TESLA COIL TOWER

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Abstract: *This paper explores the current wireless power transmission schemes and their practicability. It also delves into theory, design and construction of a method to transmit power through space. To this end, the €solid-state Tesla coil configuration is used as the basis to generate high voltage, high frequency electrical power. Electrical power is crucial to modern systems. From the smallest of sensors and bionic implants to satellites, remote controlled airplanes/cars/robots and oil platforms, it is important to be able to deliver power by means other than wires or transmission lines. The use of wireless power transmission, on a scale larger than used by magnetic induction devices, would allow for systems to operate remotely without the need for relatively large energy storage devices or routine maintenance. It will also be employed in cases where interconnecting wires is inconvenient, hazardous or impossible such as in wet environments, rotating or moving joints as well as powering remote telecommunication equipment.*

Key Words*:* Wireless power transmission, Nikola tesla, Tesla coil , Resonance transformer, Micro grid.

1. INTRODUCTION

The world of wireless technology is here! Innumerable wireless applications like wireless powered lighting, wireless smart homes, wireless chargers and so on are developed due to wireless technology. In 1891, the most famous discovery of the Tesla coil was invented by the inventor Nikola Tesla. Tesla was obsessed with providing wireless energy, which led to the invention of the Tesla coil. This coil does not require a complex circuit and so it is part of our daily lives like remote control, smartphones, computers, X-rays,[2] neon and fluorescent lights. A Tesla coil is a radio frequency oscillator that drives the air- core double-tuned resonant transformer to produce high voltages with low currents. To understand better, let's define what is a radio frequency oscillator.

Primarily, we are aware that the electronic oscillator is a device that produces electrical signals of either a sine waves or a square wave. This electronic oscillator produces signals in the radio frequency range of 20 kHz for integrating the renewable resources such as solar and wind along with the power from grid. With the advancement in power electronic technology to 100 GHz, known as a radio frequency oscillator. Increasing the usage of renewable resources are the ideal solution to meet the increasing demand without any harmful emissions. Micro grids are used DC microgrids[1] are more preferred than AC microgrids including high efiiciency , reliability and stability. In this paper, optimized energy management system is designed using genetic algorithm. Optimization is performed inorder to increase the usage of renewable resources as well as to reduce the cost of electricity.

3. SYSTEM ANALYSIS

EXISTING SYSTEMS

Green Energy Corridor

POWERGRID evolved a comprehensive plan for integration of renewable capacity addition envisaged in the 12th plan as part of "Green Energy Corridors" report. About 43GW capacity is envisaged mainly through wind & solar in 12th plan in the eight (8) renewable rich states viz. Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Rajasthan, Himachal Pradesh and Jammu & Kashmir. The plan includes Intra State as well as Inter-state transmission strengthening(s) and other related infrastructure like dynamic reactive compensation, energy storage, smart grid applications, forecasting of renewable generation, real time monitoring, establishment of renewable energy management centre, electric vehicles, investment etc. It also covers perspective plan for integration of renewables by 2030.

Physical Structure

Wind and Solar generation by its inherent characteristics is variable in nature and poses severe challenge to Grid security and system stability. To facilitate renewable integration into the Grid, transmission and balancing reserves are required. In the Report "Renewable Energy Integration[4] - Transmission an Enabler" balancing reserve requirement, sources of balancing reserves as well as impact on system stability due to intermittent and variable generation has been studied.

LIMITATIONS OF EXISTING SYSTEM

Transmitting electricity at high voltage reduces the fraction of energy lost to resistance, which varies depending on the specific conductors, the current flowing, and the length of the transmission line[3]. Factors that affect the resistance, and thus loss, of conductors used in transmission and distribution lines include temperature, spiraling, and the skin effect. The resistance of a conductor increases with its temperature. Temperature changes in electric power lines can have a significant effect on power losses in the line. Spiraling, which refers to the way stranded conductors spiral about the center, also contributes to increases in conductor resistance. The skin effect causes the effective resistance of a conductor to increase at higher alternating current frequencies. Corona and resistive losses can be estimated using a mathematical model.

PROPOSED SYSTEM

The principles behind the Tesla coil are relatively simple. Just keep in mind that electrical current is the flow of electrons, while the difference in electric potential (voltage)[5] between two places is what pushes that current. Current is like water, and voltage is like a hill. A large voltage is a steep hill, down which a stream of electrons will flow. A small voltage is like a near-flat plain with almost no water flow. The power of the Tesla coil lies in a process called electromagnetic induction, i.e., a changing magnetic field creates an electric potential that compels current to flow. Conversely, flowing electric current generates a magnetic field. When electricity flows through a wound-up coil of wire, it generates a magnetic field that fills the area around the coil in a particular pattern. Similarly, if a magnetic field flows through the center of a coiled wire, a voltage is generated in the wire, which causes an electrical current to flow. The electric potential ("hill") generated in a coil of wire by a magnetic field through its center increases with the number of turns of wire. A changing magnetic field within a coil of 50 turns will generate ten times the voltage of a coil of just five turns.[6] (However, less current can actually flow through the higher potential, to conserve energy.) This is exactly how a common alternating current (AC) electrical transformer, found in every home, works. The constantly fluctuating electric current flowing in from the power grid is wound through a series of turns around an iron ring to generate a magnetic field. Iron is magnetically permeable, so the magnetic field is almost entirely contained in the iron. The ring guides the magnetic field (in green below) around and through the center of the opposite coil of wire. Flying blue streamers of electrons flow off the coil and through the hot air searching for a conductive landing place. They heat the air and break it into a plasma of glowing ion filaments before dissipating into the air or surging into a nearby conductor.

