The Evolution of Electricity

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INTRODUCTION

Electricity has a long and fascinating history that stretches back over several thousands of years.

The earliest known observations of electrical phenomena can be traced back to the Vedic age and to ancient civilizations in Greece and Egypt.
The Vedic Age, which lasted from approximately 1500 BCE to 500 BCE, was a period of ancient Indian history characterized by the development of the Vedas, a collection of sacred texts that form the basis of Hinduism. During this time, electricity was not yet understood or used as a source of power.

In Egypt, long before people were aware of the concept of electricity, they were aware that certain types of fish could produce and electric shock. Their texts dated back to 2750 B.C. described the electric catfish as the "Thunderer of Nile". In Greece, the mathematician Thales of Miletus observed that certain materials, such as amber, could attract lightweight objects like feathers when rubbed with fur. This is static electricity. The Greek word for amber is 'elektron', which is where words such as 'electricity' and 'electron' come from.

The study of electricity and its uses for practical purposes continued to evolve over the centuries. In the late 18th and early 19th centuries, important discoveries were made in the field of electricity, including the identification of the electrical nature of lightning and the development of the electric battery by Alessandro Volta.

It wasn't until the late 19th and early 20th centuries that electricity began to be widely used as a source of power in homes and industry. The development of the electric motor and the widespread adoption of alternating current (AC) electrical systems played a major role in the widespread use of electricity.

In summary, the Navagraha Sthotram is a Hindu hymn that is dedicated to the nine celestial bodies in Hindu astrology and is not directly related to the evolution of electricity.

REFERENCE TO ELECTRICITY IN NAVAGRAHA STHOTRAM

The Navagraha Sthotram (ನವಗ್ರಹ ಸ್ತೋತ್ರಂ) is a Hindu hymn that is dedicated to the nine celestial bodies that are the deities of the nine planets in Hindu astrology. These celestial bodies are the Sun, Moon, Mars, Mercury, Jupiter, Venus, Saturn, Rahu (north lunar node), and Ketu (south lunar node).
The Navagraha Sthotram is not directly related to the evolution of electricity. Electricity is a physical phenomenon that is based on the movement of electrons and the transfer of electrical energy through conductive materials. It was not understood or used as a source of power during the Vedic Age, when the Navagraha Sthotram was composed.

The Sthotram begins:

ಆದಿತ್ಯಾಯ ಚ ಸೋಮಾಯ ಮಂಗಳಾಯ ಬುಧಾಯ ಚ ।
ಗುರು ಶುಕ್ರ ಶನಿಭ್ಯಶ್ಚ ರಾಹವೇ ಕೇತವೇ ನಮಃ ॥

Specifically, let's look at the Kujah Sthothram (ಕುಜಃ ಸ್ತೋತ್ರಂ) where in its mentioned about electricity and its powerfulness. The Sthotram begins and its translated meaning is as follows:

ಧರಣೀ ಗರ್ಭ ಸಂಭೂತಂ ವಿದ್ಯುತ್ಕಾಂತಿ ಸಮಪ್ರಭಮ್ ।
ಕುಮಾರಂ ಶಕ್ತಿಹಸ್ತಂ ತಂ ಮಂಗಳಂ ಪ್ರಣಮಾಮ್ಯಹಮ್ ॥

ಧರಣೀ	"Dharani" is a term in the Kannada language that means "earth."
ಗರ್ಭ	"Garbha" is a term that means "womb."
ಸಂಭೂತಂ	"Samabhuta" is a term that means "born."
ಧರಣೀ ಗರ್ಭ ಸಂಭೂತಂ	Together, the phrase "Dharani Garbha Samabhuta" translates to "born from the womb of the earth." It is possible that this phrase is being used metaphorically or symbolically to refer to something or someone that has emerged or originated from the earth or from natural or elemental forces.
ವಿದ್ಯುತ್ಕಾಂತಿ	"Vidyutkaamti" is a term in the Kannada language that means "Electricity".
ಸಮಪ್ರಭಮ್	"Samaprabham" is a term that means "flow".
ವಿದ್ಯುತ್ಕಾಂತಿ ಸಮಪ್ರಭಮ್	Together, the phrase "Vidyutkaamti Samaprabham" translates to "flow of Electricity," or "Electric Current".
ಕುಮಾರಂ	"Kumar" is a term in the Kannada language that means "prince" or "son."
ಶಕ್ತಿಹಸ್ತಂ	"Shaktihasta" is a term that means "power hand" or "powerful hand."
ಕುಮಾರಂ ಶಕ್ತಿಹಸ್ತಂ	Together, the phrase "Kumar Shaktihasta" translates to "prince with a powerful hand" or "son with a powerful hand." It is possible that this phrase is being used to describe someone who is strong or capable, or who has a special ability or skill.

