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Research Article

THE LIGHTNING: A HUGE PROMISING SOURCE OF ELECTRICAL ENERGY

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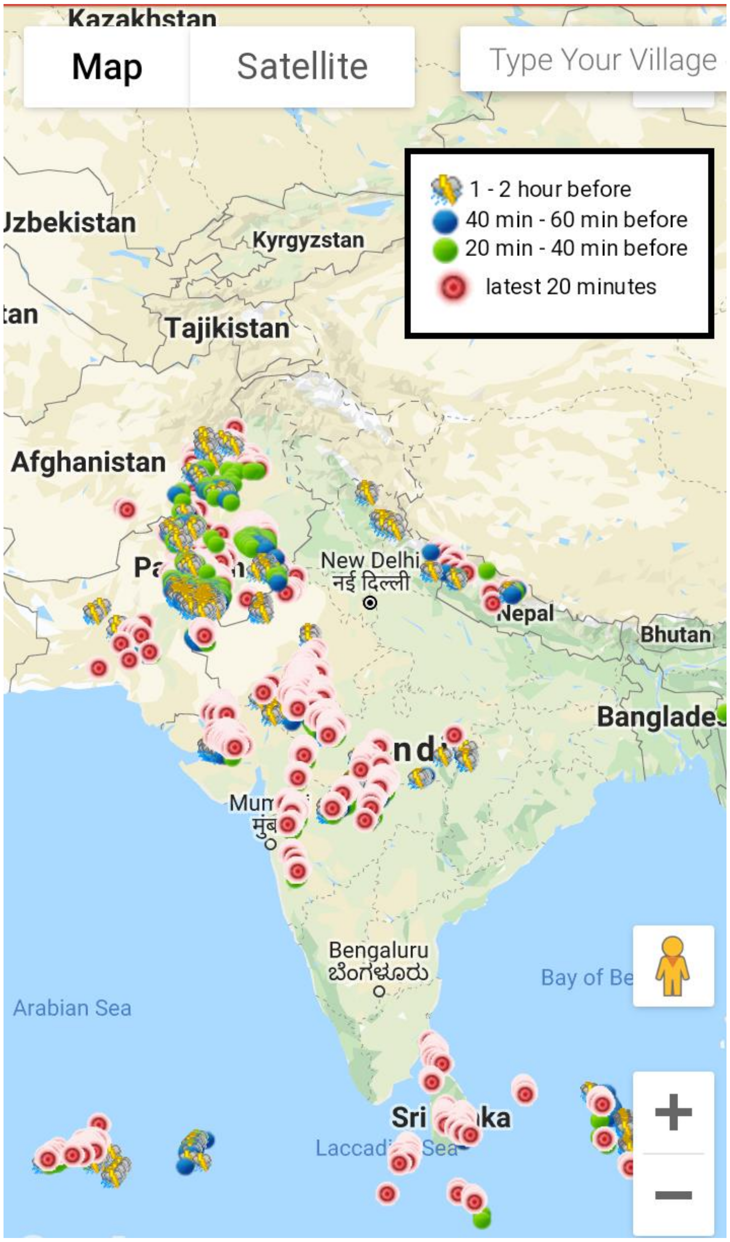
ABSTRACT
World today is in search of viable alternative source to drive its power requirements. Various sources of alternate and renewable sources are being tried but the amount of power that can be tapped is not enough in comparison to the need that is required to meet our present power demand. Hence, there is an urgent need to look for some viable option. Here, we present a possibility and technique of harnessing electrical energy from lightning.

Keyword: *Power Crisis, Electrical Energy, Thundering/ Lightning Electrical Energy, Lightning Power*

INTRODUCTION

Concurrently with the growth of new technologies in modern world, the power crisis ghost grew on since the era of industrialization. There have been lots of innovations and discoveries for the searching new energy resources like solar, hydro, wind energies etc., but the future of the invention have been jeopardized just because of the fact of non-availability of sufficient energy sources. The energy crisis can be knocked out by new possible energy sources and likewise substantial attempts led the alternative possible power sources from the lightning. There have been several investigations of harvesting energy from lightning since 1980's because it bears approximately five billion joules in a single bolt of lightning. Although this energy is concentrated in a small area while passing during a mile but delivered within few seconds of time. In 2013, It had been purposed by S. MALAVIKA (2013) that the energy contained in the lightning could be used to generate hydrogen from water or to harness the energy for rapid heating of water due to lightning or to use indictors spaced far away so that a safe fraction of energy might be captured. Lighting occurrence frequency is measured on an average 40 -50 times in a second over the entire earth globe and estimated lightning of about 1.5 billion per year. The number of lightning is depended upon number of factors like ground elevation, latitude, longitude, wind current, relative humidity, proximity to warm and cold body of water etc. lightning may also vary to certain degree on the nature of the cloud and ratio between their classes, intra cloud like cumulus, stratus, cumulonimbus, altostratus, nimbostratus etc. Under clouds atmosphere polarizing disturbances brought by the warm air current mixed with colder air current resulting in occurrence of lightning. Lightning also can occur during the dust storm, forest fire, tornados, and volcanic eruptions (Dhongre *et al.*, 2017).

