A review paper

Thunderstorm energy use as renewable energy in Bangladesh

Submitted By

Name: H.M.khaled
ID: 181-33-687
Session: 2018-2021

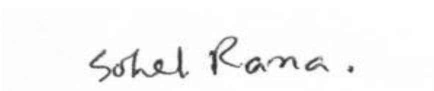
Name: Bulbul Ahmed Bijoy
ID: 181-33-650
Session : 2018-2021

Supervised By
Md Mr. Sohel Rana
Lecturer of EEE (Senior Scale)
Daffodil International University

Date of Submission

Certificate

This is to confirm that the task entitled " Thunderstorm energy use renewable energy in Bangladesh " is being presented by H.M.khaled (ID: 181-33-687) and Bulbul Ahmed Bijoy (ID: 181-33-650) incomplete satisfaction of the prerequisites for the honor of the level of Bachelor of Science in Electrical and Electronic Engineering from Daffodil International university is a record of Bonafede’s work did by them under my guidance and supervision.



Md Mr. Sohel Rana
Lecturer (Senior scale)
Department of EEE
Daffodil International University,
Dhaka, Bangladesh

DECLARATION

I declare that the review paper "Thunderstorm energy use renewable energy in Bangladesh" is my original work. To the best of my knowledge, it does not contain any previously published materials. I further declare that no part of it will be submitted for any degree or diploma program. However, the contents of other sources are properly acknowledged in the references.

Khaled

Name: H.M.khaled
ID: 181-33-687
Session:2018 - 2021
Department of EEE
Daffodil International University (DIU)

Bulbul Ahmed

Name: Bulbul Ahmed Bijoy
ID: 181-33-650
Session: 2014 - 2021
Department of EEE
Daffodil International University (DIU)

ACKNOWLEDGMENT

I wish to express my sincere thanks to my supervisor MD. Sohel Rana , for providing me with all the necessary facilities for this research. I am extremely thankful and indebted to her for her valuable guidance and encouragement. I place my sincere thanks to the Department of EEE, Faculty of Engineering Studies on record. I am also grateful to my parents because I could not have come this far without them. I also place on record my sense of gratitude to one and all, who directly or indirectly, have let their hand in this study.

H.M.khaled

&

Bulbul Ahmed Bijoy

ABSTRACT

Today, the question of energy is a global one. Many inventions and discoveries have been made, but the future of new ones is in jeopardy merely because energy sources are in short supply. However, our take on the subject is that nature provides us with a plethora of possibilities that we fail to make use of. The power of lightning is one of the most useful strategies that humanity can use less. This study proposes that lightning be used to treat an electrical problem and that as a result, power outages will be a thing of the past. - The world's energy crisis is a big issue. There have been several developments and breakthroughs, however, those new techniques have been jeopardized due to the scarcity of energy supplies. Nature provides us with one such option: the power of lightning. It is well known that lightning can generate enormous amounts of energy. This study explains how to gather lightning strikes as a new source of renewable energy.

CONTENTS

CHAPTER 1

CHAPTER 2 LITERATURE REVIEWS

CHAPTER 3 METHODOLOGY

Method-1

Lighting harnessing power plant by using a transformer, inverter, and rectifier

Method-2

Lighting harnessing power plant by using Thermionic Generator

LIST OF FIGURES

Chapter-1

1.1-INTRODUCTION

Electricity can be generated in a variety of methods (both renewable and non-renewable). However, focusing on renewable energy to generate power may be far more beneficial than using non-renewable energy. As a result, the cost of electricity can be reduced. Thunderstorm energy is a type of renewable energy that can assist in the generation of large amounts of electricity. We can get roughly 1 billion volts from a single thunder strike if we can use this energy. So, if we can get more power by consuming more energy from thunderstorms, we can get more electricity. Lightning is very common in haor locations in Bangladesh, such as nikli, sunamganj, nuakhal, I, and other places. The flood-ravaged Sunamganj district of Bangladesh has been named the world's most lightning-prone location based on the number of lightning strikes recorded in March and May of this year. In a study done by NASA and Maryland University in the United States, the northeastern region had the most lightning strikes during three months. Kimara Demkop in Congo was designated the world's most lightning-prone the location between December and February, while Lake Maracaibo in Venezuela was dubbed the world's lightning capital. Because of the geological location of Sunamganj, a total of 25 lightning strikes have struck each square kilometer in the last 90 days. The number of lightning strikes is steadily increasing. A total of 918 lightning strikes struck the United States in 2014. In 2015, the number increased to 1,218 people, and by 2016, it had risen to almost 2,500. According to the district's calamity board division, thunderclap strikes have killed most un-1,152 people in the last seven years. In the first five months of this year, Sunamganj was home to approximately 37 of the 62 people who died in the process of lighting the country. Lightning strikes were particularly common where there were no trees, according to Brace's head of the catastrophe and environment office, Naim Gowhor Prothom Alo. We can use this energy in a variety of ways. However, utilizing a tesla coil may be more beneficial or effective. Lightning can reach temperatures of 50,000 degrees Fahrenheit. That's five times the surface temperature of the sun. We can produce a big amount of electricity if we can use this temperature to stream water to run a steam turbine.

Chapter-2

LITERATURE REVIEWS

2.1-Lightning:

Established researchers have been debating the cause of lightning strikes for quite some time. Even now, It's the subject of a lot of logical speculation and inquiry. It's rare to see the subtleties of how a cloud becomes statically charged (as of this composition). Regardless, a few ideas appear to be correct and exemplify many of the concepts covered in this area of The Physics Classroom.

The polarization of positive and negative charges within a tempest cloud is the precursor to any lightning strike. The highest places in the tempest mists are known to have an abundance of positive charge, while the lowest areas have an excess of negative charge. The polarization cycle appears to have two important components. One approach uses a cycle to split charge, which is comparable to frictional charging. Mists are believed to contain an unfathomable number of suspended water drops and ice particles that move and spin about in a tumultuous pattern. Extra water rises and builds groups of beads as it advances toward a cloud, beginning at the earliest stage. This rising dampness condenses into water droplets within the mists. Electrons are knocked out of rising droplets during impacts, resulting in negative electron partitioning of an electrically charged water droplet or cluster of beads.

A freezing interaction is the second method that contributes to the dichotomization of a stormy cloud. At higher elevations, rising wetness encounters colder temperatures. The group of water beads freezes as a result of the colder temperatures. The frozen particles will frequently stick together even more strongly and form the center of the cluster of the follicle. The frozen component becomes erect wetness bunch is found to be negatively charged, whereas the external beads are positively charged. Internal air flows can shred the external pieces off the bunches and carry them vertically to the mists' highest point. The negative charge of the frozen beads causes them to float towards the bottom section of the tempest mists. As a result, the mists get even more engrossed.

These two systems are thought to be the primary drivers of tempest mist polarization. Positive charges are carried to the top segments of the mists, and negative charges are carried to the lower portions of the mists, resulting in a mesmerizing tempest cloud. The polarization of the mists also has a substantial impact on the Earth's outer layer. The cloud's electric field reaches outer space, causing electrons to increase on Earth. The negatively charged cloud's base surface repels electrons from the Earth's outer surface. This produces an opposing charge on the Earth's surface. Structures, trees, and even individuals can develop a static charge due to the electrons being repelled by the cloud's base. Act 2 of the lightning dramatization begins with the cloud being collected on both ends and a positive charge is formed on the Earth's surface.

2.2-The Mechanics of a Lightning Strike:

The electric field surrounding a tempest cloud becomes more grounded as the static charge buildup expands. Normally, the air around a cloud would provide enough protection to prevent the release of electrons to Earth. The solid electric fields, on the other hand,

surrounding a cloud is capable of ionizing and making the surrounding air more conductive. Ionization is the process of removing electrons from the outer shells of gas particles. The gas particles that make up the air are thus converted into a soup of positive particles and free electrons. Conductive plasma transforms protective air. The ability of a thundercloud's electric fields to turn the air into a channel allows charge to travel from the cloud to the ground (or even to different fogs) like lightning.

The advancement of a stage chief is the beginning of a lightning bolt. Overabundance electrons in the bottom half of the cloud begin a 60-mile-per-second journey through the leading air to the earth. These electrons go in a crisscross pattern towards the ground, stretching at various points. There are no major factors that alter the complexities of the actual pathway. It is widely acknowledged that the availability of contaminants either leftover fleck in certain portions of the wind might result in more conductive districts among mists and earth than other places. The purplish shine that is normal for ionized air atoms may well illuminate the advancement chief as it develops. Regardless, the progression chief isn't the actual lightning strike; it simply indicates the path that the lightning bolt will take between cloud and universe.