KEY MILESTONES

Further, over the centuries, scientists and inventors made numerous discoveries and innovations that have led to the development of the complex and sophisticated electrical systems we have today. Some of the key milestones in the evolution of electricity include:

CONNECTION BETWEEN ELECTRICITY & MAGNETISM BY WILLIAM GILBERT IN 1600

William Gilbert, who was a scientist and physician to Queen Elizabeth I, invented the term 'electricity'. He was the first person to recognise that there was a connection between magnetism and electricity, and the first to describe the Earth's magnetic field.

THE DEVELOPMENT OF LEYDEN JAR IN 18TH CENTURY

The development of the Leyden jar in the 18th century, which was the first device that could store an electric charge. A Leyden jar (or Leiden jar, or archaically, sometimes Kleistian jar) is an electrical component that stores a high-voltage electric charge (from an external source) between electrical conductors on the inside and outside of a glass jar. It typically consists of a glass jar with metal foil cemented to the inside and the outside surfaces, and a metal terminal projecting vertically through the jar lid to make contact with the inner foil. It was the original form of capacitor (also called a condenser).

PROVING THAT LIGHTNING IS A FORM OF ELECTRICITY BY BENJAMIN FRANKLIN IN 1752

Benjamin Franklin, a famous U.S. politician, published a proposal for an experiment to prove that lightning is electricity by flying a kite in a storm. On May 10, 1752, Thomas-François Dalibard of France conducted Franklin's experiment using a 40-foot-tall (12 m) iron rod instead of a kite, and he extracted electrical sparks from a cloud. On June 15, 1752, Franklin may possibly have conducted his well-known kite experiment in Philadelphia, successfully extracting sparks from a cloud. He described the experiment in his newspaper, The Pennsylvania Gazette, on October 19, 1752, without mentioning that he himself had performed it. Franklin was careful to stand on an insulator, keeping dry under a roof to avoid the danger of electric shock.

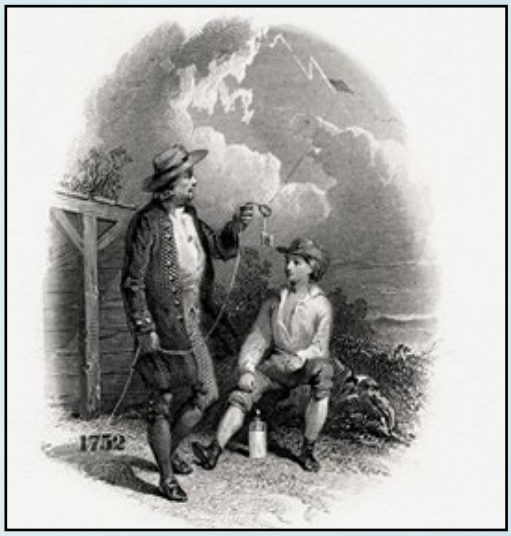

Figure 1: Franklin and electricity vignette by the BEP (Bureau of Engraving and Printing) 1860

In his writings, Franklin indicates that he was aware of the dangers and offered alternative ways to demonstrate that lightning was electrical, as shown by his use of the concept of electrical ground. He did not perform this experiment in the way that is often pictured in popular literature, flying the kite and waiting to be struck by lightning, as it would have been dangerous. Instead he used the kite to collect some electric charge from a storm cloud, showing that lightning was electrical. On October 19, 1752, in a letter to England with directions for repeating the experiment, he wrote:

When rain has wet the kite twine so that it can conduct the electric fire freely, you will find it streams out plentifully from the key at the approach of your knuckle, and with this key a phial, or Leyden jar, may be charged: and from electric fire thus obtained spirits may be kindled, and all other electric experiments [may be] performed which are usually done by the help of a rubber glass globe or tube; and therefore the sameness of the electrical matter with that of lightening completely demonstrated.