Tesla Coil Working

This coil uses a specialized transformer called a resonant transformer, a radio-frequency transformer, or an oscillation transformer. The primary coil is connected to the power source and the secondary coil of a transformer is coupled loosely to ensure that it resonates. The capacitor connected in parallel with the transformer circuit acts as a tuning circuit or an[9] LC circuit to generate signals at a specific frequency. The primary of the transformer, otherwise referred to as a resonant transformer steps up to generate very high levels of voltage ranging between 2kv to 30 kV, which in turn charges the capacitor. With the accumulation of massive amounts of charge in the capacitor, eventually, breaks down the air of the spark gap. The capacitor emits a huge amount of current through the Tesla Coil (L1, L2), which in turn generates a high voltage at the output.

Oscillation Frequency

The combination of a capacitor and primary winding 'L1' of the circuit forms a tuned circuit. This tuned circuit ensures that both primary and secondary circuits are finely tuned to resonate at the same frequency. The resonant frequencies of the primary 'f1' and secondary circuits 'f2' and are given by,

$$f1=1/2\pi\sqrt{L1C1} \text{ and } f2=1/2\pi\sqrt{L2C2}$$

As the secondary circuit cannot be adjusted, the moveable tap on 'L1' is used to tune the primary circuit till both

the circuits resonate at the same frequency. Therefore, the frequency of the primary is the same as the secondary. $f = 1/2\pi\sqrt{L1C1}$

$=1/2\pi\sqrt{L2C2}$

The condition for primary and secondary to resonate at the same frequency is,

$$L1C1= L2C2$$

The output voltage in the resonant transformer does not depend on the number-of-turns ratio as in ordinary transformer. As soon as the cycle begins and as the spar sets up, the primary circuit's energy is stored in the primary capacitor 'C1' and the voltage at which the spark breaks down is 'V1'.

$$W1=1/2C1V12$$

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Similarly, the energy at the secondary coil is given by,

$$W2=1/2C2V22$$

Assuming there is no loss of energy, W2 = W1. Simplifying the above equation, we get

$V2 = V1\sqrt{C1/C2} = V1\sqrt{L2/L1}$In the above equation, the peak voltage can be achieved when air brakes down do not occur.

The peak voltage is the voltage at which the ai

Advantages of Tesla Coil

- Allows uniform distribution of voltage throughout the winding coils.
- Builds up the voltage at a slow pace and hence no damage.
- Great performance.
- The use of 3-phase rectifiers for higher powers can offer tremendous load sharing.

Disadvantages of Tesla Coil

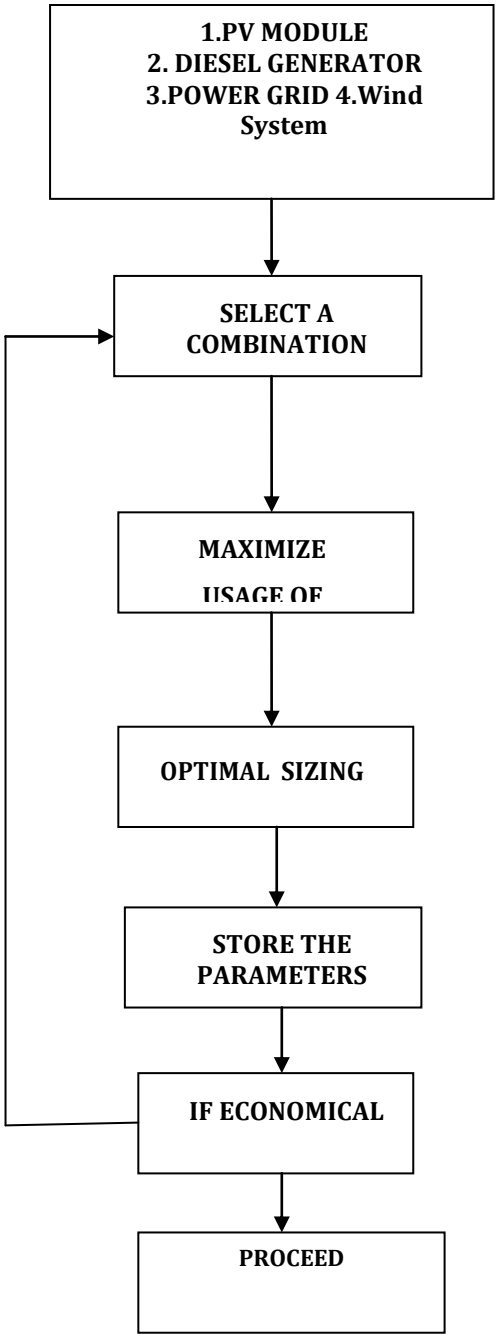
- Tesla coil poses several health hazards due to high voltage radio frequency emission that includes skin burn, damage to the nervous system and heart.
- Involves high costs in buying large DC smoothing capacitor.
- Construction of circuit consumes much time as it needs to be perfect to resonate

Applications of Tesla Coil

- At present, these coils do not require large complex circuits to produce high voltage.
- Aluminum welding

- Cars use these coils for the spark plug ignition
- Created Tesla coil fans, used to generate artificial lighting, sounds like music Tesla coils in Entertainment and Education industry are used as attractions at electronics fairs and science museums
- High vacuum systems and arc lighters
- Vacuum system leak detectors.

6.2. FLOW DAIGRAM:



This chart is an activity chart in which consists of initial user node and destination node. The User shooting module consists of Sensor, Gyro, minute mistakes that human cannot be able to address. It also helps in customizing the gun handle based on the gun handler and can easily able to self-assess their performance. It is very cheap in the cost wise and provides the great Muscle sensor, semantic model. UML provides a comprehensive notation for the full lifecycle of object-oriented development. UML[8] is a common language for business analysts, software architects and developers used to describe, specify Above flow chart illustrates the step-by- step process of the system.

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