As the electrons of the progression chief methodology the Earth, there is an additional repugnance of electrons falling from the Earth's surface. The quantity of positive charge that resides on the Earth's surface turns out to be far more significant. Out of sight, this charge begins to flow up via structures, trees, and persons. The increasing chief in the air across the Earth's outer layer approaches this vertically rising positive charge, called a decoration. The decoration may come into contact with the pioneer at a height equal to the length of a football field. When the ornament and the pioneer make touch, an entire guiding pathway is established, and the lightning begins. At velocities of up to 50 000 miles per second, the contact point between ground charge and cloud charge rapidly rises. In less than a millisecond, billions of trillions of electrons can travel this way. A few supplementary strikes or charge floods follow this underlying strike in rapid succession. These alternate floods are timed so perfectly that they can be mistaken for a single strike. The enormous and quick passage of charge between the cloud and the ground warms the surrounding air, causing it to expand forcefully. The wind expands, causing a shock wave that humans experience as lightning.

2.3-Lightning Rods:

Lightning bars are typically installed on tall structures, farmhouses, and other designs that are vulnerable to lightning strikes. In the case of a lightning strike, a grounded lightning pole linked to a structure serves as a defensive measure to safeguard the structure. The notion of a lightning bar was initially proposed by Ben Franklin. According to Franklin, lightning poles should be fashioned of a pointed metal post that reaches vertically over the structure being protected. According to Franklin, a lightning bar defends a structure in one of two ways. To begin with, the bar prevents a charged cloud from causing an electrical discharge. Second, the lightning pole guarantees that when a cloud produces lightning in the form of a bolt, the bolt is securely guided to the ground. Franklin's musings on the subject

For years, the activity of lightning bars has been hampered. Furthermore, it has only been in the last few years that logical studies have provided proof to support how they work to protect structures from lightning injury.

The first of Franklin's two proposed ideas is known as the lightning dispersal hypothesis. According to the belief, using a lightning pole atop a structure protects the structure by preventing a lightning strike. The hypothesis is based on the huge electric field strength that exists around a sharp item. The high electric fields that surround a sharp item ionize the air around it, increasing its conductive capacity. The dissipative hypothesis suggests that when a tempest cloud approaches, a conductive channel is formed between the statically charged cloud and the lightning bar. According to the theory, static charges migrate slowly through this conduit to the ground, minimizing the chances of a painful discharge. According to proponents of the lightning dispersion hypothesis, the primary job of a lightning bar is to release the cover over a longer period, preventing the over-the-top charge buildup that occurs after a lightning strike.

Franklin's suggested lightning redirection theory is the second of his hypotheses regarding how the lightning pole works. A lightning pole protects a structure by providing a conductive route for the charge to reach the Earth, according to the lightning redirection hypothesis. A sturdy copper wire connects a lightning bar to an establishing pole that is buried beneath the Earth. The cloud's unexpected release would be drawn towards the increased lightning bar, but it would be securely coordinated to the Earth, preventing damage to the structure. The lightning pole, as well as the linked link and ground post, provide a low-obstruction path from the structure's upper level to the ground below. The structure is protected against damage caused by a large amount of electric charge passing through it by channeling the energy through the lightning insurance framework.

Most lightning experts believe that the lightning dispersal theory presents an erroneous model of how lightning bars function. The ability of a lightning rod's tip to ionize and make the surrounding air more conductive is indisputable. In any scenario, the impact is limited to a few meters beyond the lightning bar's point of strike. A few meters of increased conductivity at the pole's tip isn't enough to create a large cloud that extends hundreds of kilometers north. Regrettably, there are yet no deductively established lightning defense systems. In addition, subsequent field experiments have found that the lightning pole's tip should not be aimed as violently as Ben Franklin advised. Lightning bars with an obtuse tip are assumed to be more sensitive to lightning strikes, and hence provide a more likely path for the emission of a charged cloud. When putting a lightning protection device on a structure, the pole must be raised above the building and linked to the ground by a low obstruction wire.

2.4-How does a lightning rod work?

A lightning rod is a basic device that protects a tall structure against lightning strikes. It is made up of a long, thick copper rod that runs through the structure and down to the earth. The rod's bottom end is attached to a copper plate buried deep underground. The top end of the copper rod is attached to a metal plate with many spikes, which is kept at the building's end. When a negatively charged object travels through the building, it induces a positive charge on the pointed conductor. The positively charged sharp needles will ionize the air in the area, partially neutralizing the cloud's negative charge by lowering the cloud's potential. Their attracted negative charges go down to the earth via the conductor. As a result, the lighting stroke will not cause the building to be damaged.

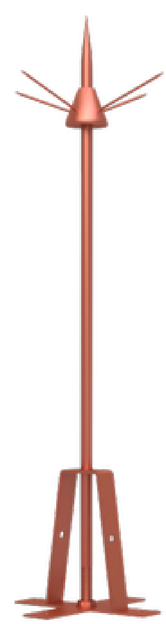
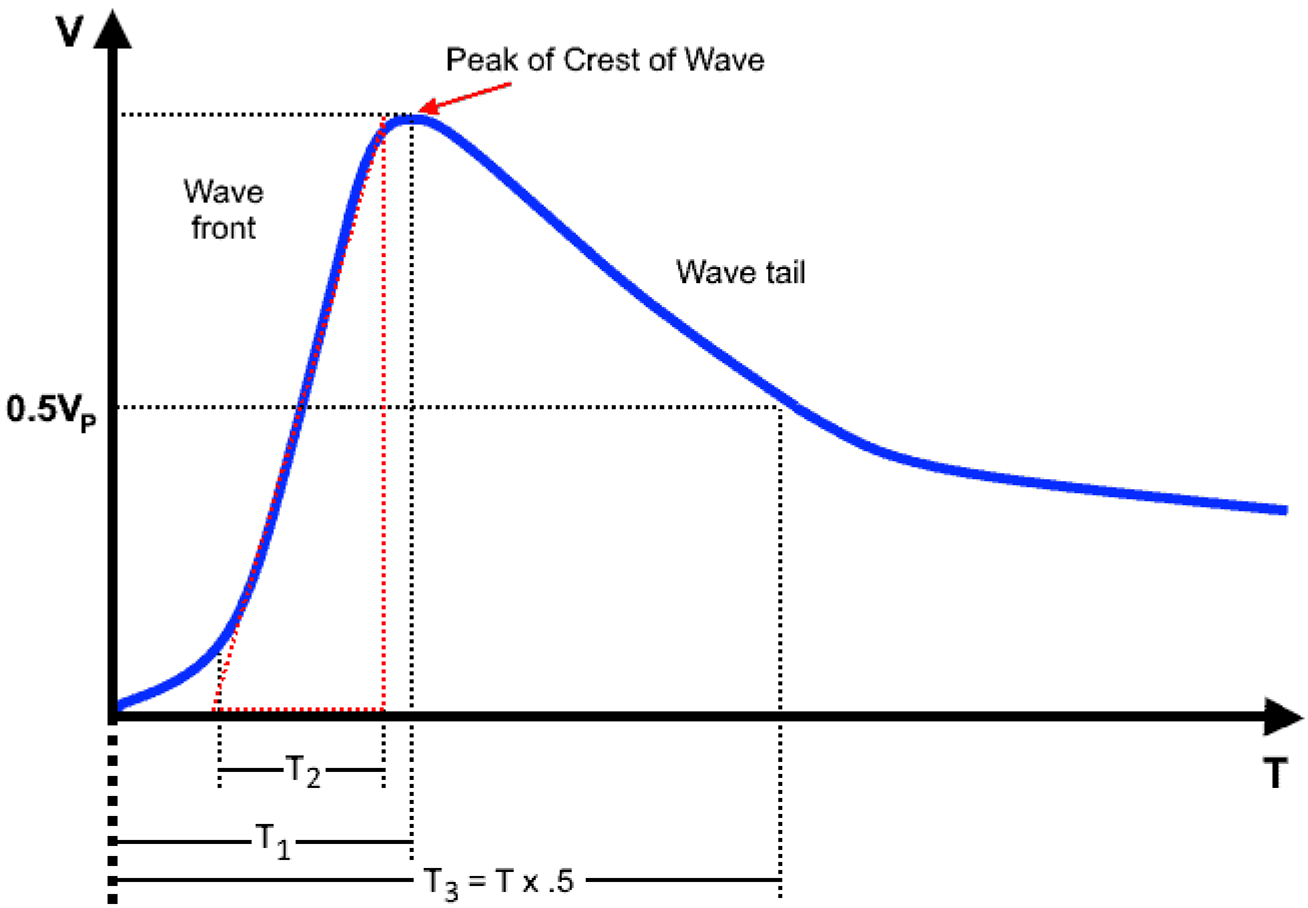


Fig1: lightning rod

2.5-Is lighting Ac or Dc?

Over time, the trajectory and magnitude of an AC (Alternating Current) signal shifts. As a result, AC wave streams follow a single path among the main half cycle and revert among the last half-cycle, switching characteristics from the beginning until the end of most extreme together with then returning in-order-to primary mark, for example, 0, etc.