In principle, Lightning is understood as a massive electrostatic discharge resulting between electrically charged regions developed within clouds, or between a cloud and the earth's surface (John E. Oliver 2005). The charged regions in clouds created by internal friction within the atmosphere temporarily equalize themselves though a lightning flash, which is commonly referred to as a strike. If this strike hits an object on the ground, a lightning streak is visible with intense flashes and high decibel sound energies. These are of primary two types viz - from a cloud to itself (intra- cloud or IC) and between a cloud and a ground (CG). Although lightning is generally accompanied by the sound of thunder however, when a lightning is far way, it is only seen and thunder not to be heard (Uman Martin A. 1986).



POWER OF LIGHTNING

An enormous amount of power is available in lightning and the total energy a typical strong thunderstorm exits is equivalent to the energy released during an atomic explosion. During a typical lightning bolt, the power could be of the order of million volts along with the rise of air temperature over the 60000^{O} C. Rarely temperature rising more than one lakh of degree is also seen (field et al. 2010). As around 1800 thunderstorms are active all over the world at a given time, there is a big scope of power generation. At every second about 100 lighting flashes occur all over the earth. In 1997 NASA and NATIONAL SPACE DEVLOPMENT AGENCY JAPAN had launched the first lightning imaging sensors (LIS) equipped satellite which could detect and record the lightning (NASA Science,2010). The sensor has recorded on an average 44 ± 5 times lightning per second for total of nearly 1.4 billion flashes per year over the earth. The analysis of lightning rate data occurring for intra cloud, and cloud to ground have been taken in the ratio of (IC:CG =75:25 has been found on an average over the entire globe. The stratification of the cloud in the monsoon season is normally typical and ground strikes are more likely to occur in this cloud because of the closeness to the ground of this cloud. In the tropics where the freezing zone is higher, the ratio of (IC + CC):CG is increased to 90:10. This ratio becomes 50 :50 at 60^{O} latitude of Norway where the freezing elevation is low. It is noticed that the location where the majority of thunderstorms occur the lightning is found about 70% and the lowest lightning strike rate are detected over the oceans and north and South Pole of the earth.

The anisotropic lightning distribution around the planet is shown in the map given in figure- (1). (From the curtsey of Map data @2019 Google, ORION-ME, SK telecom)

LIGHTNING POWER CAPACITANCE

Even with the advancement of technology, harvesting of lightning power is an endless big problem even today. The high power involved in lightning bolt needs to be captured immediately when lightning occurs. The solutions of harvesting lightning energy have been given in several technological research papers published in literature (Kevin Pierce, 2007). There are basically two problems existed with the lightning energy

1. Sporadic in nature
2. Highly fluctuating.

The sporadic nature of lightning is referred to occurrence of lightning depending upon the time and space. Space dependence may be within the range of several kilometres' proximity around the central where lightning is supposed to occur. The fluctuations in the lightning are of two types; there may be occurrence of lightning at different vertical heights in cloud and secondly sometimes too high or too low power lightning. Additionally, lightning power of several Mega Watts is difficult to convert high voltage to low voltage electrical power that can be stored. The capacitance of the globe Earth at the location, where during the cloud formations in the atmosphere and monsoon seasons is enhanced on basis of the principle of spherical capacitor,

$$C = 4\,\pi \epsilon_0\, K R \quad \text{Farad}$$

of radius R covered with the dielectric media of constant K. In our case it could be the radius of our earth 6.4×10^6 m and dielectric constant of water 82 which amounts to the immensely large resultant capacitance of value 0.056 Farad. The value is quiet high and enough to give rise megawatts electric power in one lightning strike with in a second.

METHOD

Lightning is an electrical discharge either within inter clouds (IC), or between clouds and the ground (CG). Huge electric current flows in the atmosphere during the lightning flash which generates electromagnetic radiations in all frequency bands. Generally, radiations from CG flashes lie in the LF (Low frequency) and VLF (Very Low frequency) bands whereas for IC discharges they lie in VHF (Very high frequency) band. These radio waves propagate many thousands of kilometres away from the lightning channel, and can be detected by ground based electromagnetic lightning sensors. Generally lightning detection network consists of lightning sensors spread over a region and all these sensors are connected to central processing unit through internet. Most of lightning detection networks use 'time of arrival (TOA)' technique to estimate the lightning flash location. In this technique, the arrival times of radiations produced by lightning discharge is measured at different locations by lightning sensors. From the difference between times of arrival from different locations the exact location of the lightning discharge can be estimated. Lightning detection networks can give the real time detection of lightning flashes along with other parameters like location, time, flash rate, peak current, polarity etc. Many studies in the recent year have shown that lightning frequencies, polarities, and lightning types (IC and CG) are known to be related to microphysical and dynamical processes within storms (Price 2008).

