Renewable Energy Based Wireless Power Transfer

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***Abstract* — In today's world wireless technology has a widespread application which includes industrial and household applications. In this paper we have reviewed on wireless power transfer (WPT) using renewable source i.e. solar energy. The principle behind WPT is inductive coupling wherein an electric field is generated thus transmitting power from transmitter to receiver. Wireless power transmission concept is applied behind WPT. This differs from wired transmission as the medium is costly and requires space because of wires. This paper makes use of components like a solar panel, rechargeable battery, booster circuitry, and load.**
Wireless transmission of power to work up a load is the highlight of this paper.

Keywords* — *Renewable Source, Inductive Coupling, Wireless Transmission.

I. INTRODUCTION

Wireless power transfer (WPT) is basically the transfer of electrical power from a power source to a receiving device. This can be done using several techniques like inductive coupling, microwave power transfer, magnetic resonance etc. Since this paper makes use of renewable energy source, the most compatible technique is electromagnetic induction. Solar panels are incorporated in this system owing to the requirement of providing a renewable source of energy on contrary to non-renewable or AC source supplies. Since earlier times, wired technology had been used. They communicate with the help of cables which makes them bulky and costly as well. Wireless technologies target this very point. Not only the estranged wires are eliminated, the cost due to the same is eradicated. Nikola Tesla in 1890 introduced the idea of wireless communications through inductive coupling. The coils are nothing but a medium of transferring electricity. This paper as a whole gives details of effective concept of efficiently transmitting the power to the required load, wirelessly.

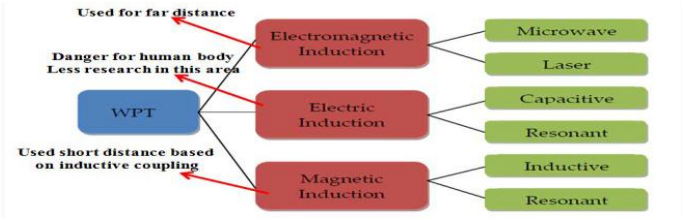

Figure 1: Classification of wireless power transmission.

II. BLOCK DIAGRAM AND EXPLANATION

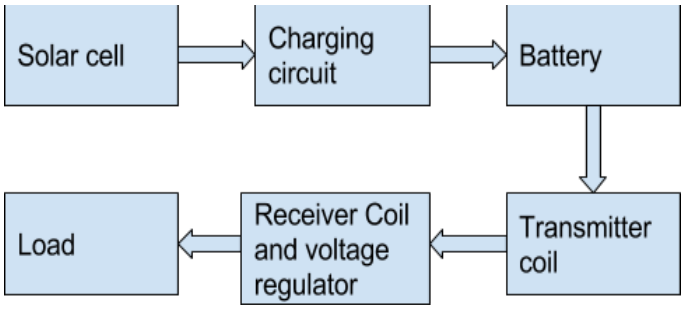

Figure 2

III. WORKING PRINCIPLE

The circuit mentioned in the paper in perspective consists of transmitter and receiver devices. Since inductive coupling is being used, Tesla coils are placed at both transmitter and receiver end. The number of coils and its prescription depends on the load used in the circuit. Typically to charge an LED bank, coils worth 24mH are used.

The input used is a solar panel. Renewable energy charged devices are a thing of the new present and hence wireless technologies must make full use of it. The solar panel gets charged completely during daylight and can be stored in the rechargeable batteries used in the circuit. This AC voltage can thus be used for transmission. The voltage gets stored in the batteries in the form of DC and hence needs to get converted to AC for transmission through the coils. Eventually, this transferred voltage gets through to the booster circuit and regulator for charging the load, here LED bank.

The main issue this paper addresses is to provide a sustainable and a long-lasting solution to the problem of usage of the nonrenewable sources of energy as well as wired communication. The solar energy which is a renewable form of energy and is available in abundance can be put to maximum use provided the techniques for harnessing it are appropriate and environment-friendly. Witricity on the other hand does provide us with a wireless solution, however, is not widely implemented owing to the concerns of the lack of efficiency. One of the major constraints for implementing

both the technologies together hand-in-hand is efficiency. This paper aims to bridge that gap. This paper has mainly focused on combining both the technologies together. Overcoming these shortcomings, the concept explained in this paper can be applied in various applications.