The standard states of drive and stroke waves are shown below. It's clear that the lightning wave isn't the same as an AC sine wave current and voltage



Typical Impulse Wave Shape & Parameters

In fig 2 for Impulse wave shape parameters

- T_1 = Switching impulses have a lead time. (The front time is the amount of time it takes for The to reach its maximum value.)
- T_2 = Lightning impulses arrive ahead of schedule.
- T_3 = Time to achieve half-value (tail time or time to half of the Peak value)

While:

• A conventional lightning impulse has a front time of 1.2 seconds and a tail period of 50 seconds. Tolerance allowed in peak value is ±3%.

• For a front time, a 30% tolerance is permitted, while for tail time, a 20% tolerance is allowed.

Lightning is simply a short out from mists to mists or mists to ground, not the projected distinction, due to charge thickness. Another factor to remember is that thunder is a capacitance discharge, with a current that passes from positively to negatively in the same manner as a capacitor. In general, the charge flows in a specific direction (uni-polar), just as in DC. It is due to this that thunder cannot be AC.

2.6-HARVESTING LIGHTNING ENERGY:

An invention capable of harvesting lightning energy would be able to capture the tremendous power associated with a lightning bolt quickly. A few solutions have been presented, however, the constantly fluctuating energy connected with each lightning bolt makes harvesting lightning power from ground-based poles nonsensical - too high, and the capacity will be harmed; too low, and it may not work. Furthermore, because lightning is unpredictable, energy would need to be captured and stored in this manner; it is difficult to go from high-voltage electrical control to lower-voltage power that can be stored.

CHAPTER-3

3-Methodology:

This notion may no longer be as absurd as it once was. The inability to store a large amount of power for some time in the future was a major limiting factor in completing a lightning catching scheme, for example. In any event, new Utility-scale Battery technology or other energy storage breakthroughs, like Flywheels or Capacitors, might be used to store massive amounts of lightning power for later matrix usage. In regions where there are frequent storms, such as Florida, a lightning-catching power plant would be useless. What could be more difficult than putting together a variety of lightning poles to capture intermittent tempest power? The most difficult challenge would be to build a power plant base that could withstand the harsh floods caused by lightning strikes, but even that appears to be feasible with present technology and materials. Inventive electrical and building configuration architects might be able to come up with a way to make it work. Extraordinary cradle/protection and transformer materials might be used to safely catch and handle the massive amounts of power generated by a lightning strike, and transfer it to a large-capacity device for later use.

Method 1

Lighting harnessing power plant by using transformer, inverter, and rectifier

3.1.1-Inverter:

An inverter is a component of power electronics that transforms a fixed DC (Direct Current) into a controllable AC (alternating current) (Alternating Current). The control of two AC signal characteristics, frequency, and amplitude, is referred to as controlled AC. To put it another way, an inverter is a device that remains stationary. It is capable of converting one sort of electrical energy to another. It is, however, unable to generate power.

When the power goes off, the inverter transforms the DC power from the batteries to AC power. Because of their self-commutation qualities, we utilize power semiconductor switching devices like IGBT, MOSFET, and GTO in inverters.

A power inverter is a device that transforms large amounts of DC electricity into AC power for use in the electrical system. Power inverters, for example, are used at the receiving end of HVDC transmission lines. This sort of inverter is known as a grid-tie inverter.

3.1.2-Working Principle of Inverter:

The main function of an inverter is to convert DC electricity into AC power while also controlling the signal's voltage, current, and frequency. The inverter is essentially a type of oscillator.

- The fundamental components of an inverter are transistors, which transform DC electricity into AC power.
- The most typically utilized switches in inverters are IGBT and MOSFET.
- The amount of switches we use is determined by the type of inverter.

- The transistor changes the voltage level and single-way current flow of DC to the constantly shifting voltage and pulsating current of AC.
- ability to quickly turn on and off is a significant feature of the transistor in the creation of AC electricity.

3.1.3-Let's see the work:

We use a 12V battery, one transformer (the primary winding of the transformer is center-tapped), one two-way switch, and a 50 Hz oscillator in this circuit schematic.

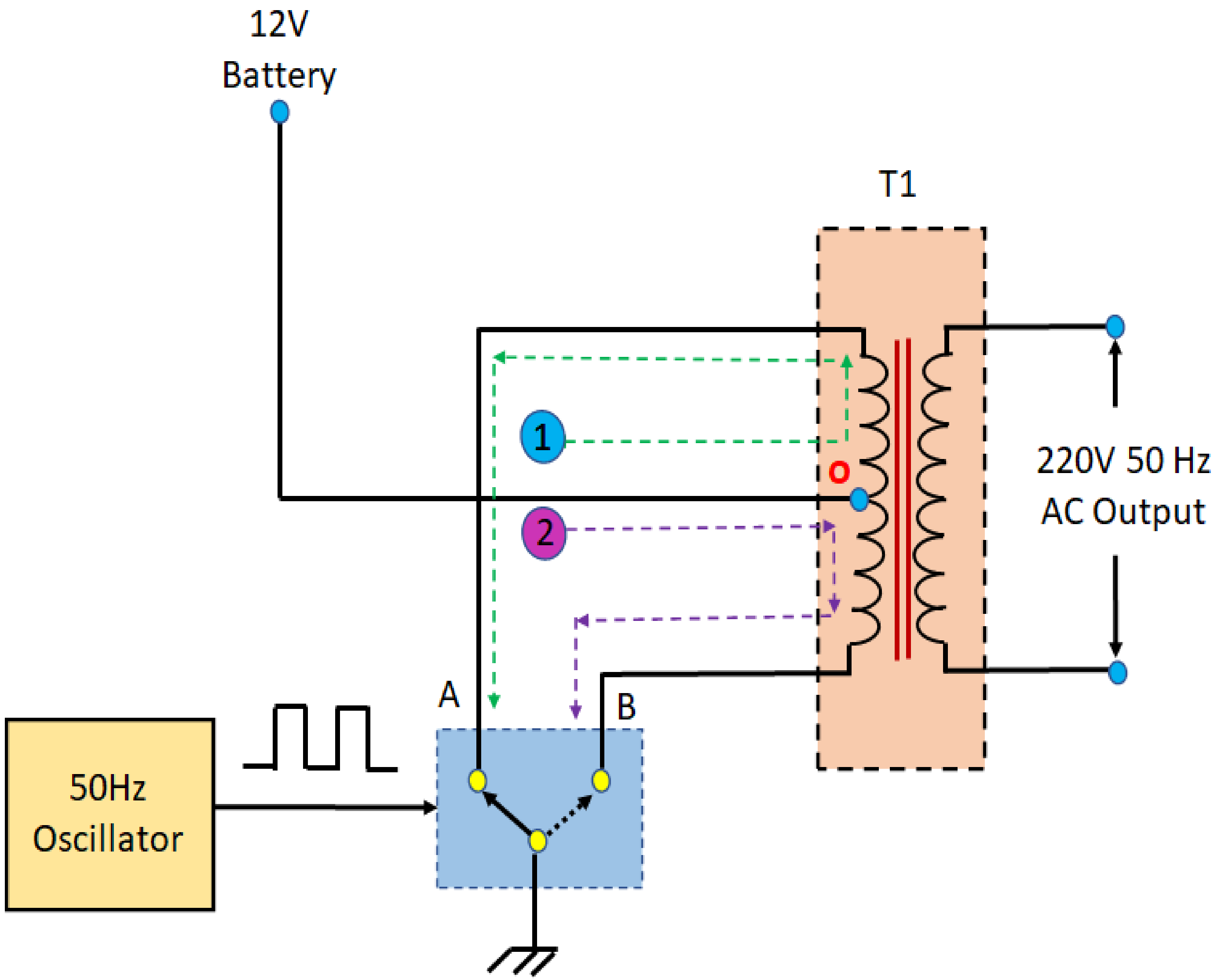


Fig-3: working of inverter

The 12V battery generates DC power, which the inverter converts to 220V, 50Hz AC power that may be used to power any equipment.

The transformer's center-tapped primary winding receives a 12V DC supply from the positive terminal of the battery. The two ends of the transformer's primary winding (A and B points) are connected to the ground through a two-way switch. If the switch is connected to the primary winding's A point. The current flows from the battery into the primary winding's top half (o) via the switch's A contact with the ground. If the switch is turned from A to B. This is the first time the current number 1 has stopped flowing. The current 2 then travels to the ground via the switch's contacts o and B.

The square wave oscillator generates a frequency of 50 Hz, which is used to regulate the two-way switch. It causes the switch to alternate between points A and B at a ratio of approximately 50 times per second. In addition, currents 1 and 2 alternately flow to the transformer a ratio of approximately 50 times per second. As a result, the current flowing into the transformer alternates between looking like AC voltage and looking like DC voltage.

Transformers, as we all know, work on the concept of electromagnetic induction. When current flows in the main winding, an EMF is created, and a current is induced in the transformer's secondary winding. Which results in a 220V 50Hz AC voltage. The voltage is now used to supply many types of electrical appliances that run on a 220 Volt AC supply.

