MODULE 7
Lightning Power

One lightning strike has enough energy to light 150,000,000 light bulbs. One storm can discharge enough energy to supply the entire U.S. with electricity for 20 minutes. There are approximately 2,000 thunderstorms at any given moment worldwide. A typical lightning bolt bridges a potential difference (voltage) of several hundred million volts. A typical lightning bolt may transfer 10 electrons in a fraction of a second, developing a peak current of up to 10 kilo amperes. Most measurements have been in the range 5,000 to 20,000 amps. Currents over 200,000 amps have been reported.

Most commonly, the lightning current ceases in about a millisecond for a given stroke, but sometimes there is a continuing current on the order of 100 amps following one or more of the strokes. This is called "hot lightning" and it is the cause of lightning fires according to Martin Uman, one of the world’s leading experts on lightning.

The temperatures of lightning are 15,000-60,000°F for both "cold" and "hot" lightning - it is the continuing current that starts some 10,000 fires per year in the U.S. in the estimation of Uman. A moderate thunderstorm generates several hundred megawatts of electrical power

Utility Scale Batteries

Large utility scale batteries have been slow to develop, due to technological limitations and the demands and costs of delivering utility scale power, when necessary, for use on the grid.

Recent developments indicate that utility scale batteries have finally reached a point of technological development in which they can be integrated into the grid in select applications to ensure a constant power supply.

This development will affect the entire alternative energy field, as large amounts of electricity generated by alternatives means from solar to wind to any alternative power source, can be stored in large quantities and used when necessary.

USB are starting to be tested in localized applications, such as military bases, and if they prove effective in providing reliable electricity in these isolated areas, then large batteries are sure to be used in many more utility scale applications.

Flywheel- is a mechanical battery (a mechanical means of storing energy - simply a mass rotating about an axis). Flywheels store energy mechanically in the form of kinetic energy. Kinetic energy is energy of motion. The kinetic energy of an object is the energy it possesses because of its motion. As energy is transferred into a flywheel, as it spins, it builds up kinetic energy that can be released when necessary.

Capacitor- is similar to a battery in that it is a medium for storing electrical energy. However, a capacitor is a much simpler device than a battery, it cannot produce new electrons -- it only stores them. Capacitors that are scaled up to power levels required for delivering power to vehicles and the utility grid are known as ultra capacitors.

How to Store It

This concept is perhaps not as impractical as it once was. The main limiting factor of implementing a lightning capturing scheme such as this was the inability to be able to store large amounts of electricity for later use. However, new Utility Scale Battery technology or other energy storage technologies such as Flywheels or Capacitors could be used to store the electricity captured from lightning in massive quantities, for later grid use.

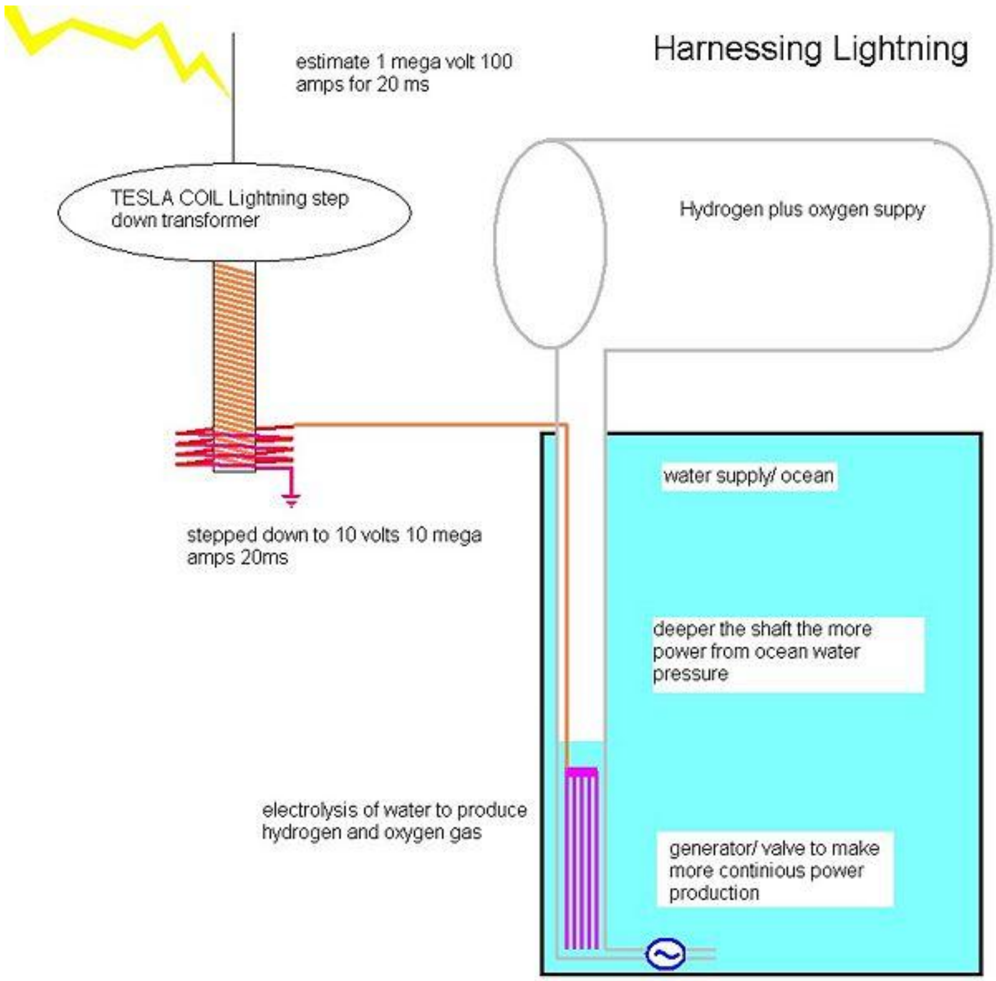
Obviously, a lightning capturing power plant would only be practical in regions with frequent thunderstorms, such as Florida.