Lighting is detected by using a lightning detection network. In this network frequency ranging from 1 HZ to 12 MHZ is used for detection. The low frequency (1 KHz) is used for long range detection of Cloud-to-Ground (CG) discharges. The middle frequencies (1 KHz to 1 MHz) are used for locating return strokes.

The highest frequencies (1 MHZ to 12 MHz) are used to detect and locate in-cloud pulses. The sensor records whole waveforms of each flash and sends them back, in compressed data packets, to the central server. Instead of using only the peak pulses, the whole waveforms are used in locating the flashes and differentiating between Intra-Cloud (IC) and CG strokes. When lightning occurs, electromagnetic energy is emitted in all directions. Every ENLS sensor that detected the waveforms records and sends the waveforms to the central lightning detection server via the Internet. The precise arrival times are calculated by correlating the waveforms from all the sensors that detected the strokes of a flash. The waveform arrival time and signal amplitude can be used to determine the peak current of the stroke and its exact location including latitude, longitude and altitude. Strokes are then clustered into a flash if they are within 700 milliseconds and 10 kilo meters

OBSERVATIONS

There was a big thunder and dust storm in the western part of India on April 16, 2019. This thunderstorm lasted for about 2 hours. observation of occurrences of lighting was done by using a lightning location network (LLN) system during the period 12:00 – 2:00 P.M during which the storm was over the region of, Chittorgarh district of Rajasthan. One sensor of LLN system in is located at KAPASAN in the campus of our Ravindra Nath Tagore P.G. college which recorded data on that day. Entire western belt of INDIA was under severe heat wave for a fortnight before this occurrence of this storm and a severe thunderstorm occurred on April 16 which induced a lot of loss to life and properties. The data of lightning is plotted in Ffigure-1 (Lightning Information System-1 by the courtesy of www.tropmet.res.in) comprising information of lightning strikes and flashes is shown with latest 20 minutes duration as indicated by red circle in the map, the green dots represent lightning occurring within 20- 40 min before whereas the blue dots exhibit of lightning 40- 60 min before and 1-2 hour before lightning are depicted by yellow flashes which occurred on April 16, 2019 in dense clouds with heavy rain. Beside the north INDIA, the southern region of SHRILANKA and ANDOMAR NIKOBARA were also affected by thunderstorms. This kind of climatic changes are seasonal and depended of heat waves current in different part of the world. The map in the figure-1 shows that lightning is not distributed evenly around the planet. It is evident that 70 % of lightning occurs on land located in the tropics where the thunderstorms are more susceptible to happen. Very few thunder strikes in cloud in cloud occur at north south poles of the planet.

The Table-1 shows the data taken by lightning location network system at our observational place which is also available on the website of Indian Institute of Tropical Metrology, Pune.

April 16, 2019: at time 12:00:00 UTC TO 12:00:13 UTC

Date Time	Latitude	Longitude	Kamps
2019-04-16 12:00:00 UTC	23.8039593	77.0454692	24.053
2019-04-16 12:00:00 UTC	23.7169839	77.2290615	-30.053
2019-04-16 12:00:00 UTC	23.6986196	77.1984416	-27.017
2019-04-16 12:00:00 UTC	23.7328902	77.2378626	-64.584
2019-04-16 12:00:01 UTC	31.9470846	70.1526758	-16.788
2019-04-16 12:00:02 UTC	24.3355034	77.1996627	19.334
2019-04-16 12:00:02 UTC	24.2008553	77.2000371	-13.924
2019-04-16 12:00:02 UTC	24.2030016	77.2337861	-25.536
2019-04-16 12:00:02 UTC	24.2033248	77.2030891	-17.272
2019-04-16 12:00:04 UTC	23.9393947	87.4347417	-4.491
2019-04-16 12:00:04 UTC	7.6087801	80.1901019	-30.806
2019-04-16 12:00:04 UTC	27.0352295	84.4286079	74.159
2019-04-16 12:00:04 UTC	7.7686006	79.975241	13.49

