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RE-ELECTROMAGNETISM- The Energy Generation from Waste Strong Electromagnetic Fields

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ABSTRACT: *Recently the trend in power system is going about the use of HV and EHV transmission network over long distances to feed load scattered over the large area, this is really going to be helpful in reducing mainly I^2R losses; but what about the strong electromagnetic fields and its respective losses produced due to these transmission networks? These strong Electromagnetic fields create various problems on human health, animals, crops, nearby equipment's and environment etc. and this is considered as a huge loss of energy too. So we take little initiative towards not only in reducing all these problems especially in rural areas but also regenerate electricity from those waste electromagnetic fields, by implementing various engineering techniques. The generated electric power from this trial is either stored in batteries for further use or it feeds to utility and customers for improving reliability and efficiency of the system.*

Keywords—High Voltage and EHV system, Electrical and electromagnetic fields, Gauss meter, electron vacancy, MuMETAL, metal Screening.

I. INTRODUCTION

Continuous growth in industrialization and increase in power demand become an issue in front of the power utility. Which leads us towards implementation of high and extra high voltage transmission network, helps in reduction of copper losses too. But at the same time we are neglecting generation of strong electromagnetic fields around transmission networks which depend on both current and voltage; As per Maxwell equations of electromagnetism. Hence we are providing fruitful situations to those strong electromagnetic fields to grow up further. Until now we don't get the result of cancer issue due to these magnetic fields but still, they cause various considerable effects over the performance of surrounding equipment's, humans living and staying behind those HV and EHVAC transmission lines, animals, crops etc.

Still with using different advance compensating devices e.g.: Super capacity, Synch. Generator, FACTS etc. in the country like India we are having 25% losses. It's a need of time that these losses are getting reduce which ultimately reduces its adverse effects on system performance and leads to efficient operation. So we take initiative to reduce these losses, their adverse effect on efficient power generation from those losses too.

II. BASIC OF ELECTRICAL AND ELECTROMAGNETIC FIELDS?

Electric and magnetic fields (EMF) are always formed in varying levels, with the generation and use of electricity and at the frequency of the electrical power system. Power system frequencies are much lower than the frequencies of electromagnetic energy applied. Any biological effects that may occur from exposure to microwave frequencies will be as a result of heating of biological tissue due to electric current induced in the subject by the EMF. Safety precautions, for this frequency range, are thus based on limiting field levels that may cause a rise in tissue temperature.

Electric fields are produced by the presence of electric charges and therefore the Voltage (V) applied to a conductor.

Magnetic fields are produced by the current flowing (movement of electric charge) on a conductor.

Electric current is measured in Ampere (A). The current on a system may vary depending on the number of devices (load) supplied by the system. As the load changes, the magnetic field will change. Magnetic fields decrease with an increase in distance from the source (conductor). Magnetic field levels are measured in Tesla (T). Because of the range of the levels encountered in typical power system environments, field levels are reported in microtesla (µT). (One-millionth of a Tesla = 1 µT). Some American literature uses the unit of Gauss (G) where 10 milligauss (mG) = 1 µT. Magnetic fields created in the vicinity of overhead power lines depend on the current flowing on the line, the tower configuration and the conductor height above ground.

III. EFFECTS OF STRONG ELECTROMAGNETIC FIELD

Magnetic fields are able to pass through a material, building, &humans etc. possess the biological determination effects including the possibilities of leukaemia, neural disorders such as depression, as well as a problem in reproduction systems. Emf effect is seen prominent with the living thing such as humans, animal, plants along with fences, vehicles, buried pipes close buried to the high vtg transmission line.

Therefore the emf and mmf cause effects upon the plants i.e. their growth get saturated all year round; a crop root length, leaf area, leaf weight, overall biomass content with water content, shoot ratio and other growth characteristics are significantly reduced. It reduced physiological as well as growth parameters was mainly because of the effect of cell enlargement and distortion

Fig.1:Effects of EMF on plants

IV. MAGNETIC FIELD SHIELDING

Isolation to Magnetic fields can be done through following methods:

- By Active magnetic field cancellation system (By using opposite magnetic charges which cancels each other).
- By using µ (Mu Metal)
- Strong Magnetic Shielding by Common Available Material.