3.1.4-Rectifier:

Rectifiers are circuits that convert alternating current (AC) to direct current (DC) using diodes in a bridge circuit design (DC). In most rectifiers, four or more diodes are employed. The polarity of the output wave created is the same regardless of the polarity of the input wave.

3.1.5-Working principle of rectifier:

Half-wave and full-wave rectifiers are both parts of the same type of electrical device known as rectifiers. Figure 1 shows a rectifier circuit built up of 4 diodes (D1, D2, D3, and D4), with the feed linked to terminals A and B and the output gathered among terminals C and D through the load resistor RL.

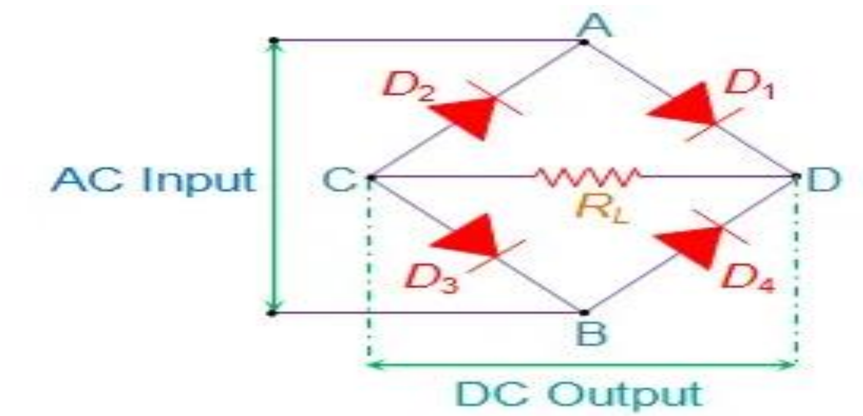


Fig-4: bridge rectifier

Look at the case when a positive pulse arises from the AC input, with termination A being positive and termination B being negative. Diodes D1 and D3 become forward biased as a consequence, whereas diodes D2 and D4 become short-circuited.

As a consequence, the current flows via the short-circuited channel created either by diodes D1 and D3, as shown in Figure 2a (assuming the diodes are perfect). As a consequence, towards the terminal D end, the voltage formed throughout the resistor will be positive, while near the terminal C end, it will be negative.

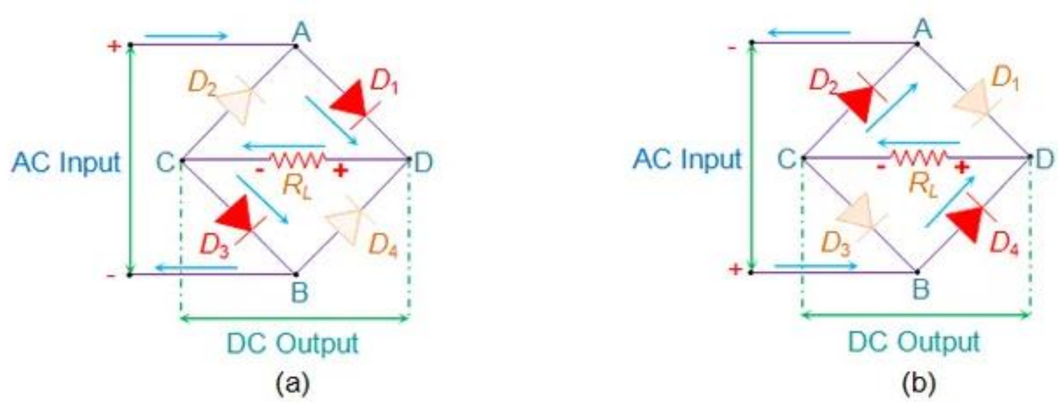
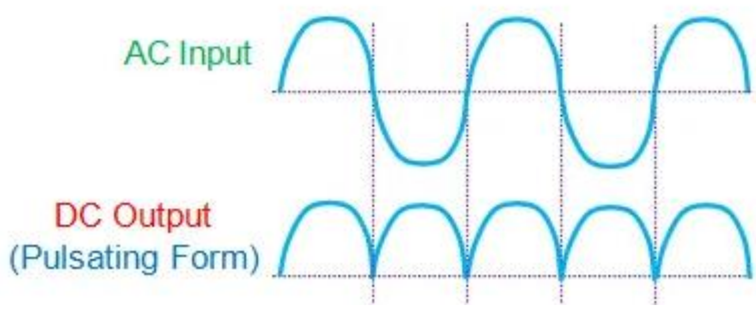


Fig-5: current path through the bridge rectifier (a)positive half-cycle (b)negative half cycle

Major ports A and B are positively and negatively, correspondingly, if the AC input produces a negative pulse. The current goes in the way shown in Figure 2b because the diodes D2 and D4 are forward biased, whereas D1 and D3 are reverse biased.

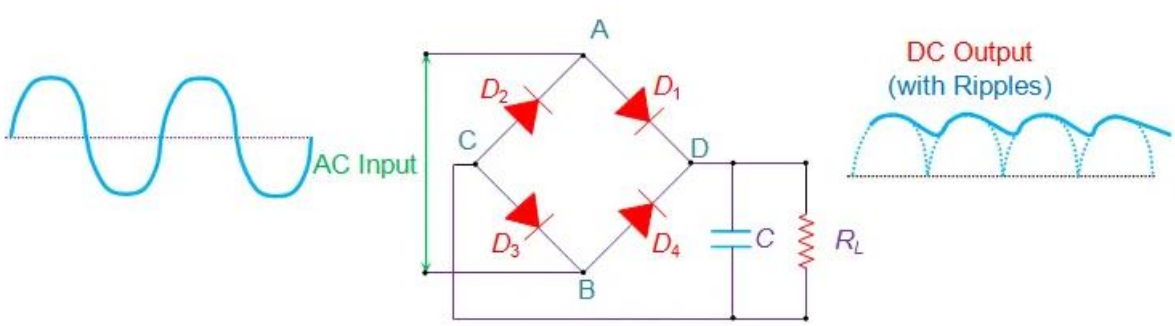
It's worth noting at this point that the voltage established across RL is a similar polarity to the voltage produced when the incoming AC pulse is positive. As seen in Figure 6, the output of the bridge rectifier will have the same polarization for both positively and negatively pulses.



.

Fig-6:input-output waveforms of a bridge rectifier

The DC from the bridge rectifier, on the other hand, will be pulsing. A capacitor must be used in combination with the bridge circuit to get a pure form of DC.



In this configuration, the positive pulse at the input charges the capacitor through the diodes D1 and D3. The capacitor's charging activity ends when a negative pulse is received at the input, and it starts to drain through RL.

As a consequence, DC output is produced, which has ripples as seen in the diagram. The ripple factor is a measure of the AC portion to the Dc source in the output voltage. In addition, the equation offers the wave voltage's mathematical form.

$$V_r = \frac{I_l}{fC}$$

The ripple voltage is represented by Vr.
The load current is represented by Il.

f denotes the ripple frequency, This will be twice as fast as the input.

The capacitance is denoted by the letter C.

Furthermore, there are two types of bridge rectifiers: Single-phase and 3 phase rectifiers are two types of rectifiers. Each one of these may also be Uncontrolled, Half-Controlled, or Fully Controlled.

The load current requirements are taken into account while choosing bridge rectifiers for a certain application. These bridge rectifiers provide several advantages, including the ability to be built with or without a transformer and the ability to handle high voltages.

In this situation, however, two diodes will conduct per half-cycle, resulting in a higher voltage drop between the diodes. Finally, in addition to converting AC to DC, bridge rectifiers are employed to detect the amplitude of modulated radio signals and to provide polarized voltage for welding applications.

3.1.6-Transformer:

Electrical transformers are static electrical machines that convert electrical power from one circuit to another while maintaining the same frequency. The voltage of a transformer can be increased or decreased, with a corresponding decrease or rise in current.

3.1.7-Transformer Principles of Operation

The functioning of a transformer is based on the phenomena of mutual induction between two windings connected by a common magnetic flux. The figure on the right shows the most basic form of a transformer. The main and secondary windings of a transformer are made up of inductive coils. The coils are magnetically coupled yet electrically separated. When the main winding is connected to an alternating voltage source, an alternating magnetic flux is created around it. The flux travels through the core on its way to the secondary winding through a magnetic route. "Useful flux" or "primary flux" refers to the flux that is connected to the secondary winding, while "leakage flux" refers to the flux that is not connected to the secondary winding. EMF is formed in the secondary winding, according to Faraday's law of electromagnetic induction, since the flux created is alternating (the direction of it is always changing). This emf is known as mutually induced emf,' and it has the same frequency as given emf. Mutually induced current passes through the secondary winding if it is a closed circuit, transferring electrical energy from one circuit (primary) to another circuit (secondary) (secondary).

