

Thermal storage units that repair themselves

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In the future, paraffin wax could help to make underground thermal storage units more durable. Such systems are used, for example, to store solar energy over a longer period of time. In a new study, geologists from Martin Luther University Halle-Wittenberg (MLU) investigated the extent to which paraffin wax can be incorporated into the shell of the



storage tanks and whether this can prevent heat loss and close fissures. The research team reports on its findings in the journal *PLOS ONE*.

A major challenge for renewable energies is finding a way to store them in the medium term. Simple, cost-effective solutions are needed, so that, for example, <u>solar energy</u> that is produced in the summer can be used in winter. To do this, water is often heated using solar thermal energy systems and then stored in large underground basins. Ideally, the stored thermal <u>energy</u> lasts into the winter. The basins are lined with a foil to insulate them and prevent water loss. "When you look at the projects implemented so far, you see the same weaknesses again and again," says Professor Peter Bayer from the Institute of Geosciences and Geography at MLU. Water and <u>heat</u> often escape through areas that are damaged.

Bayer has brought his research on seasonal thermal storage systems with him to Halle from the Institute of New Energy Systems at the Ingolstadt University of Applied Sciences. As part of a project sponsored by the Volkswagen Foundation, his team investigated whether these shortcomings could be offset by an additional component in the outer shell of the thermal storage unit: paraffin wax. Better known as candle wax, it is already being used as a latent heat storage material. Paraffin wax melts at relatively low temperatures, absorbing heat, which is rereleased on solidification. It is also highly hydrophobic, which means that it repels water. "The idea was to take advantage of both of these material properties," explains Bayer. When integrated into the outer shell of a thermal storage unit, paraffin wax could help reduce <u>heat loss</u>. At the same time, it could bring about a self-healing effect. "When a crack develops in the shell, the wax liquefies and closes this gap."

Paraffin wax is also environmentally friendly. If it were to leak out of the storage basin, there would be no toxic impact. And, according to Bayer, it is more cost-effective than other latent heat storage materials. In two laboratory experiments, his colleague Christoph Bott tested the



extent to which paraffin wax reduced heat loss and whether the outer paraffin wax shell would really heal itself. "At first glance, the mechanisms we expected worked very well," says Bott. When the outer shell was damaged, the liquefied wax filled in the damaged spot. There was also an improvement in the heat storage capacity. "However, it is difficult to upscale this to an industrial level," says Bayer. The larger the basin, the more the paraffin wax in the outer shell is displaced by the weight of the water. Additional structures would be needed to keep it in place. And if the <u>shell</u> were to incur major damage, the self-healing effect would no longer work. "At <u>high pressure</u>, the water just ignores the paraffin wax," says Bayer. It just flows right past it.

But Bayer is convinced that even if the idea cannot be immediately put into practice, it still has potential. "Right from the start we knew that it would be difficult to implement," he remarks. "We were using <u>paraffin</u> wax for the first time in an entirely new setting." However, the research is a further step towards improving seasonal storage and thus creating more efficient <u>storage</u> capabilities for renewable energies.

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