A. µ (MU METAL):

Mu metal is a nickel–iron soft magnetic alloy with very high permeability suitable for shielding sensitive electronic equipment against static or low frequency magnetic fields. It has several compositions. One such composition is approximately 77% nickel, 16% iron, 5% copper and 2% chromium or molybdenum. More recently, Mu metal is considered to be ASTM A753 Alloy 4 and is composed of approximately 80% nickel, 5% molybdenum, small amounts of various other elements such as silicon, and the remaining 12 to 15% iron. Mu metal typically has relative permeability values of 80,000–100,000 compared to several times of ordinary steel.

The high permeability of Mu metal provides a low reluctance path for magnetic flux leading to its use in magnetic shields against static or slowly varying magnetic fields. Magnetic shielding made with high permeability alloys like Mu metal works not by blocking magnetic fields but by providing a path for the magnetic field lines around the shielded area.

Other materials with similar magnetic properties include Co-Netic, supermalloy, superMuMETAL, nilomag, can bold, molybdenum Permalloy, Sendust, M-1040, Hipernom, HyMu-80 and AMuMETAL. Plates of Iron, Stainless Steel, Tin, Rubber, Aluminium Brass and some more common material.

V. EQUIPMENT'S FOR MEASUREMENT

Gauss meters and Tesla meters are magnetometers that measure in units of gauss or Tesla, respectively. In some contexts, a magnetometer is the term used for an instrument that measures fields of less than 1 millitesla (mT) and gauss meter is used for those measuring greater than 1 mT.

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Fig.2: Advance sensor for EMF meas.

VI. MODEL-CONCEPTUAL DESIGN FOR RE-GENERATION OF POWER

We are finding the various suitable design arrangements for having more and more amount of energy to be generated.

A. SIMPLE SINGLE CONDUCTOR WITH ADVANCED I-F AND F-V CONVERTER (FOR WIRELESS TRANSMISSION) ARRANGEMENT:

As its name indicates have we are using a simple conductor to get alternating fluxes cut down and results in EMF induced in that conductor. As per the real calculation show earlier. At the same time, we are using a pair of frequency from current conversion and frequency to voltage conversion. This leads in quite a complex circuit but for advancement, it plays a bold role.

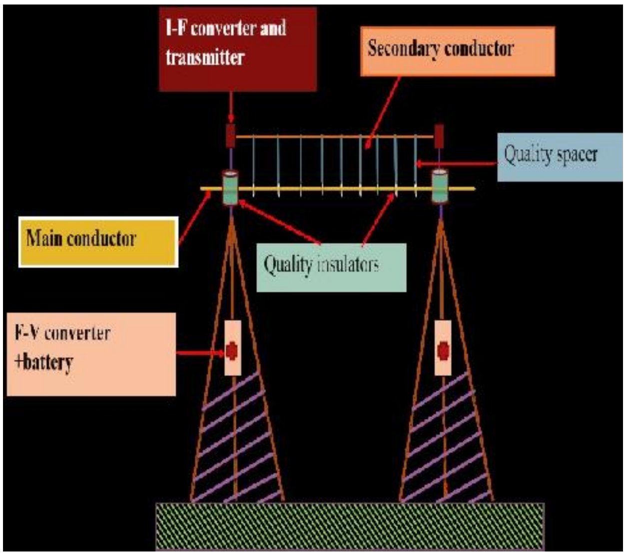

Fig.3: simple single conductor with Advanced I-F and F-V arrangement.

B. PEN TYPE STRUCTURE WITH METAL SCREENING:

As of our pen structure including the refill and outer covering we use the same structure; and here the main conductor act and a refill and metallic screening come with isolation structure outside act as a pen covering.

Sometimes the metallic substance is placed on an inner side so that most of the electromagnetic field is get interacted by those metallic particles and causes the production of more emf in it. This generated emf is then transmitted to end users side through the wire connection.

It is further of two types:

[1] One sided connection

[2] Both side connection in order to get advance where transferring that generated emf wireless.

