THUNDERSTORM AS AN ALTERNATIVE SOURCE OF ENERGY

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Man has learned to use the energy of the sun, water, wind, waves and even the atom. Now, humanity is looking for new alternative energy sources because the earth's natural resources will run out sooner or later. That is why scientists are trying to harness the energy of lightning. They are searching an answer to the question: if a single stroke of lightning can light up the sky, why not to light up an entire house?

The energy of a large thunderstorm is equal to the energy from an atomic bomb explosion. The problem is that the lightning energy is concentrated for a very short period of time, about a few microseconds. And it is hardly possible to predict in advance where a thunderstorm will happen. And even if we solve this problem, scientists will have to deal with a voltage of several million volts. Also, we should take into account that lightning can be negatively charged, with energy accumulated in the lower part of the clouds and positively charged, with energy accumulated from the upper part of the clouds.

The way to get energy from a thunderstorm is to capture the energy of lightning and redirect it to the electrical network. A single lightning discharge collects 5 billion Joules of pure energy. Theoretically, lightning power plants can reduce the cost of electricity by several times.

Steve Le Roy, presented a device that can generate enough electricity from a simulated 3-foot lightning bolt to power a 60-watt light bulb for 20 minutes. It looks like a Tesla coil, where each mini-bolt is produced by an electricity generator. His system was described as consisting of "an array of ground wires to divert most of the incoming energy and a giant capacitor". Based on his simulations, Le Roy estimates that lightning will power 30,000 homes in one day (retrieved from https://webberenergyblog.wordpress.com/2013/02/22/lightning-hows-that-for-alternative).

Also, the research team from Technical University of Malaysia conducted the experiment on how to save the energy of the bolt after it is captured. They tested many types of capacitors, currents, and transistors to create the perfect way to capture energy and keep it from discharging. In order to solve the problem of battery life, they used metallized propylene film capacitors, which can be quickly discharged and charged. Although these capacitors had a limited energy density, they worked well with high frequencies and temperatures, with direct current, and were also quite cheap. The group tested the capacitors for their ability to charge and prevented them from discharging. They did this by adding an Insulated Gate Bipolar Transistor which essentially acts like a switch and insulates the capacitor so it can't discharge to anything. The research was successful, the capacitors could capture and store 5,000 volts in 1.2 microseconds from a single bolt (Bogdanov, 2006).

A possible installation is a lightning receiver and a capacitor. The receiver is a steel conductor. In order for the voltage on each capacitor to be the same, they are connected in parallel. It is possible to install lightning rods, which are smaller than the receiver, so that lightning would be least likely to hit the capacitor. You can fix the laser so that lightning strikes the receiver. The laser beam ionizes the air, creates an "ionized column" directed into the clouds. After lightning strikes the receiver, the charge enters the capacitors and charges them.

For all calculations, with the price of electric energy 1.68 UAH per 1 kWh, the cost of energy, subject to the full use of all lightning energy, will be 373,296 UAH.

Many projects have been created around the world and many scientists have studied lightning as an alternative energy source, but unfortunately due to their inconstancy and a very short discharge phase, at the moment no one has been able to create a completely effective and safe method of storing energy from a lightning discharge. But lightning farms can become an inexhaustible environmentally friendly source of very cheap energy, which is quite possible in the future.

Despite the obvious difficulties, the idea of creating lightning farms is alive - humanity really wants to tame nature and gain access to huge renewable energy reserves. Today the whole world is provided with electricity thanks to the burning of

coal and gas, the control of a nuclear reaction - these methods are effective but bring great damage to our planet and atmosphere, and in the future, we will have to turn to alternative energy sources.

References:

Bogdanov, K.U. (2006). Walking with physics. Lightning: more questions than answers, 140-149.

John, G. (2007, December). Lightning farms. *New York Times.* Retrieved from https://www.nytimes.com/2007/12/09/magazine/09lightningfarm.html

Lightning, How's That for Alternative? (2013, February 27). Retrieved from https://webberenergyblog.wordpress.com/2013/02/22/lightning-hows-that-for-alternative