2019-04-16 12:00:04 UTC	7.2965871	79.9941698	26.766
2019-04-16 12:00:04 UTC	7.5909416	79.9945168	39.006
2019-04-16 12:00:04 UTC	7.6735546	79.9777295	24.921
2019-04-16 12:00:04 UTC	24.999694	76.7694772	-7.996
2019-04-16 12:00:05 UTC	27.0648817	84.4170889	23.702
2019-04-16 12:00:05 UTC	25.3833967	73.513075	16.321
2019-04-16 12:00:06 UTC	19.0870218	77.3531479	3.897
2019-04-16 12:00:06 UTC	19.0617365	77.3104775	3.521
2019-04-16 12:00:06 UTC	10.0897869	76.8232494	16.041
2019-04-16 12:00:06 UTC	22.903288	76.3732396	4.448
2019-04-16 12:00:07 UTC	10.0965711	76.7452049	13.134
2019-04-16 12:00:07 UTC	22.0779896	75.9492126	-23.299
2019-04-16 12:00:07 UTC	9.0638934	77.014719	31.474
2019-04-16 12:00:08 UTC	24.7957645	73.746285	-12.248
2019-04-16 12:00:08 UTC	19.2918513	77.5623042	4.401
2019-04-16 12:00:08 UTC	31.8017076	70.0984918	15.441
2019-04-16 12:00:08 UTC	27.832577	84.3712609	123.228
2019-04-16 12:00:09 UTC	19.1535977	75.6173217	-14.468
2019-04-16 12:00:09 UTC	24.9791187	76.6779421	-14.009
2019-04-16 12:00:09 UTC	25.3817632	67.3702986	-22.553
2019-04-16 12:00:09 UTC	24.9779594	76.7502134	-10.452
2019-04-16 12:00:09 UTC	24.7611091	73.7746432	-17.018
2019-04-16 12:00:09 UTC	9.0896635	76.8653036	-15.258
2019-04-16 12:00:09 UTC	19.1540475	75.6187351	-7.687
2019-04-16 12:00:10 UTC	10.0675205	76.7140211	-15.342
2019-04-16 12:00:10 UTC	10.0367751	76.7754514	-26.386
2019-04-16 12:00:10 UTC	24.2148733	77.230409	-11.681
2019-04-16 12:00:10 UTC	21.7865561	79.5654361	-9.876
2019-04-16 12:00:10 UTC	21.6615985	79.3774424	-9.341
2019-04-16 12:00:11 UTC	19.0862861	75.6558778	-31.089
2019-04-16 12:00:11 UTC	19.0823872	75.6585395	-18.535
2019-04-16 12:00:11 UTC	24.9235655	76.6758837	-17.254
2019-04-16 12:00:11 UTC	24.9232084	76.6782065	-24.821
2019-04-16 12:00:12 UTC	27.2734332	76.4647136	45.863
2019-04-16 12:00:12 UTC	28.5746132	71.3269577	-20.038
2019-04-16 12:00:13 UTC	7.7658552	79.9283343	-31.361

April 16, 2019: at time 13:00:00 UTC TO 13:00:27

Date Time	Latitude	Longitude	Kamps
2019-04-16 13:00:00 UTC	23.7880794	88.1244597	4.424
2019-04-16 13:00:00 UTC	20.5840432	76.5685001	-14.248
2019-04-16 13:00:00 UTC	26.8434336	84.9004036	-43.837
2019-04-16 13:00:01 UTC	23.9049802	88.1591792	-12.652
2019-04-16 13:00:02 UTC	26.9933876	84.8043366	36.957
2019-04-16 13:00:03 UTC	26.7610289	85.0390644	-38.488
2019-04-16 13:00:04 UTC	19.7460434	75.7610804	3.57
2019-04-16 13:00:04 UTC	24.1831061	77.6522133	26.996
2019-04-16 13:00:05 UTC	26.6535033	85.0532918	-11.496
2019-04-16 13:00:05 UTC	27.1184735	84.9150481	13.177
2019-04-16 13:00:06 UTC	23.7881344	88.0239581	13.73
2019-04-16 13:00:06 UTC	21.5276558	86.5978922	-11.812
2019-04-16 13:00:06 UTC	21.5165044	86.6099134	-17.199
2019-04-16 13:00:06 UTC	21.523824	86.5834084	-36.993
2019-04-16 13:00:07 UTC	23.8241809	77.2114737	-8.649
2019-04-16 13:00:07 UTC	23.6443936	77.1150087	-9.711
2019-04-16 13:00:07 UTC	19.4692234	76.095453	4.716
2019-04-16 13:00:07 UTC	19.2441055	76.0094727	2.917
2019-04-16 13:00:08 UTC	23.887626	88.0939085	11.448
2019-04-16 13:00:08 UTC	26.4740151	85.2192117	12.338
2019-04-16 13:00:09 UTC	19.7104554	76.0909883	6.362
2019-04-16 13:00:10 UTC	19.5489691	76.037225	2.729
2019-04-16 13:00:10 UTC	23.9365323	88.0244592	17.566
2019-04-16 13:00:11 UTC	23.8506373	87.965017	-4.754
2019-04-16 13:00:12 UTC	29.049538	71.7500498	-12.045
2019-04-16 13:00:12 UTC	19.6712251	77.6388366	6.015
2019-04-16 13:00:12 UTC	24.6540185	77.561671	-14.778
2019-04-16 13:00:12 UTC	23.9636437	88.1060959	-7.778
2019-04-16 13:00:13 UTC	19.7097814	75.8712402	1.766
2019-04-16 13:00:13 UTC	23.5956113	77.3958799	-4.358
2019-04-16 13:00:14 UTC	23.8575522	88.1146639	-6.105
2019-04-16 13:00:15 UTC	26.8757875	84.7950685	10.988
2019-04-16 13:00:18 UTC	23.8297931	77.3959382	-7.361
2019-04-16 13:00:19 UTC	23.8043977	88.0378719	7.73
2019-04-16 13:00:20 UTC	23.9356316	88.030057	17.041
2019-04-16 13:00:20 UTC	19.5568852	77.8360805	6.49
2019-04-16 13:00:20 UTC	23.7949214	88.1606094	7.484
2019-04-16 13:00:20 UTC	26.8342754	84.8691391	14.63