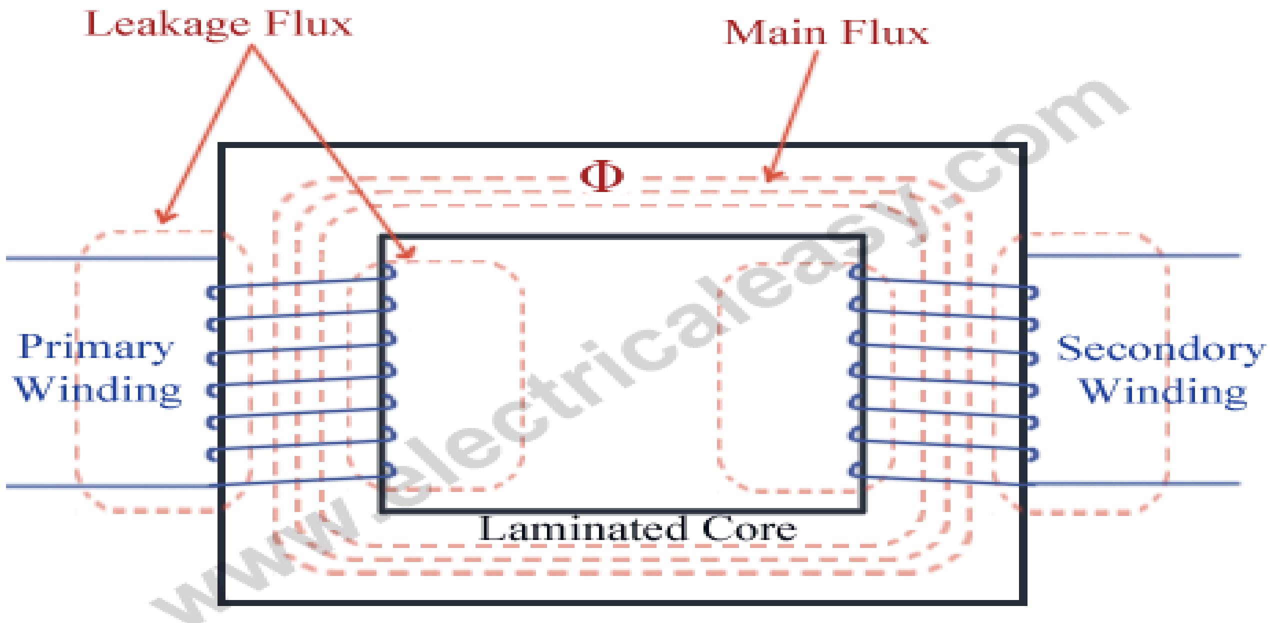


Fig-7: working principle of transformer

3.1.8-The Transformer's Basic Design

Two inductive coils and a laminated steel core make comprise a transformer. The coils are insulated from each other as well as the steel core. A transformer may also include, among other things, a tank for winding and core assembly, appropriate bushings to remove the terminals, and an oil conservator to supply oil in the transformer tank for cooling reasons. All kinds of transformers have a core comprised of laminated steel sheets stacked with a tiny air gap between them (to achieve a continuous magnetic path). The steel used has a high silicon content and is heat-treated on occasion to obtain high permeability and minimal hysteresis loss. The use of steel laminated sheets reduces eddy current loss. E, I, and L shapes are cut out of the sheets. To minimize high resistance at joints, laminations are layered by alternating the surfaces of joints. If the joints on the first sheet assembly are on the front face, the joints on the second sheet assembly are on the backside.

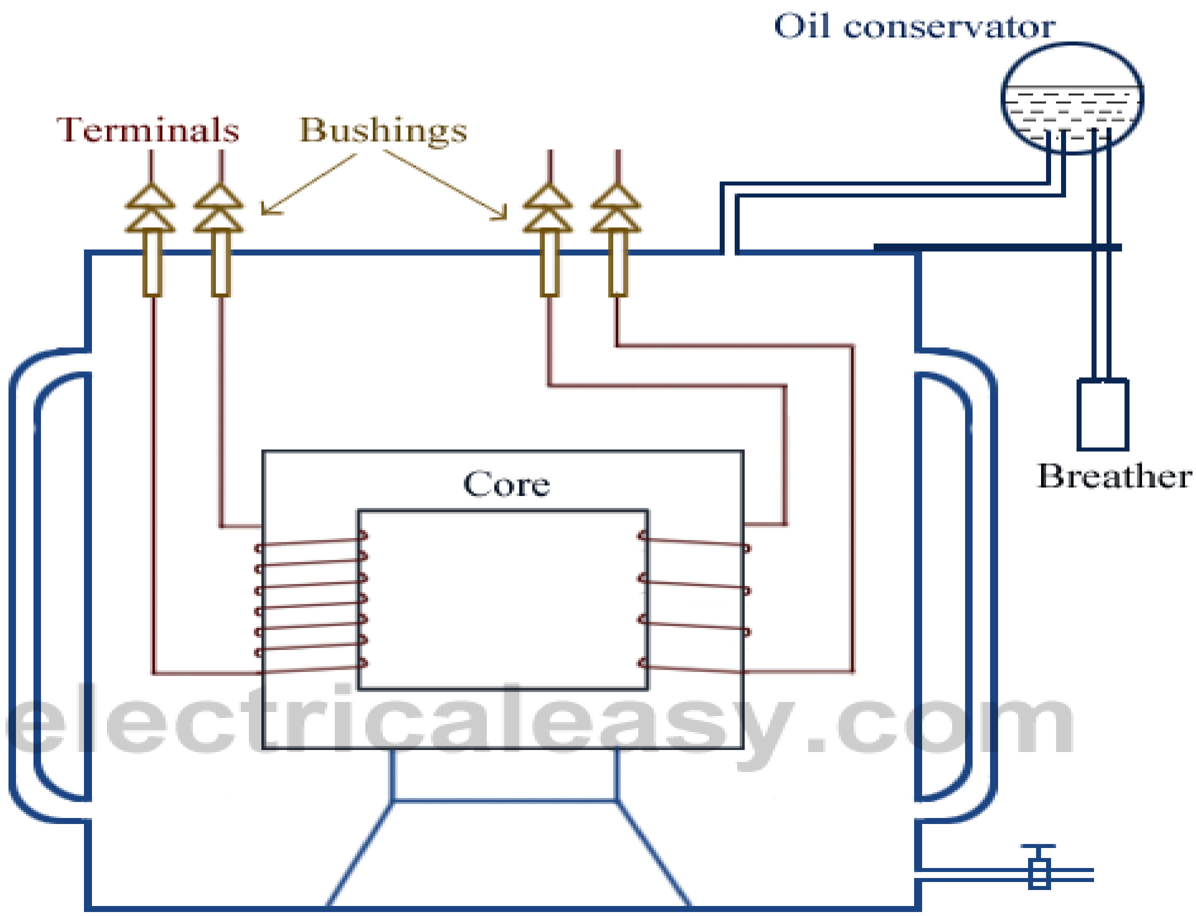


Fig-8 & 9: construction of transformer

Transformers can be categorized based on a variety of factors, such as construction, cooling, and so on.

(A) Transformers are classified into two categories depending on their construction: I core-type transformers and (ii) shell-type transformers, both of which are described further below.

