Space based Solar Power Satellites

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Abstract: **To put it another way, the new millennium has heightened the urgency of developing new renewable energy sources. The notion of creating a power station in space that delivers electricity to Earth arose from the hunt for a new, safe, and reliable non conventional energy source.. In 1968, Peter Glaser proposed the notion of solar power satellites (SPS). This field is still under investigation, with NASA hoping to have one functioning by 2040. Solar power satellites changes solar energy into microwaves, which are then transformed to electricity at a receiving antenna on Earth. Microwave power is a crucial technology for SPS's long-term survival. Efficiency of the transmission crop. Solar power satellites are a large structure that covers an area of 56 sq m and weighs between 30,000 and 50,000 kilogrammes.**

Solar power satellites that are stationed on land. One of the most prominent is space-based solar power satellites. Land-based solar power satellites entail placing solar collectors across a vast amount of surface and letting sunlight to fall directly on the collection, resulting in solar energy conversion. However, land-based solar power satellites have several drawbacks, including as the fact that sunlight is only available during the day and is affected by climatic change. This resulted in a paradigm shift for space-based solar power satellites.

INTRODUCTION

Since the invention of electricity, mankind has been generating electricity using conventional energy sources such as coal. Traditional energy sources, such as coal, will, however, run out in a few years. As a result, renewable energy sources must be pursued. Because there are so many of them, solar power satellites are the most frequent renewable energy source. Satellites that convert solar energy and distribute it to the ground via microwave energy beams are known as solar power satellites. The microwave is converted back to electricity at the rectenna. A key challenge facing the planet is the availability of a sufficient amount of clean energy. We've been dealing with three major challenges for a long time: population growth, resource consumption, and environmental degradation.

Solar power satellites go through a series of steps.
1. Collecting and converting solar energy into current.
2. It converts current into radio waves and sends them to the ground.
3. Convert radio frequency energy into electrical energy.
4. Supply electricity to the grid.

NEED FOR SOLAR POWER SATELLITES

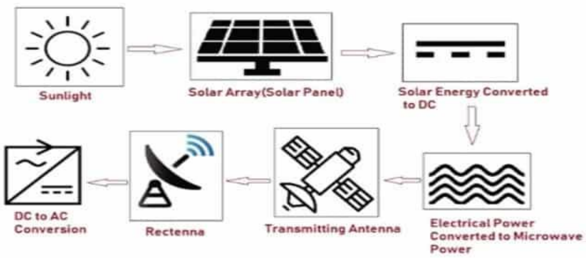
- Global energy consumption is increasing,
- renewable energy sources are growing scarce
- fossil fuels are wreaking havoc on the environment.
- Defeat the effects of day and night, as well as other factors like clouds.
- Get rid of the energy problem.

SOLAR POWER SATELLITES BACKGROUND

In MI1968, Peter Glaser proposed a massive solar power satellite that would be put geostationary satellite orbit. In the late 1970s, the US (DOE) and (NASA) conducted substantial research into the SPS concept (NASA). The SPS Reference System Concept was suggested by the DOE-NASA in 1979. A key component of this proposal was the creation of a large-scale power infrastructure in space, consisting of around 60 solar power satellite and capable of supplying a total of about 300GW. However, in 1980-1981, all US SPS initiatives were discontinued because to exorbitant costs, a lack of evolutionary concept, and a lessening energy crisis, with the intention of re-evaluating the concept in ten years. There was a lot of international interest at this period.

POWER TRANSMISSION BY WIRELESS

Transfer of 50 or 60 Hz electricity from the production point to the without the utilization of wires at the client end has yet to become a similar and practical technology. The reported research on terrestrial wireless power transmission, on the other hand, have not divulged the design technique or technical details, nor have they addressed the full-scale potential of wireless power transmission when compared to alternatives like a physical power transmission line. However, the concept of energy transmission from space to ground via microwave beam has been the main thrust of wireless power transmission. The 50 Hz alternate current electricity on the plant wires is decrease in voltage level that allows rectification into direct current. This is sent to a magnetron through a wire. line, electrons are forced to adopt a circular path, which attracts them.



Block Diagram of solar power satellites Solar power satellites

SPS would be sent into geostationary orbit The difference in power between traditional satellites and solar-powered satellites would generate significantly more energy than is required for their own functioning. Solar energy would be collected by a satellite, which would then be converted to electricity and microwaves. A large array of devices known as rectifying antenna or rectenna would send microwaves to the earth's surface, where they will be received and convert back it into energy. This direct current can subsequently be converted to alternating current at 51 or 65 Hz.

Each solar power satellite would have been massive, with a total surface of 56 square kilometers and a length of 10.3 kilometers and a width of 5.3 kilometers. The surface of each satellite would have.

Space based solar power satellites

However, rather from being technological, the major hurdle to improvement of SPS is societal. Solar power satellites have a high initial development cost and a lengthy development time. The dangers that come with such a large operation are enormous, and the payoff is uncertain. Lesser price technologies could be improved at the time it takes to build the system.