This directory addresses the power of lightning and its utilization. There are several questions concerning this, but the most pertinent are (a) how to harness that power, and (b) whether there are substantial reasons not to.

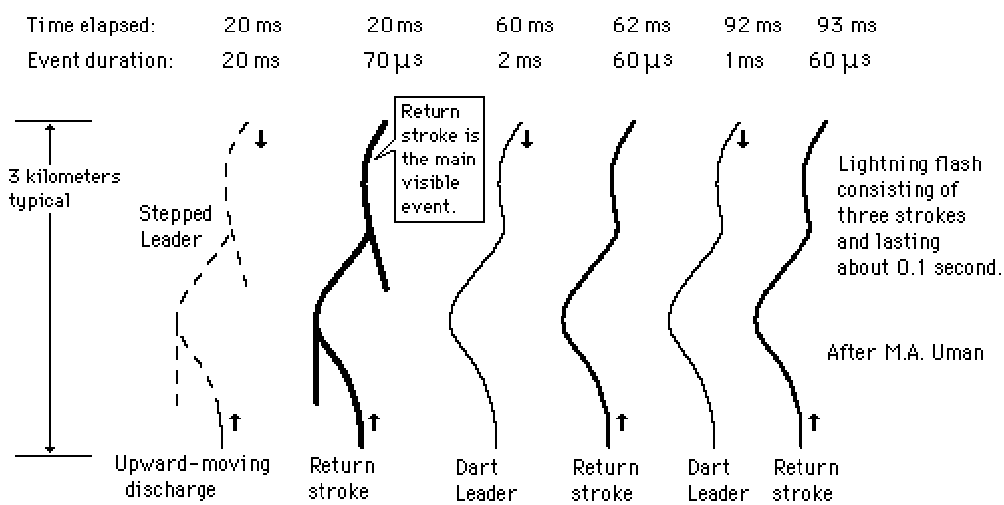
Even if a harnessing method were derived, the primary drawback of lightning power is its inconsistency. Storms might come regularly into some regions, but would enough lightning potential fall within the range of the device to make it worth while?

The Power of Lightning

Each year lightning destroys more property and causes more injuries than hurricanes, floods and tornadoes combined. It can cause structural damage to buildings, destroy electronics and damage electrical and communication systems....the cost of this damage can be astounding!"



A lightning strike is composed of several stroke events.



Voltage: A typical lightning bolt bridges a potential difference (voltage) of several hundred million volts.

A typical lightning bolt may transfer 1020 electrons in a fraction of a second, developing a peak current of up to 1000 kilo amperes.

Current: Most measurements have been in the range 5,000 to 20,000 amps. Currents over 200,000 amps have been reported.

Hot v Cold Lightning: Most commonly, the lightning current ceases in about a millisecond for a given stroke, but sometimes there is a continuing current on the order of 100 amps following one or more of the strokes. This is called "hot lightning" and it is the cause of lightning fires according to Uman. The temperatures of lightning are 8,300-33,000°C for both "cold" and "hot" lightning - it is the continuing current that starts some 10,000 fires per year in the U.S. in the estimation of Uman.

Total power: A moderate thunderstorm generates several hundred megawatts of electrical power.

"Gigantic Jets" Blast Electricity Into the Ionosphere - These lightning bolts that reach from cloud tops upward into the ionosphere, as high as 90 kilometers, have been measured by researchers at Duke University to carry as much energy skyward as ordinary lightning strikes carry to the ground. (*New Scientist*; Aug. 23, 2009)