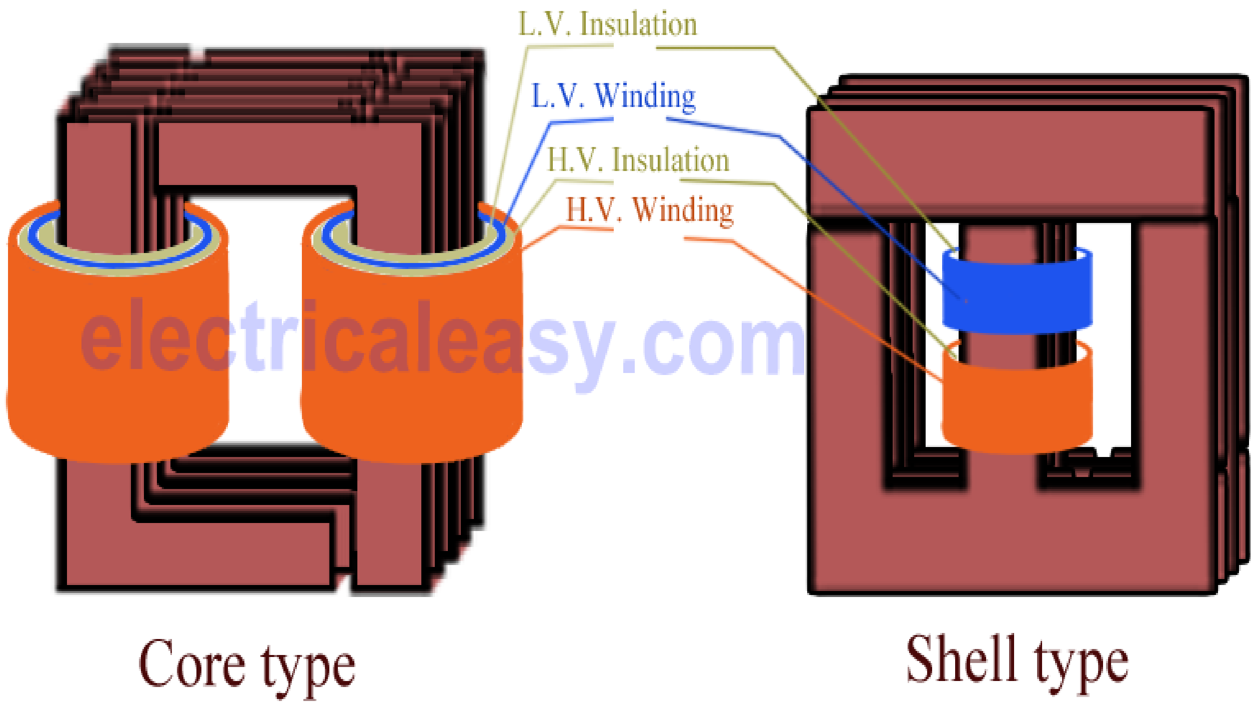


Fig -10: core and shell-type of transformer

(I) Transformer with a Core
A core type transformer has cylindrical former wound windings that are mounted on the core limbs as shown in the figure. Layers make up the cylindrical coils, each of which is insulated from the others. Paper, cloth, or mica may be used as insulation materials. Low voltage windings are put closer to the core because they are simpler to insulate.

(ii) Transformers of the Shell Type

The coils are pre-wound and stacked in stages, with insulating in between. A shell-type transformer may be shaped as a simple rectangular transformer (as seen in the figure above) or as a dispersed transformer.

(B) As a result of their goal

1.Step-up transformer: At the secondary, the voltage rises (and the current falls).

2. Step down transformer: At the secondary, the voltage drops (and the current rises).

(C) Depending on the source kind

1. A solitary transformer

2.A three-phase transformer

(D) As a consequence of their involvement

1.In transmission networks, high-capacity power transformers are employed.

2.Distribution transformers are utilized in distribution networks and have a lower rating than power transformers.

3. Instrument transformers are used for relay and protection in several industries.

current transformer (CT)

Potential for transformation (PT)

(E) Based on the cooling method used

1.Models with an oil-filled self-cooling system are available.

2. Models with an oil-filled water-cooling system are available.

3. The kind of air blast (air-cooled)

3.1.9-Our concept:

Sunamganj, Bangladesh, is the world's most lightning-prone location.
So that we can build the Lighting Harnessing Power Plant here.
When lightning strikes, the lightning rod captures glimmers of alternating current (AC) in nature mixed with a significant amount of Direct Current (DC), causing a massive amount of power to flow via the conductive feeder wire and related circuit. The electrical energy collected by the lightning rod is passed through an inverter circuit, which converts it to alternator Current, and then these alternator Current electrical voltages are passed through the step-down transformer's hundred. Lighting current electrical voltages are transformed into 10 volt 10 mega amps for 20 ms, which is 1 megavolt 100 amps for 20 ms. We can store those currents in the capacitor. However, capacitors can only hold DC voltage. Because AC voltage flips direction regularly, capacitors cannot store it. As a result, the capacitor alternates between charging and discharging, and no energy is stored. As a result, we can convert the AC to dc using a rectifier circuit. The current is then stored in the capacitor. We can feed this back into the inverting circuit to convert it from dc to ac once the capacitor discharges those currents. We can flow those currents into a step-up transformer, and the transformer can also run on ac rather than dc, so it's a win-win situation. We direct those currents into the step-up transformer, which allows us to obtain a usable current of 240 volts and 100 amps. After all of this, we'll be able to use those currents to charge the battery and use them in our homes.

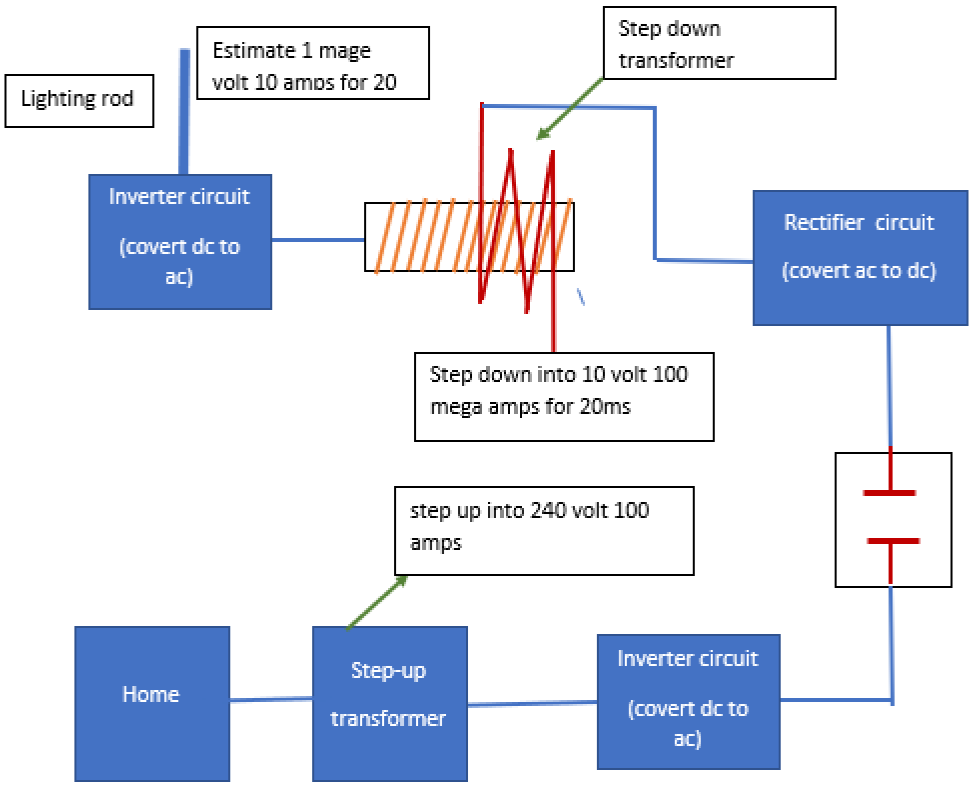


Fig-11: lighting harvesting plant by using transformer

Method 2

Lighting harnessing power plant by using Thermionic Generator

3.2.1-Elements of Heat:

Because of its excellent thermal conductivity, copper is employed in the majority of heating equipment. The system would only need a single lightning conductor since the lightning conductor is likely to be copper as well. if copper was to be utilized as a building material

The highest amount of energy that may be transmitted According to the theorem, the greatest power transmission to a load (the heating element) occurs when the load resistance matches the source resistance. The source in this situation is the lightning conductor and the lightning channel. Because lightning is unpredictable, and the channel's resistance isn't consistent, it's difficult to make a matching component.

impedance. On the other side, a high impedance might be targeted for better efficiency.

This is the situation as,

$$\frac{R_{load}}{R_{load}+R_{source}} = \frac{1}{1+\frac{R_{source}}{R_{load}}}$$

As a consequence, having a lower source resistance (conducting tower resistance) and larger load resistance is ideal. The efficiency is one when the load resistance is infinite, yet there is no power transmission. When taking into consideration 200 MJ of distributed energy and a current of 30 kA lasting 200 milliseconds, a resistance of 1.1 is necessary.

provided by,

$$R = \frac{E}{I^2 t}.$$

The resistance needed to disperse that energy is substantially larger if the current length is shorter or the average current is lower. As a consequence, a heating element with a resistance of higher than 1.1 is preferred. To get the optimum rate of heat transmission, the conductor's surface area should be increased. A possible heating element is shown in the schematic below, Fig 3. a.

