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Climate Change topics 06

We may be able to store renewable energy as thermal energy!😃(04/18/2022)

I was reading an article called "'Thermal batteries' could efficiently store wind and solar power in a renewable grid" on Science website. Thank you very much.😊This article introduced researchers reported a major improvement to store renewable energy as thermal energy. The following are quotes from this article:

> A team at the Massachusetts Institute of Technology (MIT) and the National Renewable Energy Laboratory achieved a nearly 30% jump in the efficiency of a thermophotovoltaic (TPV), a semiconductor structure that converts photons emitted from a heat source to electricity, just as a solar cell transforms sunlight into power. “This is very exciting stuff,” says Andrej Lenert, a materials engineer at the University of Michigan, Ann Arbor. “This is the first time [TPVs have] gotten into really promising efficiency ranges, which is ultimately what matters for a lot of applications.” Together with related advances, he and others say, **the new work gives a major boost to efforts to roll out thermal batteries on a large scale, as cheap backup for renewable power systems.**

> The idea is to feed surplus wind or solar electricity to a heating element, which boosts the temperature of a liquid

metal bath or a graphite block to several thousand degrees. The heat can be turned back into electricity by making steam that drives a turbine, but there are trade-offs. High temperatures raise the conversion efficiency, but turbine materials begin to break down at about 1500°C. TPVs offer an alternative: **Funnel the stored heat to a metal film or filament, setting it aglow like the tungsten wire in an incandescent light bulb, then use TPVs to absorb the emitted light and turn it to electricity.**

When the first TPVs were invented in the 1960s, they only converted a few percent of the heat energy into electricity. That efficiency jumped to about 30% in 1980, where it has largely been stuck ever since. One reason is that tungsten and other metals tend to radiate photons across a broad spectrum, from high-energy ultraviolet to low-energy far-infrared. But all photovoltaics—TPVs included—are optimized to absorb photons in a narrow range, meaning light with higher and lower frequencies tends to be wasted.

With researchers at the National Renewable Energy Laboratory, Henry's team laid down more than two dozen thin layers of different semiconductors to create two separate cells stacked one on top of another. The top cell absorbs mostly visible and ultraviolet photons, whereas the lower cell absorbs mostly infrared. A thin gold sheet under the bottom cell reflects low-energy photons the TPVs couldn't harvest. The tungsten reabsorbs that energy, preventing it from being lost. **The result, the group reports today in Naturenone, is a TPV tandem that converts 41.1% of the energy emitted from a 2400°C tungsten filament to electricity.**

This progress has triggered commercial interest. Antora Energy in California launched a thermal energy company in

> 2016. Lenert and others are eyeing their own startups. And Henry recently launched a venture—Thermal Battery Corp.—to commercialize his group's technology, which he estimates could store electricity for $10 per kilowatt-hour of capacity, less than one-tenth the cost of grid-scale lithium-ion batteries. "**Storing energy as heat can be very cheap,**" even for many days at a time, says Alina LaPotin, an MIT graduate student and first author of the current Naturenone paper.

> Henry and others add that **thermal storage systems are modular, unlike fossil fuel plants, which are most efficient at a massive, gigawatt scale. "That makes them equally good at providing power for a small village or a large power plant,**" says Alejandro Datas, an electrical engineer at the Polytechnic University of Madrid—and for storing power from solar and wind farms of any size. "This is the beauty."

As I quoted above, it is very good that it is cheaper than lithium-ion batteries and there is a possibility of storing electricity.👏I introduced previously the climate change topic called "Using gravity to store renewable energy💪 (02/02/2022)". And recently, thanks to TEPCO's power crisis, I was able to understand that pumped storage hydropower is the same type.😉I think it's very good to have more options to store electricity.😃

Keywords: Thermal Energy, Thermophotovoltaic, TPV, Backup, Graphite, Tungsten

We can generate electricity with a kite!? 😃 (04/11/2022)

I was reading Ars Technica's article called "Could high-flying kites power your home?". Thank you very much.😊This article introduced the latest wind power generation that generates electricity using kites. The following are quotes from this article:

> At least 10 firms in Europe and the United States are developing variations of this kind of kite power. **If they succeed, kites could make it possible to build wind farms on land that isn't windy enough for conventional wind turbine towers. Kites might also be a better choice for offshore wind power, and one day could even replace at least some anchored towers now in use**.

> **At the moment, kite power is in its infancy. Most companies are working on relatively small pilot projects, and none have scaled up their technology to the megawatt range that would make them comparable to conventional wind turbines. But small versions are already on the market**.

> Airborne wind energy systems use two basic ways to generate electricity. Ground-based approaches, like SkySails, use "pumping power" to run a generator on the ground. The ground-based end of the tether is wound around a winch, and as the kite flies across the wind it pulls against the tether and unwinds the winch, driving a generator that produces

> electricity. Then the kite is allowed to float while it is reeled back in, and the cycle starts again.