2019-04-16 13:00:21 UTC	26.8214279	72.7029033	22.052
2019-04-16 13:00:22 UTC	23.9127543	88.0630587	3.984
2019-04-16 13:00:22 UTC	23.5761912	77.3698003	23.175
2019-04-16 13:00:23 UTC	28.4636489	72.8603293	-34.307
2019-04-16 13:00:23 UTC	27.0635641	84.8715665	56.849
2019-04-16 13:00:24 UTC	23.9258129	88.0831244	8.766
2019-04-16 13:00:24 UTC	26.5705588	85.1895452	12.347
2019-04-16 13:00:24 UTC	22.7689366	72.4476939	-14.37
2019-04-16 13:00:25 UTC	19.2973429	76.0418951	-2.267
2019-04-16 13:00:26 UTC	19.5797381	77.5984074	13.922
2019-04-16 13:00:27 UTC	15.478211	77.485553	-13.337

The last column in show the maximum electric current in units of kilo Amperes that the lighting strikes produced. The positive current represents direction of current from cloud to ground and negative from ground to cloud. On the other hand, positive-negative pair of currents or pair of negative–positive current drive lightning strikes between cloud and ground but positive-positive or negative-negative pairs are between cloud and cloud or intracloud. These pairs of currents are clearly visible in data and in their plots. The numbers of graphs are plotted for data as given in figures below.

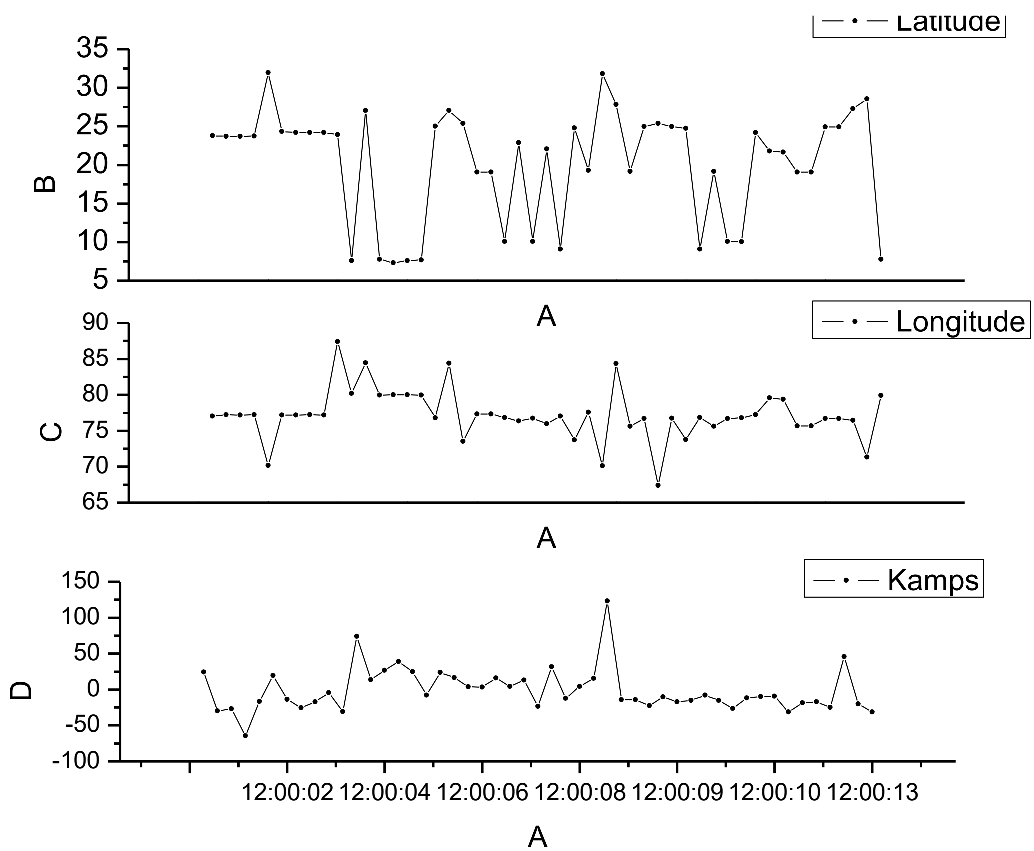


Figure-2: Panel shows real time data for lightning events curve recorded at varying positions of different latitudes and Longitudes over the Indian continent on April 16, 2019 during 12:00:00 to 12:00:13 UTI. It also depicts current curve measured for lightning strikes.

