, and the anode as a cylinder around it.

This arrangement was then placed between the poles of a horseshoe magnet.



With no magnetic field present, the electrons will flow directly from the cathode to the anode, operating as diode. In the presence of the magnetic field, the electrons will experience a force. The curvature of the path can be controlled by varying either the magnetic field or by changing the electrical potential across the electrodes.

## V. TRANSMISSION

There are two ways of transmission are

- Laser transmission
- Micro waves transmission

### MICROWAVES TRANSMISSION

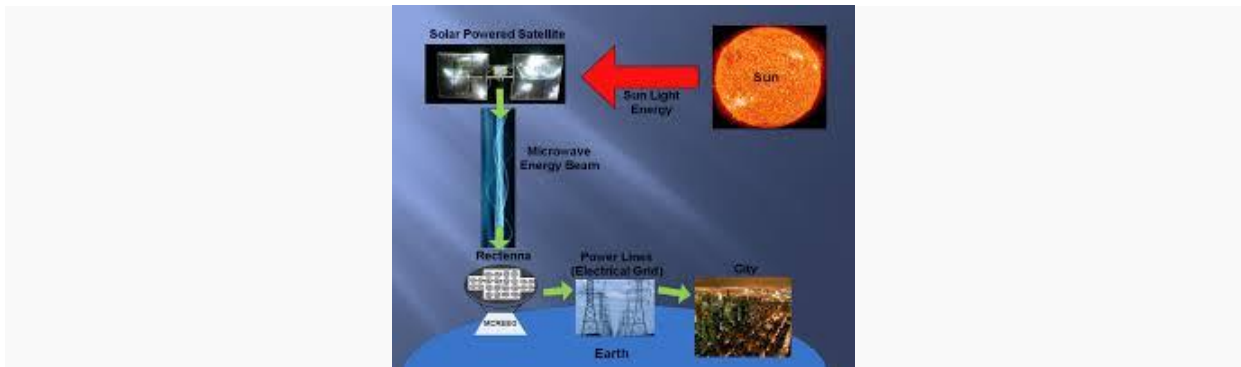
Microwave transmission is the technology of transmitting information or energy by the use of electromagnetic waves whose wavelengths are conveniently measured in small numbers of centimeter these are called microwaves. The part of the radio spectrum ranges across frequencies is roughly 1.0 GHz to 30 GHz. These correspond to wavelengths from 30 cm down to 1.0 cm.

Microwaves are widely used for point-to-point communications because their small wavelength allows convenient size antennas to direct them in narrow beams, which can be pointed directly at the receiving antenna. Advantage is that the high frequency of microwaves gives the microwave band a very large information-carrying capacity. A disadvantage is that microwaves are limited to line of sight propagation they cannot pass around hills and mountains

Microwave radio transmission is commonly used in point-to-point communication systems on the surface of the Earth, in satellite communications, Other parts of the microwave radio band are used for radars, radio navigation systems, sensor systems, and radio astronomy.

There are three ways of communication system are

- One-way telecommunication
- Two-way telecommunication
- Terrestrial microwave relay links in telecommunications

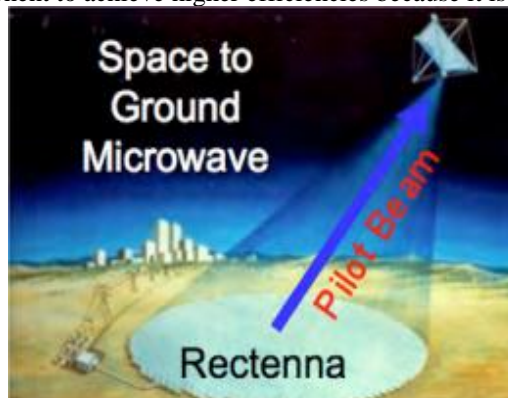


#### LASER TRANSMISSION:

Electromagnetic radiation closer to the visible region of the spectrum, power can be transmitted by converting electricity into a laser beam that is then pointed at a photovoltaic cell. This mechanism is generally known as "power beaming" because the power is beamed at a receiver that can convert it to electrical energy.

#### VI. RECTIFYING ANTENNA

RECTENNA is otherwise called as **RECT**ifyingant**ENNA**the microwave to direct current electricity. It consists of a receiving antenna, an input low pass filter, a rectifying circuit and an output smoothing filter. In RECTENNA arrays, the diode is the most critical component to achieve higher efficiencies because it is the main source of loss.



Schottky diodes are usually used because they have the lowest voltage drop and highest speed and therefore have the lowest power losses due to conduction and switching.

#### HIGH VOLTAGE DIRECT CURRENT(HVDC) TRANSMISSION

The transmission is improved by transmitting power using HVDC transmission line. The high voltage alternating current is first converted into high voltage direct current by using HVDC converter. Numbers of converters are connected in series or parallel in HVDC converter. The converted direct current is transmitted via transmission lines. HVDC converter is bidirectional.

In distribution system HVDC is again converted into alternating current and send to the consumers.

HVDC links are majorly classified into 3 links as

- Monopolar link.
- Bipolar link.

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- Homopolar link.

In monopolar link, one conductor is used and the return path is provided by ground or water.

In bipolar link, two conductors are used. One is positive while the other is negative. Each terminal consists of two converters. The two poles are equal and hence there is no ground current.

In homopolar link, it has two or more conductors having the same polarity usually negative polarity. The return path of the system is through ground.

### ADVANTAGES

- The power could be directed to any point on the earth surface.
- The power density would be uninterrupted by darkness, clouds, or precipitation, which are the problems
- No moving parts.
- No fuel required.
- No waste product.

### DISADVANTAGES

- The main drawback of solar energy transfer from orbit is the storage of electricity during off peak loads.
- The frequency of beamed radiation is to be at 2.45 GHz and this frequency is used by communication satellites also.

### CONCLUSION

The Solar Power Satellite (SPS) is able to fulfill the energy demands and create a future powered by clean energy. So, we can adapt to SPS for pollution free future. Wireless power transmission using microwaves and high voltage direct current transmission is efficient way of transmitting electrical energy with less loss.

The SPS will be a central attraction of space and energy technology in future. Another important area of technological development will be the reduction of the size and weight of individual elements in the space section of SPS. Large-scale transportation and robotics for the construction of large-scale structures in space include the other major fields of technologies requiring further developments. Finally, we look forward to universal acceptance of the premise the electromagnetic energy is a tool to improve the quality of life for mankind. A man made extension of the naturally generated electromagnetic spectrum that provides heat and light for our sustenance. From this view point, the SPS is merely a down frequency converter from the visible spectrum to microwaves.

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