> The other approach is to generate the electricity onboard the kite. Onboard generation uses a rigid kite, similar to an airplane wing, which supports small wind turbines. When the kite flies, the wind runs the turbines and electricity generated by the craft is sent down the tether to the ground station.

It is very interesting and helpful to have the possibility of building a wind farm on land without enough wind power.😊

Keywords: Kite, Wind Power

It seems that Japan is proceeding with renewable energy, but it don't want to use it as much as it can.🧐(04/11/2022)

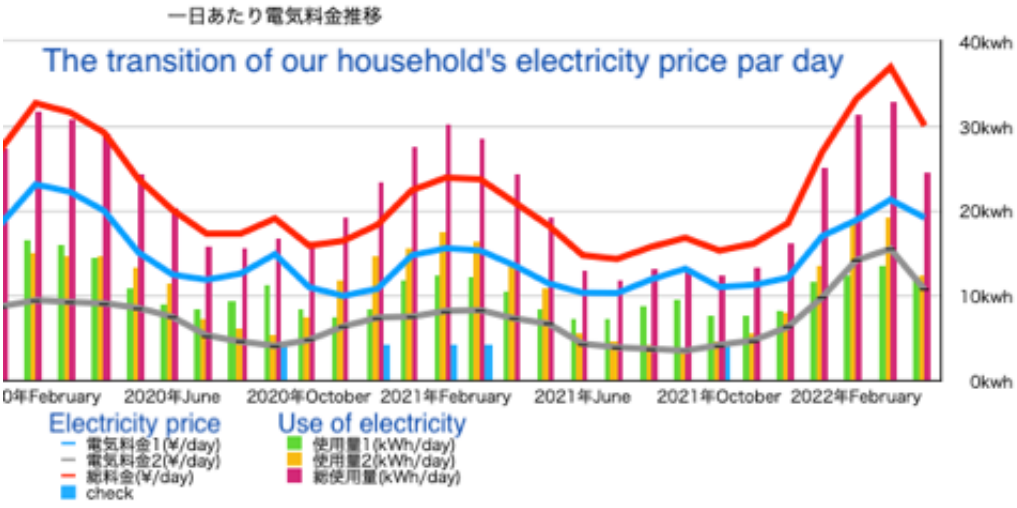
I used my Apple Script file to graph electricity information such as electricity usage, electricity price for monthly my household.😃Recently, a layout of the TEPCO websites have changed, and I was modifying the Apple Script file two days ago.😅It's no longer fully automatic, but it's still useful. The video is here. Also, I don't know if I'll make it with Apple Script, but I want to make it for checking tweets as soon as possible.

I'd like to briefly explain how this Apple script works:

1. Open the Safari app, log in on the TEPCO website, retrieve the data, log out on it, and close the Safari app.
2. In order to get the necessary data, it is to process and calculate, export it to spreadsheets (Numbers app), and finally make it a graph.

For reference, I checked the electricity consumption per day and electricity prices per day in April 2021 and April 2022. In addition, a part of the graph is also posted. **Note: These data are from this March.**

Date	Electricity price per day	Use of electricity per day
April 2021	474 yen	24kWh
April 2022	677 yen	25kWh



Our electricity consumption in this April has hardly changed

compare to last year's. However, the electricity bill is surging.🥺If you simply multiply above each electricity price per day from the above table by 30 and make it monthly version, I think you can see that each price has increased significantly, such as 14,220 yen and 20,310 yen, respectively.

Due to changes dramatically in the global situation, electricity prices are surging. Because TEPCO uses the national fuel trade statistics to adjust the fluctuations in fossil fuel prices to electricity prices. Below is a quote from the Japanese website explaining TEPCO's fossil fuel cost adjustment system:

> TEPCO Energy Partners has introduced a "fossil fuel cost adjustment system" that automatically adjusts electricity prices according to fluctuations in fossil fuel prices. We are pleased to announce that the unit price of fossil fuel cost adjustment for May 2022 according to this system has been confirmed based on the trade statistics price of fuel from December 2021 to February 2022.

And here, I'd like to write a story of renewable energy.😃 Yesterday, Tohoku Electric Power issued renewable energy output control instructions and restricted renewable energy generation such as solar power generation. Below is a part of the information of its Japanese report:

Report on renewable energy output control instructions based on the "renewable energy fixed price purchase system"

Amount of renewable energy output control
380 MW

On the other hand, the Ministry of Economy, Trade and Industry and the Ministry of Land, Infrastructure, Transport and Tourism have begun to recruit wind power generation companies in Hachiho Town and Noshiro City, Akita Prefecture. I think a promotion of renewable energy is good, but this place is under a jurisdiction of Tohoku Electric Power. If they proceed it as it is, it will be added to its power supply of renewable energy, and in the future, renewable energy output control instructions will be issued frequently, and it is expected that the renewable output control amount will increase.🙃

I think it would be better to prioritize renewable energy generation over power generation from fossil fuels.🥺

Keywords: Renewable Energy, Apple Script, Safari, TEPCO, Fuel Cost Adjustment System, Tohoku Electric Power, Renewable Energy Output Control Instructions, Wind Power Generation