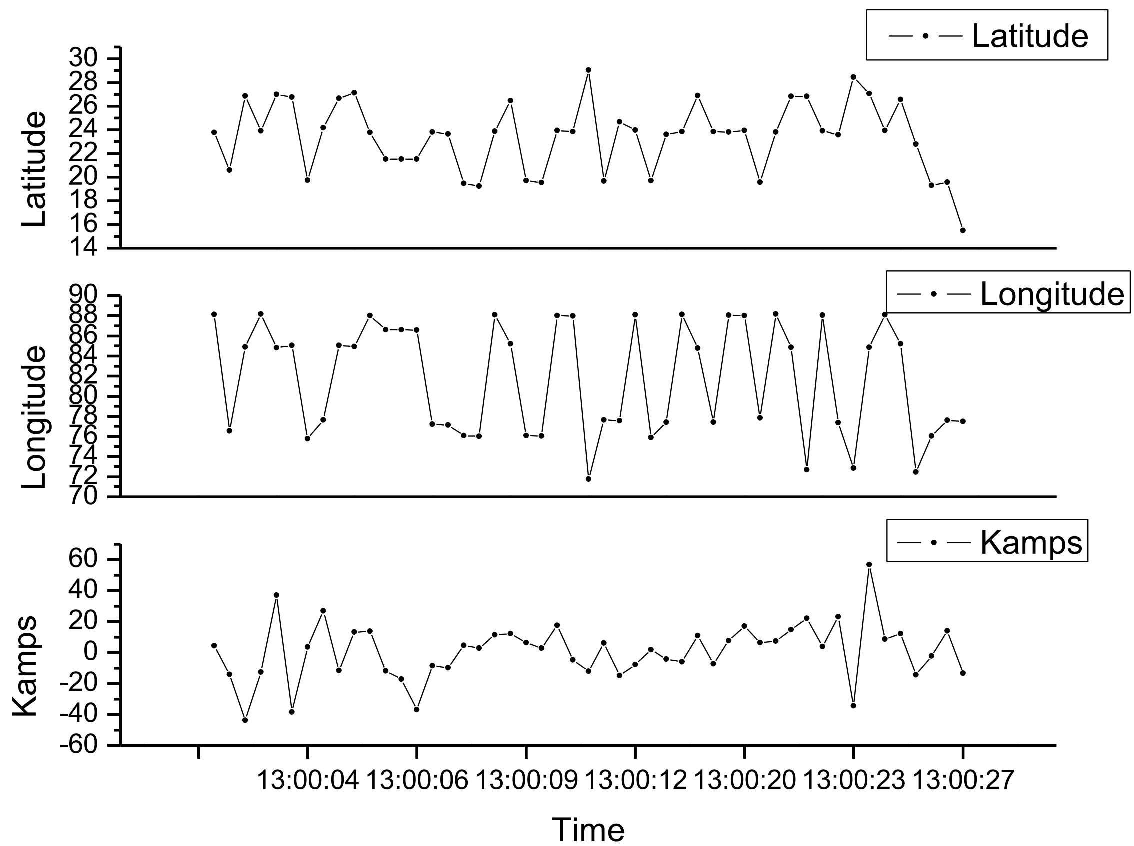


Figure-3: Panel shows real time data for lightning events curve recorded at anisotropic positions of different latitudes and Longitudes over the Indian continent on April 16, 2019 during 13:00:00 to 13:00:27 UTI. It also depicts current curve measured for lightning strikes.

In each lightning strike expected power is iV=W and it can be simplified in terms of measured quantities as

$(it)^2/2C = U$ Jules

evolved in time t. Here i is observed average current for time period of t and C be the capacitance of the earth. Panel in figure-2 shows temporal spectrum of amount of electric current measured during period 12:00:00 to 12:00:13 UTC with optimum varying current from -70 KA to +120 KA and minimum -5 kA to +2 kA. The measured average current i is about 80 kA in time of 13 seconds during 12:00:00 to 12:00:13 on April 16, 2019. Since the capacitance of the earth is 0.056 Farad, which gives about 9.65 x 10^{12} Joules energy generated in single lightning strike as estimated from above equation. This is quite huge amount of electric energy and can be a challenge to capture for useful purpose. Although in literature various methods have been suggested to harness lightning energy but so far no one succeeded for practical implementation. In this paper we propose one workable method in subsequent sections.

CAPTUREING OF LIGHTNING POWER BY ROD TECHNOLOGY:

Lightning rod technology is very old system originally was developed by Benjamin Franklin. The design of lightning rod is simple comprising a pointed metal rod attached to the highest point of supported by either building or tallest mass pole (Uman Martin A., 1986). The lightning rod is usually taken of 2 cm diameter and is connected to a used piece of copper or aluminium wire of about same diameter. The connecting wire is connected to a grid which is buried in the ground with the humid mixture of salt and charcoal. In fact, lightning rod does not attract lightning but it provides a low resistance path towards ground to the huge power made up of several kilo Ampere and kilo Voltage hosted by a lightning strike bolt. Whenever the lightning strikes the lightning rod then connected conducting cable grounds entire power with safety without harming the structure. In case lightning rod is not properly grounded then probably the structure might suffer massive heat damage.