IV. THEORY AND CONCEPTS INVOLVED

This paper makes use of the below mentioned concept. The interaction of transmitter and receiver takes place through the coil and the inductive coupling with them. Electricity is transferred in the form of current through the coils and is received in the AC form.

Two devices are said to be mutually inductively coupled or magnetically coupled when they are configured such that change in current in the wire at transmitter side induces a voltage across the ends of the other wire at receiver side by electromagnetic induction. This is due to the mutual inductance and this principle is known as inductive coupling. A well-known example of inductive coupling is a transformer. Inductive coupling is preferred because of its comfortable, less use of wires and shock proof.

Inductive coupling uses magnetic fields that are a natural part of current's movement through wire. Any time electrical current moves through a wire, it creates a circular magnetic field around the wire. Winding the wire to a coil amplifies the magnetic field. The more loops the coil makes, the bigger the field will be.

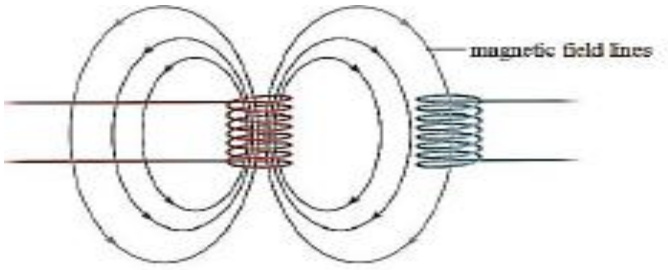

Figure 3: Inductive coupling

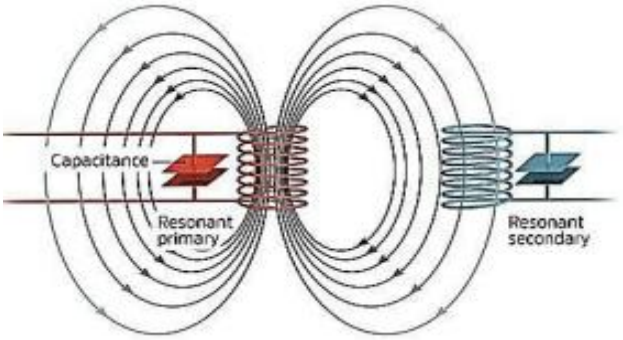

Figure 4: Resonance Inductive Coupling

RIC is the combination of both inductive coupling and resonance. Using the concept of resonance it makes the two objects to interact each other very strongly. Inductance induces current in the circuit. As seen, the coil provides the inductance. The capacitor is connected in parallel to the coil. Energy will be transferred between magnetic field surrounding the coil and electric field around the capacitor. Here the radiation loss will be negligible.

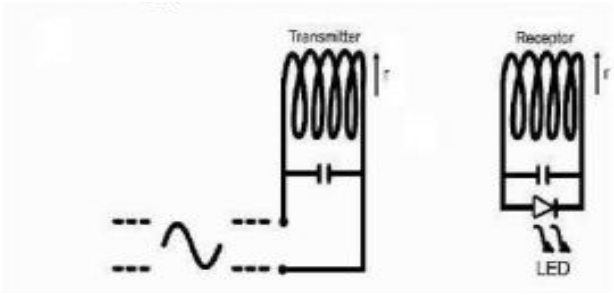

Figure 5: Basic WPT model with inductive coupling

The key principle behind the boost converter is the tendency of an inductor to resist changes in current by generating and destroying a magnetic field. In a boost converter, the concept exploited is that output voltage is higher than the input voltage. A representation of a boost power stage is shown in Figure 6.

(a) When the switch is closed, electrons flow through the inductor in anti-clockwise direction and the inductor stores some energy by generating a magnetic field. Polarity of the left side of the inductor is positive.
(b) When the switch is opened, current reduces as the impedance goes higher. The magnetic field previously created will be destroyed to maintain the current towards the load. Thus the polarity gets reversed (meaning left side of inductor is now negative). As a result, two sources will be in series causing a higher voltage to charge the capacitor through the diode D.

