

# Wireless HV Power Transfer Through Water Pipes

Mahesh Kunnurkar<sup>1</sup>, Shubham Ashtekar<sup>2</sup>

Department of Electrical & Electronics Engineering,  
KLS's Gogte Institute of Technology, Belgaum, Karnataka, India

**Abstract:-** Major problems faced by the Underground & Overhead transmission lines such as Damage to insulator, Conductor Corrosion, Vibration Damage, Arcing damage of conductor, Atmospheric lightning, ionization, Corona, Detection of fault location, Tree branches getting in contact with the power lines, birds in contact with the power lines affects the distribution of electricity. Including all the above mentioned problems, there are some instances happened due to the breakage of the power conductor and it falling on the surface of the earth or on the person in technical terms called as Step Potential & Touch Potential. This severe problem can be minimized if we replace the underground & overhead cable transmission system with the salt water. If we compare the conducting materials like copper, steel & aluminium with salt water the weight of the salt water is much less though there is much amount of difference in electrical conductivity but with much less resistivity. Sea water covers the major part of the earth surface and is also a good conductor of electricity. And it is practically proven that the transfer of high voltage AC current through salt water is possible. We proposed an alternate power transfer system which replaces Aluminium and Copper conductors in transmission with the salt water and transfer of electrical power through salt water. We are stepping up the generated (11KV) power to higher voltage levels (220 KV, 440 KV etc.) and then transferring the generated electric power through salt water filled in pipes to different distribution stations and sub-stations.

**Keywords:-** Salt Water, Transmission Lines, Step Potential, Pipes, Underground and Overhead Transmission.

## I. INTRODUCTION

Our proposed system is basically a replacement for the steel reinforced aluminum conductor, as the above-mentioned problems in abstract like conductor breakage, tree branches falling on the overhead power transmission conductors gives rise to some of the serious accident like touch potential and step potential, RYB phase in contact with each other thus causing short circuit in the transmission system and forcing the system to shut down temporarily for a longer period of time.

All the problems caused by the metallic conducting cables can be avoided by replacing the conductors with non-metallic insulating pipes filled with salt water (ocean water as it is naturally salty and available abundantly).

Installation of these pipes are pretty simple and similar to the overhead transmission system and underground transmission system process.

If we look at our traditional power transmission system specifically overhead power transmission system, tower A, tower B, Tower C and tower D are carrying conductor with transmissible voltage and power is flowing from tower A to tower D. In case of any fault like tree branch falling on the conductor CD for instance, then electric power does not reach tower D as current carrying conductor CD has been cut off at tower D due to tree branch falling on it and hence conductors from tower D will not receive any power. However, the power will still be flowing from tower A to tower C and the conductor CD that is now laying on earth's surface is still conducting as it is on ground and as we know ground is the best absorber of electricity so the electrical energy is spread on the ground at equal radius say 8 meters. Now when any person or living being is present at the point where the live conductor has fallen and is within that radius then there are high chances that the living being will get electrocuted resulting in the death of that living being. Technically this is categorized into step potential and touch potential, every year there are such accidents where farmers, cattle and wild animals lose their life because of step potential. This can be avoided by replacing the metallic conductors with insulating pipes filled with salt water, if we consider that the pipes be in discrete pattern that is for example conductor AB is separate from conductor BC and conductor BC is separate from conductor CD that is the pipe AB is connected to BC and pipe BC is connected to CD and so on. Now considering there is a breakdown of transmission pipe BC and the pipe has fallen on the earth's surface and pipe end C is touching the earth's surface now due to the impact of the tree branch the pipe is damaged and all the water in that pipe is drained out so now the pipe becomes empty and now there is no current flowing in the pipe resulting in no damage.

Though the conductivity of salt water is much less as compared to the other conducting materials used in transmission of electricity the heat bearing capacity of salt water tends to be more than any other metals that is used in transmission and also the power loss in salt water is negligible.

## II. EXPERIMENTAL RESULTS OF CONDUCTION AND SUPPLY OF ELECTRICITY THROUGH SALT WATER



Fig. 1: Experimental setup of conduction of electricity through pipes containing salt water.

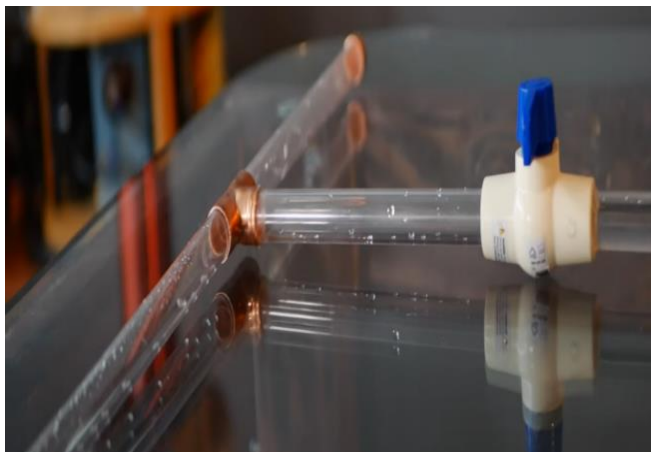


Fig. 2: End part of the transmission system showing a valve controlling the flow of water, the flow of electricity and copper capping provided on the edges of pipes.



Fig. 3: A CFL bulb placed beside the end of the pipe which is not connected or not in the direct contact with the copper capping.