The physical phenomenon involved in working of lightning rod with appropriate grounding is well understood (Robert Roy Britt 1999). The spontaneous strike is associated with the electrical potential of the strike target with regard to earth potential. The power of the lightning seeks a path of least resistance by striking on to nearby object that proved better path to ground. If the lightning occurs near the rod system, system will provide a very low resistance path then strike can divert the lightning current to ground through system before it damages any other nearby objects. This poses that lightning rod does not attract lightning but it provides a safe option to choose very low resistance path. The highest height of the lightning rod begins to send up positive steamers in an attempt to dissipate the electric field if found itself in the vicinity of a strong electric field. In this way lightning rod becomes very prompt for the possibility of strike in that given area where huge electric field is generated by the clouds, thus rod provides easy path of low resistance to ground the almost all power of lightning in that area.

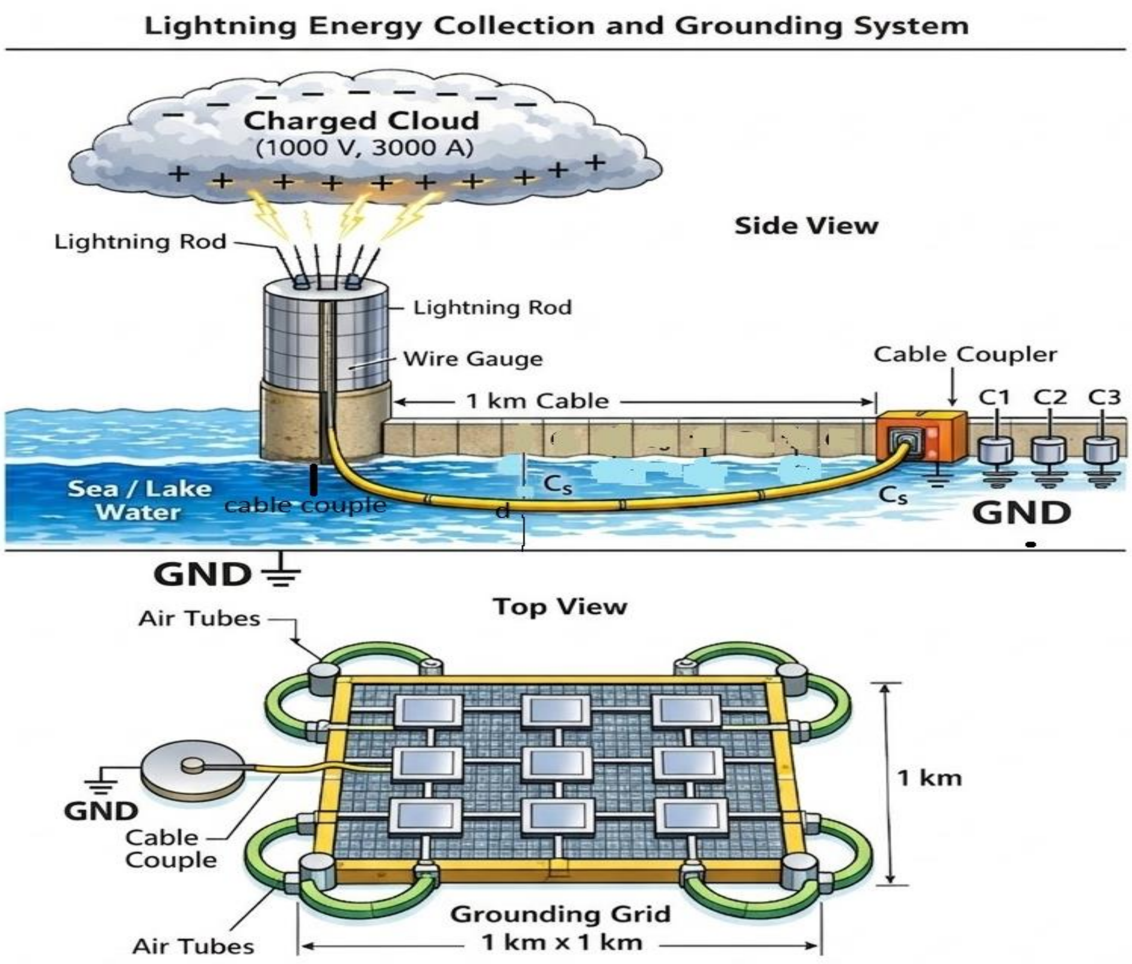


Figure-4: Represents a schematic diagram of proposed Lightning harnessing power plant.