DISCOVERIES IN THE 1800s

1800	Pile Volta created the very first simple battery using pure silver and zinc discs, placed between muslin which was dampened with a salt solution. This made it possible to generate a sustained flow of electricity. This was developed from Galvani's experiment with the frog's legs. During the same year, Sir Humphry Davy discovered electrolysis. When he passed an electrical current through some substances, they'd begin to decompose. This became known as electrolysis. Davy's experiments later led to the discovery of a range of elements, including calcium, magnesium, strontium, and barium.
1820	Magnetic fields caused by electricity were discovered. Hans Christian Oersted, from Denmark, found that when electricity flows through a wire, it generates a magnetic field which affects the needle of a nearby compass.
1821	Michael Faraday discovered that when a magnet is moved inside the coil of a copper wire, a tiny electric current flow through the wire. This discovery led to the invention of electric motors. In the same year, Thomas Johann Seebeck discovered thermo-electricity. He found that when the junctions of certain metals are heated, electricity flows through them.
1826	André Ampère published his theories about electricity and magnetism, explaining the electro-dynamic theory. He was the first person to explain this theory. The unit for electrical currents, ampere or amps, is named after him.
1827	A German college teacher named George Ohm published his complete mathematical theory of electricity. Now, the unit of electrical resistance (ohm) is named after him.
1829	Joseph Henry showed that a wire wrapped in coils produces a greater electromagnetism than a straight one.
1830	Joseph Henry discovered the principles of the dynamo — an electrical generator.
1831	Michael Faraday demonstrated electromagnetic induction by passing a magnet through a coil of wire. The discovery of the fundamental principles of electromagnetism by him in the 1830s and 1840s, laid the foundation for the development of electric generators and motors. Charles Wheatstone and William Fothergill Cooke also created the first telegraph machine.
1834	Using a revolving mirror and four miles of wire, Charles Wheatstone successfully measured the velocity of electricity.
1838	Samuel Morse invented Morse Code at an exhibition in New York. He demonstrated sending 10 words a minute by his new telegraph machine.
1876	Alexander Graham invented the telephone using electricity.
1878	A British scientist named Joseph Swan demonstrated the first electric light with a carbon filament lamp. Thomas Edison made the same discovery a few months later in America.
1881	The first public electricity supply in the UK was generated in Godalming, Surrey, using a waterwheel at a mill.
1883	*Magnus Volks* built the first electric railway. It was opened on Brighton seafront. Named the Volks Railway, it was built just for pleasure rides, is one mile long and still runs during summer.
1884	*Charles Parsons* built the first turbine, a type of engine which uses jets of high-pressure gases to operate. This type of engine was later developed to drive boat propellers, including the ones on the Titanic.
1886	Heinrich Hertz produced and detected electric waves in the atmosphere.
1890	Turbine driven generators were introduced to produce electricity.
1892	A Dutch physicist named Hendrik Lorentz published his electron theory.

1895	Wilhelm Fein invented the first electric hand drill. Wilhem Roentgen, a German physicist, discovered invisible rays that made a screen glow and passed through objects. These rays were X-rays.
1896	Nikola Tesla's hydroelectric power generators at Niagara Falls come into operation. Within a few years, these generators were supplying electricity to New York City for the elevated railways, the subways, and the lights on Broadway.
1897	Guglielmo Marconi sends a radio message from the Isle of Wight to Poole, which is 20 miles (ca. 32 km) away. He later sends a message across the Atlantic.

THOMAS ALWA EDISON AND DIRECT CURRENT (DC) IN 1870s

Thomas Edison developed many devices in fields such as electric power generation, mass communication, sound recording, and motion pictures. These inventions, which include the phonograph, the motion picture camera, and early versions of the electric light bulb, have had a widespread impact on the modern industrialized world. He was one of the first inventors to apply the principles of organized science and teamwork to the process of invention, working with many researchers and employees.

The development of the first practical electric light bulb by American inventor Thomas Edison in 1879, which revolutionized lighting and paved the way for the widespread use of electricity in homes and businesses.

He established the first industrial research laboratory built a DC (direct current) electric generator. After this, he provided all of New York's electricity.

Figure 2: Electric bulb design by Edison

TESLA COIL & ALTERNATING CURRENT (AC) IN 1893

Nikola Tesla developed an AC (alternating current) motor and a system of AC power generation. Thomas Edison believed this to be a threat to his DC supply, so he spread stories that it wasn't safe to use. However, after Tesla's system was used to power 100,000 electric lights at Chicago's World Fair in 1893, AC became the established power supply in the USA. The development of alternating current (AC) electricity by him in the late 19th century, which made it possible to transmit electricity over long distances and paved the way for the widespread use of electricity in modern society.