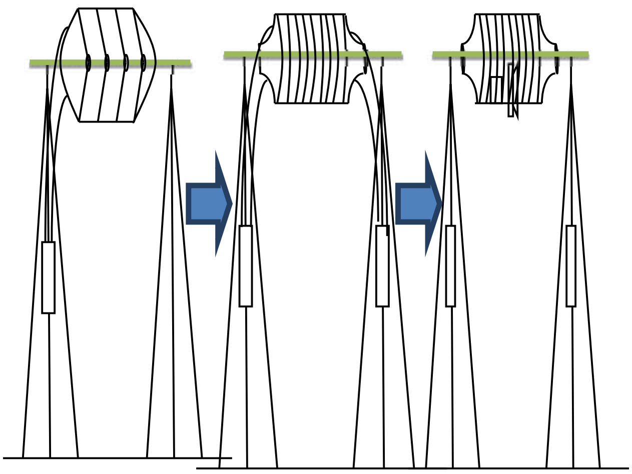

Fig.4: Pen type structure with metal screening arrangement

5.1.3 USING STRONG MAGNETIC FIELDS-RECEIVERS:

In the market, there is various sensor available which can sense the presence of electromagnetic fields sensor like vernier magnetic field sensor etc. instead of using additional conductor we can receive the wasted magnetic field using magnetic fields receivers. These magnetic fields receiver can either be placed on every single pole or at alternative poles as per the economic consideration.

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MAGNETIC FIELD RECEIVERS: Magnetic receivers are generally a small triad of electromagnet coils enclosed in a plastic shell that detects the magnetic fields emitted by a transmitter. Magnetic receivers emit electromagnetic energy that can be detected with magnetic field detector.

Fig.5:Strong Magnetic field receivers

When electrons oscillate, their electric and magnetic fields change together, forming an electromagnetic wave. This movement can come from atoms being heated and thus moving about rapidly or from alternating current electricity. The opposite effect occurs when an electromagnetic wave hits matter. In such a case, it could cause atoms to vibrate, creating heat, or it can cause electrons to oscillate, depending on the wavelength of the radiation.

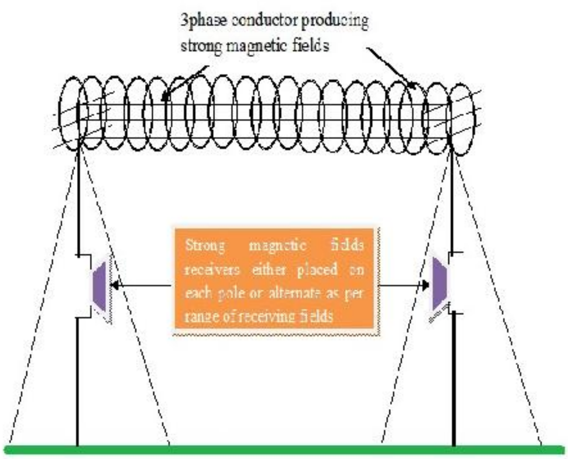

Fig.6: Regeneration using strong magnetic receivers

VII. Table no.1: Practical measurement of magnetic fields by Team

Measurement on Normal:-244v, 200w lamp load, 230v, max 10A.

Load Current(A)	Magnetic Field (mG)
0.8	0.8
3.2	3.2
4.1	4.1
5.6	5.6
6.48	6.48
7.2	7.2
9.45	9.45
10.23	10.29

Measurement on 9.8Kv, 40A

Distance(cm)	Magnetic Field (mG)
35	5.6
30	5.7
25	6.1
20	6.7
15	7.5
10	10.5
5	10.2

Measurement on 31Kv, 85-90A

Distance(cm)	Magnetic Field (mG)
35	**22**
30	**38**
25	**74**
20	**109**
15	**240**
10	**571**

VIII. CALCULATION/ ANALYSIS-

These calculations are based on the real readings taken out at **AASHVI 33kV SUBSTATION** (Baleshwar- Aashvi, 220/33kV-33/11kV)

Ideal Voltage	33kV
on field voltage	28.7kV
Load current	95A
power factor	0.7
Frequency	50Hz
Conductor specifications	0.1 dog conductor, 7/4.26mm, 100mm^2
Conductor diameter	1" =2.44cm