PROPOSED LIGHTNING HARNESSING POWER PLANT:
A lightning harnessing power plant system designed in this paper is different and based upon the concept of huge dielectric parallel plate capacitor. It is misconception that lightning is always destructive and cannot be captured. In literature various concept based harnessing power plant have been purposed which are either apparently impractical or technically complex (Demirkol *et al.,* 1999). The major problem of lightning power capturing at its first look is how to store the huge amount of electricity for later use and secondly it is spontaneously sporadic in nature. The main limiting factor is lack of indigenous technology connected to Utility Scale Battery (USB), flywheel, capacitors at large scale for grid use. Moreover, harnessing of power would be practical in that area where lightning strike is very frequent, during monsoon it is very common all over India. Lighting strike in pre-monsoon season is high in coastal area and over western India from Rajasthan desert to Maharashtra and Madhya Pradesh. While capturing electric power from spontaneous thunderstorm strike bolt, the biggest hurdle at first instant is the harsh surges created by lightning strike on the lightning rod stature. This kind of problem is subdued in our proposed lightning harnessing power plant by indigenous design. The solution seems possible out of indigenous building technology to make harnessing power plant working. However, implementation of electrical engineering and designing both will be of great help in order to capture the massive amount of electricity generated in bolt and to transfer to large storage device for later use.

Description of lightning power plant:
As shown in figure-4, we propose a lightning power plant to implement electricity generation through lightning. Heavy clouds at low altitudes during rainy season bear large positive and negative charges susceptible to create current of about 3000 amperes at around 1000 Volt. They are seen invariably on top of the mountains and sometimes at very low heights. Therefore, the location of proposed project power plant will be based on LLN (lightning location Network) data which will show the place where lightning is predominantly frequent. Preferably the location would be near coastal area and area where big lakes existed in mountains ranges. Such locations would facilitate our two basic requirements, one the huge height for the rod which is likely to provide easy path of very low resistance to electricity of heavy clouds if rod of the power plant is mounted on top of the mountains. Secondly, the nearby sea and lake around mountains would enable us to build a big extended dielectric aqua capacitance to capture electric power and later to distribute to appropriate USBs storages. From these USBs it would be possible to deliver lightning power to users in area in the vicinity of our proposed plant.

In case of excessive power from lightning bolt if available beyond the capacity of our extended dielectric aqua capacitance, then a safety guard is provided. This additional guard is built using a round shape of wire gauge fencing around central thick rod as shown in figure-4. This fencing guard has multiple earthing conductors installed inside the bottom of sea and lake. This will allow us to collect controlled power though flexible conductor having large storage. The excessive electricity will be passed through ground so as to avoid danger and destruction to plant. Moreover, location of power plant in water is another safety against fire breaking and fire burning if excessive power hits rod through major lightning strikes bolts. Plenty of water in sea and lake and readymade water projected jets on plants can make the fire extinguished immediately without major damage to the plant. Now in order to maintain the entire power plant stable against water turbulence with big tidal waves or during tsunami, we can use flexible cable couplers between rod and metallic hallow frame of size 1 square km floating on the sea and lake (see figure-4). Floating Air Tubes (FATs) of enough number would be used on the boarder of the metallic hollow frame in order to make it floating on surface of the sea and on lake water as shown in top view of power plant in figure-4. USBs C1, C2, C3 etc. based on coastal ground are also connected with Metallic hollow floating frame by flexible cable couplers for the same reasons. For later use of lightning power, these USBs are connected to distribution network which will deliver the power to different productive users like industries, villages, cities, farmers etc. Another advantage we see in commissioning this project in water is to store more electricity because of the dielectric constant of water which will further enhance our current capacity according to capacitance formula as given by

$$C_s = K\, \varepsilon_o\, A / d$$

Where $\varepsilon_o = 8.854\text{x}10^{-12}$ Farad/m,
K is the dielectric constant of the water of sea and lake, A is surface area of the extended hollow floating frame on water, d is the average depth of sea and lake, and C_s is capacitance of power plant.
The above purposed lightning harnessing power plant would become an ultimate natural resource of our electricity and electric power for use. The stored lightning power would be tapped and given to isolated power distribution network circuit for later use. This high power would be converted into Alternating Current Power (ACP) for the sake of safety and would be stepped down into smaller useful alternating voltages using multi stepdown transformers. In this way step down transformer distribution network will be able to enlighten numbers of villagers, cities, farmers for agriculture use and electrify the number of industries for their growth and production.

HURDELS AND CHALLENGES

It is important to state here that the above technique to harvest the lightning energy is a theoretical possibility and its implementation is a challenge with multiple reasons. Firstly, to install such a system requires a huge monetary investment. Secondly, the energy hidden in lightning vanishes once it hits the ground. Hence, to store the energy brought down by lightning flash, the lightning should hit the system directly else, the energy cannot be stored. The big hurdle is that even if we install the above system in a lightning prone area, percentage of lightning hitting the system to harvest lightning energy is very minimal unless all the lightning energy in the area is harvested by strong induced field between clouds and conductor pole. In this context, we need to install many such systems to cover a big area which in turn involves a lot of investment. Hence, the idea remains in theory until we continue research to really get all those energies brought by the lighting. Though today it may remain as theory, a day would come in near future so that we can get all those energies.

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