LITERATURE REVIEW

- Over a century ago, Nikolas Tesla proposed the goal of achieving global wireless power transmission, while Peter Glaser proposed the concept of a massive SPS in 1968.
- The US DOE and NASA conducted extensive research into the SPS concept in the late 1970s.

TRANSMISSION OF POWER

The component efficiencies employed in transmitting and receiving apertures, as well as the ability to concentrate the electromagnetic beam onto the receiving rectenna, all impact the capacity to efficiently deliver electrical power wirelessly. Microwave An unmodulated, continuous wave signal with a band width of 1Hz is used to deliver electricity wirelessly. 2.45GHz has been chosen as the preferred frequency for microwave wireless power transfer due to factors such as less power elements power components, band placement, and exceptionally less attenuation in the atmosphere. In the next suggested band, which is centered at 5.6 GHz, the transmission and receiving apertures are lowered. This, however, is undesirable because to stepped up attenuation at higher frequencies.

1. TRANSMITTER

It is vital for a transmitter to be able to properly convert direct current power to radio frequency power and then emit that power in a regulated and low-loss manner. The end-to-end efficiency as well as the thermal management system are determined by the transmitter's efficiency, which means that any heat generated by inefficiencies in direct current radio frequency modification must be made by transmitting to extend of life by using radio frequency devices and electronic devices like control electronics another area that needs careful thought. Noise filtering and harmonic reduction will be needs to meet regulatory requirements.

2. BEAM CONTROL

A important system and safety aspect of wireless power transfer is the ability to regulate the power beam. Retro directional beam control techniques have been the most common method of creating precise beam pointing. To generate point the power beam backwards the retina. The receiver records the phase of the pilot's signal positioned at each subarray; the frequency is compared to an on-board reference frequency that is uniformly spread throughout the array. The receiver signal is phase conjugated and sent back to earth via dc-RF conversion if the two signals have a phase difference. When the pilot signal is absent, the transmitter di phases its power beam, decreasing the peak power density by the number of transmitters.

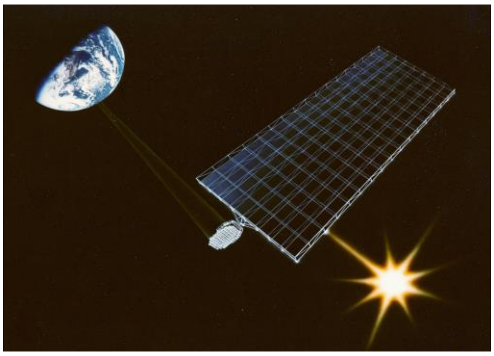
3. RECTENNA

Rectenna is a microwave to DC converter with a receiving antenna and a rectifying circuit as its main components. The rectenna circuit is represented schematically in the diagram. It There's also a receiving antenna, an input low pass filter, a rectifying circuit, and an output smoothing filter. The input filter is needed to prevent high harmonics from being re-radiated due to the rectifying circuit's non-linear features. Because the circuit is very nonlinear, Harmonic power levels must be kept to a minimum. Placing a frequency selective surface in front of the rectenna circuit that passes the operating frequency while attenuating the harmonics is one approach of suppressing harmonics.

MICROWAVE ENVIRONMENMTAL ISSUES

The cost of establishing a solar power satellite includes acceptance of microwave rays as a means of transferring energy between space and earth. Due to their vast dimension, solar power satellites would seem as a brighter star in the comparatively gloomy night sky. Solar power satellites in geostationary orbits would emit more bright or light than Venus at their brightest. As a result, the solar power satellites will be quite visible, which may be a problem.

Solar power satellites pose worries about exposure of microwave, visual pollution that would obstruct astronomers, the health and protection of astronomers in a high-radiative atmosphere, probable ionosphere disruption, and other environmental issues. At least for the microwave in question, atmospheric studies reveal that these concerns are unfounded.



Visual Introduction of Solar Power Satellites

RECENTLY DEVELOPED SYSTEM

Kyoto University improved a space-based radio transfer technology. The solar panels, a micro transmitter sub system in a near field scanner and a microwave receiver make up the sports. The solar panel provides 8 KW of direct current to the microwave transmitter subsystem, which is made up of an active phased array. It was designed to simulate the whole power conversion process for solar power satellites, including solar cells.

A solar power radio integrated transmitter, which is an integrated unit, is another microwave power transmission technology recently developed by a collaboration between Kyoto University, NASDA, and Japanese industrial businesses.

CONCLUSION

Solar power satellites will be a major pull in space and energy technology in the future days. Though, on a grander measure the feasibility of retroactive power transmission has yet to be established, and more research is needed. Other main area of technological improvement is the reduce in measurements of every single element in the space sector of solar power satellites. Large-scale transportation and robotics for the construction of large-scale structures in space are another key area of technology that requires further development. Technical hurdles will be removed during the next ten or twenty years. hence, we want the idea that electromagnetic energy may be used to improve people's quality of life to gain widespread acceptance.

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