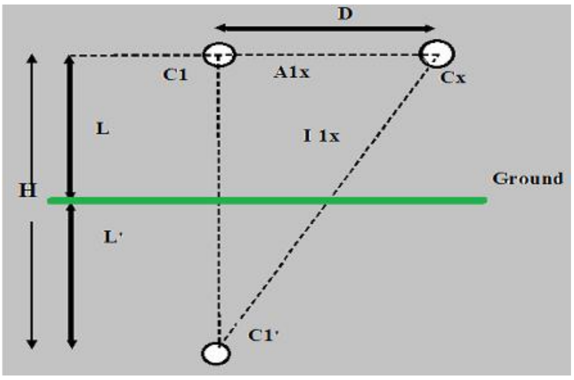

Fig.3: Two conductors with mirror image arrangement diagram.

- **C1** =Main conductor of 33kv
- **C1'**=image main conductor
- **Cx** =Secondary Conductor
- **L**=clearance between ground and main conductor
- **L'**=image clearance between ground and main conductor
- **H**=distance between C1 and C1’
- **D**=**A1x**=Distance between C1 and Cx
- **I1x**= Distance between C1’ and Cx

Voltage induced in nearby secondary conductor due to 3phase system is given by:

Vx= Vm [(P14M11+P24M21+P34M31) sin ωt+ (P14M12+P24M22+P34M32) sin (ωt-120)+ (P14M13+P24M23+P34M33) sin (ωt+120)]

P24 and p34 are neglected coz they are considered only when 2nd and 3rd phase is present in system. But here we are dealing with single phase system only hence voltage induced in nearby conductor ‘x’ due to main conductor C1 and its mirror image conductor C1’ is calculated.

Vx=Vm(P1x*M11) sin ωt

P1x=ln (I1x/A1x)

A. RESULTS

1: for L=7m, D=0.1m

P11=ln($2H/r$)

r=2.44/2=1.22cm=0.0122m

P11=ln(2*7/0.0122)

∴P11 =7.045576

[M]=[P]$^{-1}$=1/7.045576

∴M=0.141257

Vx=Vm(P1x*M11) sin ωt

P1x=ln(I1x/A1x)

P1x =ln[√(14²+0.1²)/0.1]

∴P1x =4.9416

Vx=33√2*(4.94166*0.14143)

Vx =32.7338 sin ωt

∴Vx =32.7338 kV (Peak voltage)

∴Vx=23.146kV

3: for L=9m, D=0.2m

P11=ln(2*9/0.0122)

∴ P11=7.29669

∴M=0.137

Vx=Vm(P1x*M11) sin ωt

P1x=ln(I1x/A1x) =ln[√(18²+0.2²)/0.2]

∴ P1x =4.4998

Vx=33√2*(4.4998*0.137) sin ωt

∴Vx =28.77 kV (Peak voltage) **∴Vx(rms)=20.34kV**

2:for L=9m, D=0.3m

P11=ln(2*9/0.0122)

∴ P11=7.29669

∴M=0.137

Vx=Vm(P1x*M11) sin ωt

P1x=ln(I1x/A1x) =ln[√(18²+0.3²)/0.3]

∴ P1x =4.09448

Vx=33√2*(4.09448*0.137) sin ωt

∴Vx =26.17 kV (Peak voltage)

∴Vx(rms)=18.51kV

4:for L=9m, D=0.1

P11=ln(2*9/0.0122)

∴ P11=7.29669

∴M=0.137

Vx=Vm(P1x*M11) sin ωt

P1x=ln(I1x/A1x) =ln[√(18²+0.1²)/0.1]

∴ P1x =5.19297

Vx=33√2*(5.19297*0.137) sin ωt

∴Vx =33.20 kV (Peak voltage)**∴Vx(rms)=23.4757kV**

5:for V=11kV, L=9m, D=0.3m

P11=ln(2*9/0.0122)

∴ P11=7.29669

∴M=0.137

Vx=Vm(P1x*M11) sin ωt

P1x=ln(I1x/A1x) =ln[√(18²+0.3²)/0.3]

∴ P1x =4.09448

Vx=11√2*(4.09448*0.137) sin ωt

∴Vx =8.72623 kV (Peak voltage)

∴Vx(rms)=6.17Kv

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