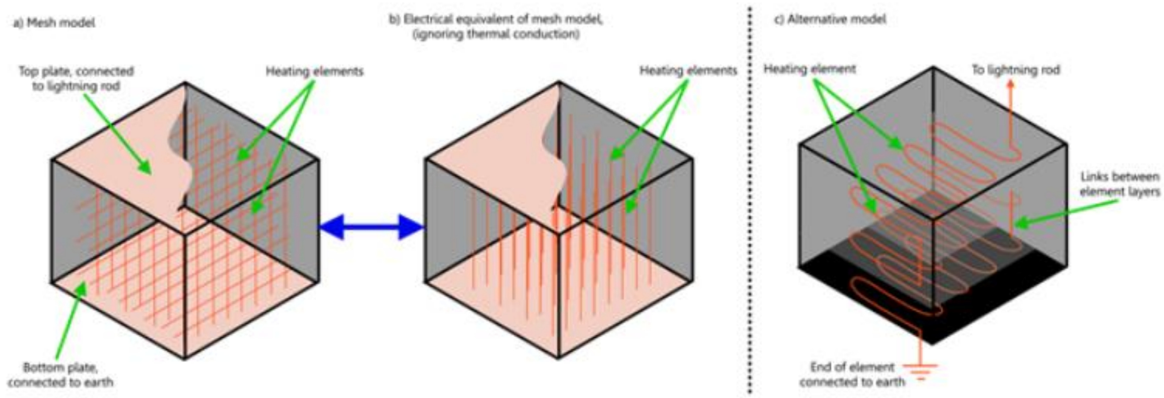


Figure 12 - Different arrangements of heating elements

Each node's copper may be seen as a resistor in this setup, generating a three-dimensional network of resistors with the top surface connected to the lightning conductor and the bottom surface connected to the ground. The voltage is the same at every point along a horizontal line, according to inspection. Resistors in the horizontal plane may be deleted since the horizontal and vertical planes are the same. As a consequence of this condensing, The heating element may be imagined as a bank of parallel resistors for each copper wire. A wire that links the input to the ground. This simplification is seen in Figure 3. b. A single wire with a radius of 1mm and a length of roughly 80cm has a resistance of 0.429. The overall resistance would be enhanced since this would run simultaneously with several other strands. As a consequence, a mesh would be inappropriate for this project's requirements. Even if the radius of the wire is shortened, or if a material with a lower heat conductivity is used instead.
There is a considerably better alternative.

If a large increase in resistance is wanted, the only options are to increase the conductor's length or resistivity, A winding copper wire that travels back and forth down the length of the cube can be used to increase the length and therefore the resistance. The pattern is repeated across the concrete block's whole depth (approx. 80cm). This is an example of a configuration Figure 3. c.

The total resistance is 28 if the distance between the copper windings is 1cm in both the horizontal and vertical planes, and the wire radius is 1mm. Per layer, the number of windings,

$$n = \frac{w}{d_s} = \frac{0.8\text{m}}{0.01\text{m}} = 80.$$

If the gap between layers is 0.01m, the storage material can accommodate 80 layers, giving the conductor a total length of 80 meters,

$$l_{total} = (0.8\text{m} + 0.01\text{m})80^2 = \ (64.8\text{m})80 = 5184\text{m}.$$

The resistance of the wire can be computed as follows:

$$R = 1.7 * \ 10^{-8}\Omega \frac{m \times 5184\text{m}}{\pi(0.001\text{m})^2} = 28.05\Omega$$

It is possible to use a wire with a lower radius, but it must be thick enough to prevent melting. Instead of copper, nichrome, which has a resistivity of [19], might be utilized (over 64 times that of copper). This would make resisting 1650 ohm more challenging. When the concrete hydrates, another issue to consider is the conductor's electrical insulation. To obtain a 4k resistance, 7392 meters of 0.1mm radius copper wire would be needed.

3.2.2-Thermodynamic Oils :

Thermal oils are often used in heating process applications to transfer heat from one substance to another. They may be the ideal fluid for the purpose since they may be used in a non-pressurized system, while other solutions like steam need more pressure. This means that a system that employs thermal oils is likely to be safer than one that uses steam, among other reasons.

Furthermore, thermal oils may save up to 30% more energy than steam since steam can condense into the water due to modest pressure changes, making it ineffective as a heat transfer medium.

Figure 4 depicts the operating temperature ranges of three different kinds of thermal oils. (As a comparison, molten salt and liquid sodium are utilized).

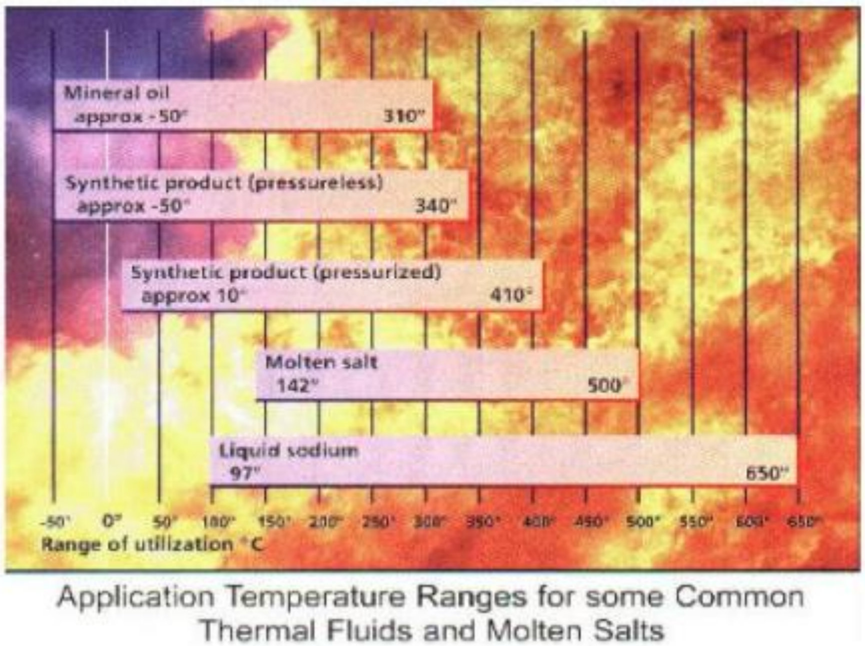


Figure13: Heat Transfer Fluids Operating Temperature Ranges

3.2.3-Water:

Water has a higher specific heat capacity than most materials (at 4.18 J g-1 K-1), enabling it to retain more energy as sensible heat for a given mass than many other materials, including concrete. It's also a lot less costly than any other storage media, which means cheaper prices (at least those related to the storage medium).

However, there are several disadvantages to using water. Because water has a density of roughly 1 g cm-3, the amount of energy that may be stored per volume, rather than per mass, is 4.18 J cm-3 K-1, or 4.18 MJ m-3 K-1. [22]. When compared to the previously cited value for the energy density of CSA (360 MJ m-3), it can be shown that an equivalent volume of water would need to be heated by 86°C to store the same amount of energy. Even that much heating, however,

would be troublesome owing to water's low boiling point, since the storage medium would be rendered unusable if it evaporated. Different storage mediums, which may store even more energy, could be utilized in addition to a larger volume. If the water is contaminated, heating may also cause precipitation. Corrosion may occur as a consequence, which can lead to leaks. As a consequence, the tank would need to be serviced regularly, which would be difficult to accomplish while it was storing energy.
Finally, when heated swiftly and severely, water may thermally split into hydrogen and oxygen. Hydrogen, as previously stated, is both combustible and explosive, providing a safety hazard (in particular, the system would be unprotected against several blows occurring in a short period).

3.2.4-Molten salts:

Another potential energy storage medium is molten salts (often a mixture of sodium and potassium nitrate). Molten salts are comparable to concrete in that they have a lower specific heat capacity than water, but they can be heated to considerably greater temperatures without evaporating. Figure 4: Heat Transfer Fluid Operating Temperature Ranges The primary drawback of using molten salts is that they must be maintained at a high enough temperature to stay molten (about 131°C). This would not only be difficult to execute, but it would also demand a large amount of energy, to the point that the system would use more energy than it could store.

3.2.5-CSA:

The medium will be calcium sulfoaluminate (CSA) concrete, which has a high latent heat of dehydration (energy stored due to a change of state at constant temperature) and can store thermal energy for an extended period with little energy loss.

This one-of-a-kind concrete mixture has a loss-free storage energy density of >100KW hm-3, which is much greater than paraffin or water's sensible heat (energy stored owing to temperature change). CSA concrete is non-flammable and has good thermal conductivity. The cost of CSA concrete is comparable to that of normal concrete.

The bulk of the concrete storage module is made up of a tube register and storage concrete. While conveying and dispersing the heat transfer medium, the tube register is utilized to maintain fluid pressure (thermal oils). The thermal energy is kept in the concrete storage.

3.2.6-Insulation:

One of the problems with thermal energy storage is avoiding losses due to dispersion into the environment. For the energy to be stored for long enough to be useful, any sensible heat storage device will need to be adequately insulated.

The most frequent approach to defining insulators is by their thermal conductivities. Materials with low conductivities, such as aerogel (a silica gel packed with gas holes) and vacuum insulation panels (insulating sheets separated by a vacuum), have conductivities of approximately 0.01 kW K-1. On the other side, such materials are expensive, costing up to £50 per square meter. Lower heat conductivity insulators, such as cork, wool, and multilayer foil, are significantly less expensive, costing roughly £10 per square meter.

Because most insulators become more conductive when wet, their usage in humid, rainy environments like the DRC is restricted. As a consequence, it's a good idea to choose a storage medium that uses latent heat rather than perceptible heat. This is another benefit of using CSA as the system's storage medium.

3.2.7-Thermionic Generation

The word "thermionic generation" refers to the process of creating heat.
To turn heat into electrical energy, thermionic generators use a temperature difference between two metallic plates separated by a vacuum. The heat stored in the system would be used to heat the 'hot' plate. As a consequence, electrons would be released from their surface and collected on the surface of the 'cool' plate. As a consequence, a charge difference forms between the two plates, allowing for the passage of usable electric current. Thermionic generators are more efficient than steam turbines, with efficiencies of up to 40%. The current produced is sufficient to charge a car battery.