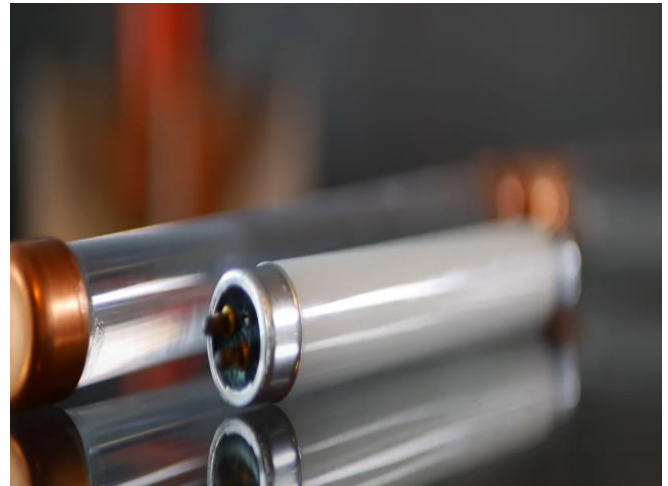


Fig. 4: A CFL tube placed beside the end of the pipe which is not connected or not in the direct contact with the copper capping.



Fig. 5: After turning ON the supply from the Tesla coil we can see that the CFL tube placed beside the Copper capping starts conducting wirelessly.

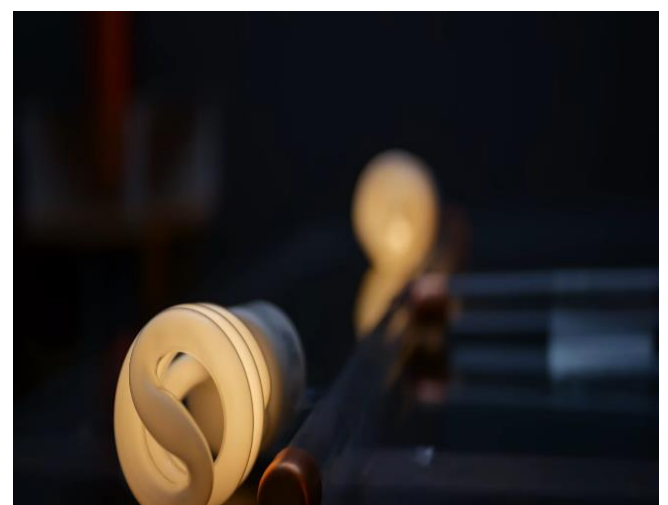


Fig. 6: We can see the conduction of electricity through pipes and the CFL bulb in contact with the copper capping of the pipe glows.

### III. COMPARISON OF DIFFERENT PARAMETERS OF CONDUCTING MATERIALS WITH SALT WATER

Weight of various materials in pounds per*Cubic foot	
Aluminium	169.48
Copper	559.87
Steel	490.44
Salt water	64.00

Table. 1: Weight comparison of different conducting materials with salt water.

Material	$\rho$ ( $\Omega$ -m) at 20 °C Resistivity
Copper	$1.68 \times 10^{-8}$
Aluminum	$2.82 \times 10^{-8}$
Steel	$6.9 \times 10^{-7}$
Salt water	$2 \times 10^{-1}$

Table. 2: Resistivity comparison of different conducting materials with salt water.

Material	$\sigma$ (S/m) at 20 °C Conductivity
Copper	$5.96 \times 10^7$
Aluminum	$3.5 \times 10^7$
Steel	$1.45 \times 10^6$
Salt water	4.8

Table. 3: Conductivity comparison of different conducting materials with salt water.

### IV. ADVANTAGES

- Sea water covers about 70% of earth so availability of water is not a problem and is free of cost (excluding the transportation cost).

- Water can take any shape, filling water in any water pipe of required diameter and using it as a conductor is easy, thus installation is very easy and can consume less time.
- When using solid conductors, it is required that material in use should be in their purest form, but this is not the case in water/salt water.
- Water can handle greater amount of temperature.
- High voltage high current bearing capacity.
- In case if there is crack in the pipe, water leaks out not completely but only where the crack is present and this will help to prevent line to ground fault. (Disadvantage is supply is interrupted).
- Extracting raw material like aluminium, steel and copper requires time and cost whereas sea water is freely available and can be transported using equipment.
- Apart from this sea water is lighter in weight as compared to the traditional conducting materials.

### V. DISADVANTAGE

- Proper protection and care need to be taken on the system side.

### VI. CONCLUSION

Wireless HV Power Transfer through Water Pipes is having several advantages over the conventional Underground & Overhead Transmission of electric power as it provides high voltage and current withstanding capabilities, it is very easy and cheap in comparison and it can be one of the effective means to improve the electric power transmission system. Since there are so many factors which affects the current Underground and Overhead transmission of the electricity due to which there is reduction in the efficiency and breakage of conductors resulting in the interruption in the system. In future the proposed system of transmission of electric power through salt-water or sea water may be one of the best alternative for the current methods or the conventional methods which are in use. And due the use of the proposed system we can eliminate so many unwanted incidents or accidents that occur due to the faults which are taking place in the underground and overhead transmission system of electric power.

### REFERENCES

- [1]. "Inductive Power Transfer Through Salt Water" by J.N.Wandinger, D.M. Roberts, J.S. Bobowski, T. Johnson 2021 13th International Conference on Electromagnetic Wave Interaction with Water and Moist Substances (ISEMA).
- [2]. "Study on High Efficiency WPT Underseas" by D. Futagami, Y. Sawahara, T. Ishizaki, I. Awai 2015 IEEE Wireless Power Transfer Conference (WPTC).
- [3]. "Study on WPT System via Fresh and Salty Water" by Yuichi Swahara, Toshio Ishizaki, Masashi Hotta, Ikuo Awai IEICE Technical Report on WPT, WPT2013 -03, April, 2013 (In Japanese)
- [4]. "Plasma Channel" on Youtube - Jay