

'SUN IN A BOX' SYSTEM TO STORE RENEWABLE ENERGY

Relevant for: World & Indian Geography | Topic: Distribution of Key Natural Resources - Energy Resources of the World

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MIT scientists have designed a system that could store renewable energy, such as solar and wind power, and deliver it back into an electric grid on demand.

The system, described in the journal *Energy and Environmental Science*, may be designed to power a small city not just when the sun is up or the wind is high, but around the clock.

The new design stores heat generated by excess electricity from solar or wind power in large tanks of white-hot molten silicon, and then converts the light from the glowing metal back into electricity when it's needed.

The researchers from Massachusetts Institute of Technology (MIT) in the U.S. estimate that such a system would be vastly more affordable than lithium-ion batteries, which have been proposed as a viable, though expensive, method to store renewable energy.

They also estimate that the system would cost about half as much as pumped hydroelectric storage – the cheapest form of grid-scale energy storage to date.

“Even if we wanted to run the grid on renewables right now we couldn't, because you'd need fossil-fuelled turbines to make up for the fact that the renewable supply cannot be dispatched on demand,” said Asegun Henry, Associate Professor at MIT.

“We are developing a new technology that, if successful, would solve this most important and critical problem in energy and climate change, namely, the storage problem,” Mr. Henry said.

The new storage system stems from a project in which the researchers looked for ways to increase the efficiency of a form of renewable energy known as concentrated solar power.

Unlike conventional solar plants that use solar panels to convert light directly into electricity, concentrated solar power requires vast fields of huge mirrors that concentrate sunlight onto a central tower, where the light is converted into heat that is eventually turned into electricity.

“The reason that technology is interesting is, once you do this process of focusing the light to get heat, you can store heat much more cheaply than you can store electricity,” Mr. Henry said.

Concentrated solar plants store solar heat in large tanks filled with molten salt, which is heated to high temperatures of about 538 degrees Celsius.

When electricity is needed, the hot salt is pumped through a heat exchanger, which transfers the salt's heat into steam. A turbine then turns that steam into electricity.

The researchers have outlined their concept for a new renewable energy storage system, which they call TEGS-MPV, or Thermal Energy Grid Storage-Multi-Junction Photovoltaics.

Instead of using fields of mirrors and a central tower to concentrate heat, they propose converting electricity generated by any renewable source, such as sunlight or wind, into thermal energy, via a process by which an electric current passes through a heating element.

The system could be paired with existing renewable energy systems, such as solar cells, to capture excess electricity during the day and store it for later use.

The system would consist of a large, heavily insulated, 10-metre-wide tank made from graphite and filled with liquid silicon, kept at a “cold” temperature of almost 1927 degrees Celsius.

A bank of tubes, exposed to heating elements, then connects this cold tank to a second, “hot” tank.

When electricity from the town’s solar cells comes into the system, this energy is converted to heat in the heating elements.

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