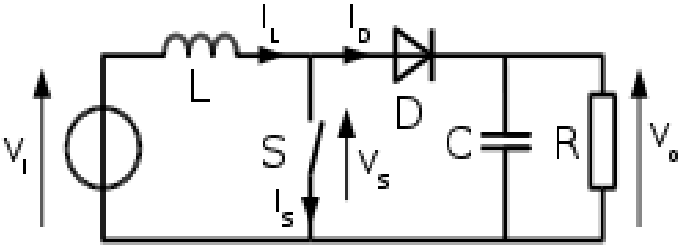

Figure 6: Boost converter schematic

The basic principle of a Boost converter consists of 2 distinct states (see figure 7):

- in the On-state, the switch S is closed, resulting in an increase in the inductor current;
- Subsequently in the off-state, the switch is open and the only path offered to inductor current is through the diode D, the capacitor C and the load R. This results in the transfer of energy accumulated during the On-state into the capacitor.

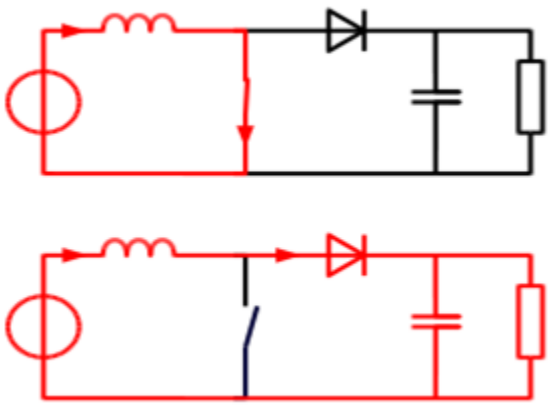

Figure 7: The two configurations of a boost converter, depending on the state of the switch S.

V. ADVANTAGES

1. It is portable and less bulky.
2. It has applications in daily life.
3. It can be used for charging.
4. It makes use of renewable energy source.

VI. DISADVANTAGES

1. No long distance communication.
2. Lossy coils
3. To increase power, coils must increase.
4. Costly setup

VII. CONCLUSION

The concept of wireless power transmission offers greater possibilities for transmitting power with negligible losses. In the long run, this could reduce our society's dependence on batteries, which are currently heavy and expensive. As the concept of wireless power transmission offers greater possibilities for transmitting power with negligible losses. In the long run, this could reduce our society's dependence on batteries, which are currently heavy and expensive.

VIII. REFERENCES

[1] Yogesh Parmar, Amit Patel, Jayant Shah, "Review paper on Wireless Power Transmission", International Journal of Scientific Research Engineering & Technology (IJSRET), ISSN 2278 – 0882 Volume 4, Issue 11, November 2015

[2] Prof. Vishal V. Pande et al Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 4, Issue 4(Version 9), April 2014, pp.46-50

[3] TeckChuan Beh1, Masaki Kato1, Takehiro Imura1, Yoichi Hori, Department of Advanced Energy, Graduate School of Frontier Science, University of Tokyo, Frontier Sciences,Transdisciplinary Sciences Building, 5-1-5, Kashiwanoha, Kashiwa Chiba, Japan

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[5] Dilip Chaurasia ,"A Review on Wireless Electricity Transmission Techniques", Current Trends in Technology and Science ISSN: 2279–0535. Volume: 2, Issue: 4

[6] Vikash Choudhary, Satendar Pal Singh, Vikash Kumar and Deepak Prashar, "Wireless Power Transmission: An Innovative Idea", International Journal of Educational Planning & Administration. ISSN 2249-3093 Volume 1, Number 3 (2011), pp. 203-210

[7] Sagolsem Kripachariya Singh, T. S. Hasarmani, and R. M. Holmukhe," Wireless Transmission of Electrical Power Overview of Recent Research & Development", International Journal of Computer and Electrical Engineering, Vol.4, No.2, April 2012