

Can we store the energy from lightning?

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Did you know: lightning can strike the same place multiple times? For example, the Empire State Building is reportedly struck by lightning roughly 23 times per year. Credit: Pixabay/CC0 Public Domain

Every second of the day, Mother Nature puts on a spectacular show with an average of around 100 lightning bolts striking the Earth's surface.

That is an amazing 8.6 million strikes every single day, with each strike discharging up to one billion Joules of electrostatically stored energy, enough energy to boil the water in 3000 kitchen kettles.

If engineers have succeeded in harnessing the power of the sun, can they capture one of nature's other huge sources of energy?

Director of UNSW Digital Grid Futures Institute, Professor John Fletcher from the UNSW School Electrical Engineering and Telecommunications, says while it may seem possible in theory, using the energy produced by lightning is not as easy as it sounds.

"The challenge of capturing energy from lightning is that while there may be a billion joules of energy, it's mainly being used up in the lightning strike itself," he says.

"The [bright light](#) and the loud thunder that humans observe is most of the energy being used up—so in some respects, it's a little too late by the time it hits the ground.

"Plus, while lightning can strike the same place twice, we can't possibly predict where it is going to hit. It's a stab in the dark—literally."

Let's break down what a lightning strike is

To understand why it's not feasible, Prof. Fletcher says we need to understand how lightning is formed.

The conditions that create lightning are primarily caused by the movement of warm air and water molecules as they rise very quickly. That movement strips electrons away and results in thunderclouds that are charged.

"In a thundercloud, the air currents start at a lower altitude, around one kilometer above ground, and can rise to about 10 kilometers above ground—similar to the altitude of a passenger aircraft during cruise," he says.

"The large volume of movement of air creates an area that has a high charge level, generating a huge energy difference between charged particles in the cloud and us here on Earth. The voltage, around hundreds of mega volts, between the two becomes so big that it breaks down the air and this process forms lightning strikes.

"The flash that we see is the flow of charge between the cloud and Earth, and it happens in a tiny fraction of a second—blink and you could miss it.

"So yes, you could technically capture that energy from somewhere on the ground, but it may be only a small fraction of the actual energy."

So it's not a bright idea?

The bulk of the energy is captured high up inside the cloud itself. However, attempting to capture that energy just isn't cost-effective once you factor in other expenses such as storage and converting it into power that the grid or other types of loads will accept, says Prof. Fletcher.

"In theory, you would need to direct the lightning strike to a piece of equipment that could capture the energy from the [lightning strike](#)," he says.

"This is a relatively simple process which could involve sticking a good conductor, such as a copper rod, high in the air.

"However, we need to remember that the utilization of the equipment will be very poor as lightning strikes only last for tens of microseconds, which means there isn't much else happening during the other times.

"You need an apparatus that can capture a billion joules in say 100th of a second, but then deliver that energy over a longer term. For example, if we were lucky enough to have a strike every minute, then the instantaneous power capability of the capture system would be 100 gigawatts.

"The average power output from the device would be much lower, about 16 megawatts. That is a huge power conversion factor.

"And even if you had the right equipment set up, there's no guarantee that lightning will hit it every second anyway."

Sticking to what we know

When compared to other natural energy sources, lightning is definitely not as viable to harvest. Prof. Fletcher says solar and [wind power](#) are king when it comes to providing reliable, clean energy.

"Compare 10 microseconds of lightning to a solar panel which, if positioned correctly and in the right weather conditions, can reap the sun's energy for 10 hours a day," he says.

"And wind power has the potential to perform even better because it's also windy at night, so it's not as

time-dependent. Then there's nuclear and hydroelectric generation, [heat pumps](#) and solar thermal that are reliable sources of electrical and thermal [energy](#)."

"So economically it doesn't make much sense to try to capture lightning."

Provided by University of New South Wales

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