3.2.8-Our concept:

Based on the premise that the power carried by lightning strikes has been properly captured through a conducting tower, this power is passed thermally into the heating components. By increasing the temperature of the heating elements to the point where the thermal oils passing through the tubes are heated, more thermal energy may be disseminated.
These tubes are then passed through a unique form of concrete (CSA) to transmit and store energy, making use of the CSA's characteristics, which include energy storage for later use, among other things. The tubes that carry the thermal oils run on both sides of the concrete, enabling the oils' energy to be used to heat the bottom 'hot' plate of the thermionic generator. The difference in temperature between these two plates is then used to create energy, which is subsequently used to charge the car's batteries.

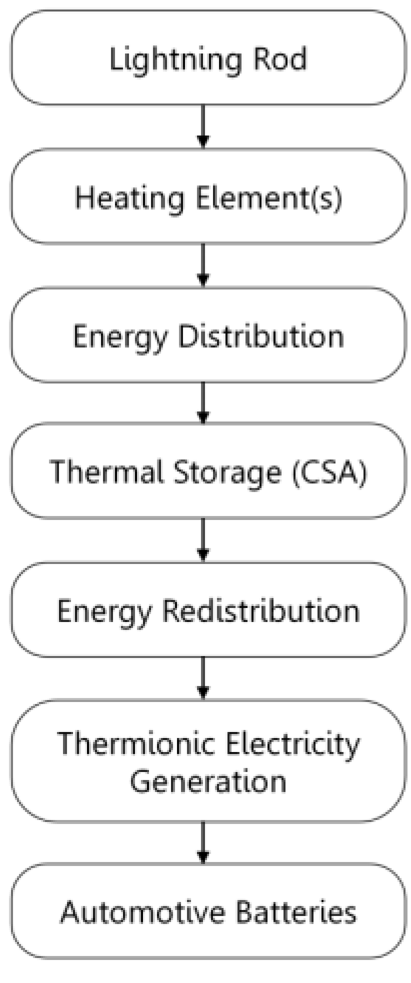


Fig-14- Lower level system flowchart

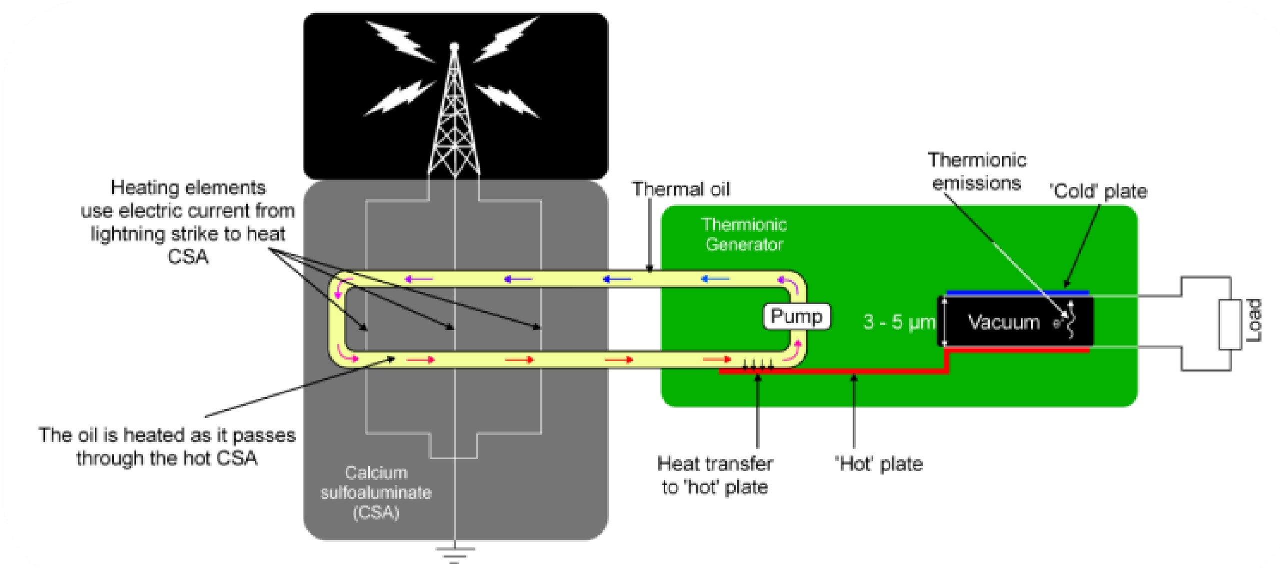


Fig -15 : Thermionic Generator

Chapter-4

4.1-THE PROBLEMS EXPERIENCED:

Another important stumbling block to using lightning to generate power is the difficulty to predict when and where thunderstorms will occur. Even during a storm, it's difficult to anticipate where lightning will strike. The method of directly capturing atmospheric charge before it transforms to lightning is rather straightforward. It was done on a small scale a few times, with Benjamin Franklin's kite experiment being the most well-known example. Massive structures, on the other hand, are necessary to collect substantial quantities of energy, and it is difficult to utilize the resultant tremendously high voltage efficiently.

4.2-CONCLUSION:

Using lightning to create electrical energy may now seem to be a pipe dream, but the day will come when lightning will be able to address all of our power-related issues. Lightning rods are the most efficient method of resolving this issue.

If thunder energy can be turned into electrical energy, the world of renewable energy sources will be changed. Along with the previously outlined ways for harvesting lightning energy, using lasers to manipulate lightning will make it simpler to gather lightning energy.

REFERENCES

[1] Byers, H. R., & Braham, R. R. (1948). Thunderstorm structure and circulation. *Journal of the Atmospheric Sciences*, *5*(3), 71-86.

[2] Reynolds, S. E., Brook, M., & Gourley, M. F. (1957). Thunderstorm charge separation. *Journal of Atmospheric Sciences*, *14*(5), 426-436.

[3] D'Amato, G., Vitale, C., D'Amato, M., Cecchi, L., Liccardi, G., Molino, A., ... & Annesi-Maesano, I. (2016). Thunderstorm-related asthma: what happens and why. *Clinical & Experimental Allergy*, *46*(3), 390-396.

[4] Karmakar, S. (2001). Climatology of thunderstorm days over Bangladesh during the pre-monsoon season. *Bangladesh J Sci Technol*, *3*(1), 103-112.

[5] Wahiduzzaman, M., Islam, A. R. M., Luo, J. J., Shahid, S., Uddin, M., Shimul, S. M., & Sattar, M. A. (2020). Trends and Variabilities of Thunderstorm Days over Bangladesh on the ENSO and IOD Timescales. *Atmosphere*, *11*(11), 1176.

[6] Shindo, T. (2007). Lighting Rod and Shielding. *Journal of The Institute of Electrical Engineers of Japan*, *125*(6), 356-359.

[7] TURNS, B. F. (2006). Benjamin Franklin and lightning rods. *Physics Today*, *59*(1), 42.

[8] R. H. Golde, Lightning, Volume 1 – Physics of Lightning, 1977

[9] Bazelyan & Raizer, “Lightning Physics and Lightning Protection”, Institute of Physics Publishing, 2000

[10] Dawson, P., Motha, L., Hoggett, J., Morton, L., Andriana I, P., Eleutherius, S., & Tsagkarakis, O. S. Lightning Harvest.

[11] Jana, S., Biswas, S., & Biswas, P. K. (2018, February). Methodological model of Lightning Energy Plant integrated with different energy extraction processes to harness Lightning Energy. In *2018 4th International Conference on Electrical Energy Systems (ICEES)* (pp. 229-233). IEEE.

[12] Helman, D. S. (2011). Catching lightning for alternative energy. *Renewable energy*, *36*(5), 1311-1314.

[13] S. Malavika,S. Vishal, DzHarnessing Electrical Energy from Lightingdz, International Journal of Application or Innovation in Engineering & Management, vol 2, Issue 9,2013.

[14] Pijush kantiBhattacharjeeedc solar-rain-wind-lightning energy source power generation systems, international journal of computer and electrical engineering, vol 2, no 2, April 2010, 1793-8163.

[15] V. A. Rakov, M. A. Uman, and K. J. Rambo, 2005. A review of ten years of triggered-lightning experiments at Camp Blanding, Florida," Atmos. Res. 76, 503-517(https://www.nssl.noaa.gov/)

[16] Ms. Sandhya K. Dongre, Ms. Bharati D. Deshmukh, Prof. Ashvini B. Nagdewate,(Jan -2017) Renewable energy source from lightning strokes, International Research Journal of Engineering and Technology,4(1)

[18] A Jidin, J.M.Herman, M.B.Farriz, 2010,A New Source of Renewable Energy From Lightning Stroke", International Power Electronic Conference , Pp.1490-1493.