He also invented the Tesla Coil. He used this coil to make ordinary household currents produce extremely high-frequency currents. This was used to develop some of the first neon and fluorescent lights.

Between 1880 and 1883, the Wimshurst machine (an electrostatic generator) was developed for generating high voltages of electricity. It was invented by a British inventor named James Wimshurst.

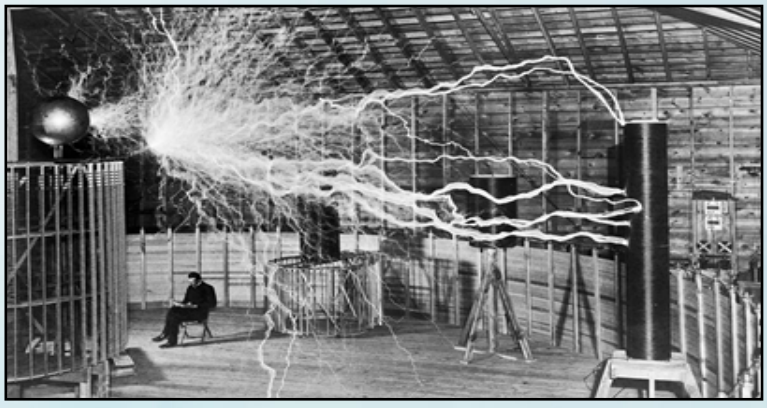

Figure 3: A multiple-exposure picture of Tesla sitting next to his "magnifying transmitter" generating millions of volts.

DISCOVERIES IN THE 1900s

1905	Albert Einstein demonstrated that light energy could be used to produce electricity.
1918	Electric refrigerators and washing machines first become available.
1926	The first National Grid was introduced in the Electrical Supply Act.
1930s	In the 1930s and 1940s, hydroelectric power stations were built in Scotland and Wales, even though most electricity still came from burning coal. Household electrical appliances were introduced, and mains powered radios, vacuum cleaners, fridges, and irons became a part of almost every household by the 1940s.
1936	The television was invented by John Logie Baird.
1956	At Calder Hall in Cumbria, the world's first large-scale nuclear power station was opened. The reactors were a prototype of the Magnox gas cooled reactor.
1960s	The UK developed advanced gas cooled reactors to improve on the previous Magnox stations. France and the USA adopted water cooled reactor technology.
1994	The UK's first pressurized water reactor (PWR) was opened at Sizewell B in Suffolk. It had taken 7 years to build.
2000	The world's first commercial wave power station, located on the Scottish island of Islay, began to generate electricity. Devices on the shoreline or out at sea use motion from the waves to compress air to drive a turbine or hydraulic pumps. It can provide energy for around 400 homes.

PRESENT STATUS

Now a days, electricity plays a vital role in our daily lives and has become an essential commodity, powering everything from our homes and appliances to our transportation systems and communication networks.
In response to the Climate Crisis, there is a big emphasis being placed on renewable and sustainable energy. That is the reason why renewable energy is currently the fastest-growing source of energy in the United States, increasing by a whopping 67% from the year 2000 to 2016. In fact, on 10th June 2020, the United Kingdom celebrated two months of running purely on renewable energy for the first time ever, which is an exciting step in the electricity timeline.
There are many options for renewable energy, such as wind, solar, hydro, tidal, geothermal and biomass energy. The possibilities are endless! When looking to the future of the electricity timeline, it is highly likely that renewable energy will be the primary source of energy. In addition to being good for the environment, running on renewable energy also has a lot of other amazing benefits. Some of the benefits of using renewable energy in your home include:

- Cheaper electricity bills: Once the initial cost of installing a renewable energy system has been paid, your energy bills can be reduced drastically.
- Make money from the electricity you generate: The Government has a thing called the Feed-in Tariff scheme, which pays you for the electricity you generate, even if you use it.
- Reduce your carbon footprint: Renewable energy sources don't release carbon dioxide or other pollutants into the atmosphere, which can majorly reduce your carbon footprint.

CONCLUSION

From ancient times to present, what then seemed like magic, has percolated in our daily routines, silently moving humanity from the stone age to the age of electronics talking to each other through internet of things. If humans can today say that they have developed, it is because of the important role electricity has played in the lives of humans.