



German Aerospace Day: Harvesting energy, a life without traffic jams and a world record attempt

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DLR energy, transport and materials research on German Aerospace Day

We all want energy to be available when we need it. During German Aerospace Day, energy researchers at the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) will demonstrate how innovative storage devices can be used to efficiently harness energy. DLR solar researchers will show the public how much power is available from the Sun, and how they can put this energy to use in solar power plants. When people move from A to B, they want to do so quickly and easily; DLR transport researchers will show how this could be achieved in future, perhaps with fewer traffic jams. DLR materials scientists have their sights set on using 22 September to demonstrate how a 15-ton truck can remain suspended in the air for over an hour, bonded by an adhesive surface no larger than credit card. Visitors can also get to know ultra-lightweight and extremely stable materials at the Institute of Materials Research.

World record attempt – an adhesive surface no larger than a credit card holds a truck suspended in the air

Scheduled for 13:00 on German Aerospace Day, the DLR material scientists will attempt to set a **new world record**: a technique developed at DLR will be used to bond two steel bolts roughly the same size as a credit card (seven centimetre diameter). Then a 15-ton truck will be kept suspended in thin air, hanging from a mobile crane for an over an hour, held in place by nothing other than these adhesive surfaces.

Electricity from heat

Thermoelectric materials have the ability to convert heat directly into electricity, without any moving parts. Scientists from the Institute of Materials Research are working on more efficient methods of utilising these substances. On German Aerospace Day, they will show how a thermoelectric generator can power a model railway with no more than the heat from one candle. There is also a reverse effect in which thermoelectric elements pump heat to different locations and hence regulate their temperature. Visitors will be able to feel this coldness in a test system.

Ultra-light and extremely stable – aerogels

Aerogels are extremely light, solid substances, generally silicates, which consist of up to 98 per cent air contained within pores in their structure. Combining them with concrete or other substances, material researchers have succeeded in using aerogels to produce extremely stable materials that provide outstanding insulation. The scientists working at the Institute of Material Research premises will be showing how light and versatile these materials are. As part of the lecture programme in the main DLR auditorium, two researchers will use the 'Science Slam' to demonstrate how aerogels are manufactured. This 10-minute science show with the title 'Resorcin-Formaldehyd-Aerogele kochen(d) leicht gemacht' (A simple guide to cooking (up) Resorcinol-Formaldehyde-Aerogels) promises to be funny and informative.

Ideal long-term storage device with high energy density in CeraStorE

Cooked and buttered, the noodles make their way from the stove to the table – and the heat remaining in the hotplate leaks away unused. Something similar to this happens in a whole range of industrial processes. To ensure that this thermal energy is not lost and is instead collected and re-used, DLR energy researchers are developing intelligent storage systems that

capture thermal energy and put it back to work precisely where it is needed. Visitors to CeraStorE – the competency centre for ceramic materials and thermal storage technologies – on German Aerospace Day will have the opportunity to inspect a thermo-chemical storage system that uses lime to convert thermal energy into chemical energy. What makes the lime storage system so special? The chemical reaction enables it to absorb large quantities of thermal energy per cubic metre. It is also an ideal long-term storage unit that holds back from releasing the energy it saves until water vapour is introduced. As part of a trial demonstration, the scientists use a thermal-imaging camera to visualise the heat energy released in this kind of reaction. In addition to the lime storage system, the DLR Institute of Technical Thermodynamics will present a range of other storage materials and technologies, among them high-temperature thermal storage units for use in existing gas and steam power plants, solar and compressed air power plants and also in combined heat and power plants, allowing consumers to use energy storage to access electricity or heat whenever needed.

Ceramic fibre composite materials are as durable as metallic materials, but they can withstand significantly higher temperatures and are far lighter. Among other things they are intended for use in gas turbine combustion chambers, where they allow a further increase in temperatures inside the combustion chamber and a reduction in the volume of air needed for cooling. Visitors to the CeraStorE building will have an opportunity to inspect the systems used to produce these materials.

How sunlight gets to the power plant

How does a solar power plant work? Visitors to the DLR Institute of Solar Research will find all their questions answered. Scientists here are working on large-scale solar power plants that use mirrors to harness sunlight, focusing it on one point or a linear axis. The thermal energy this produces – with temperatures of up to 500 degrees Celsius – is exploited to convert water into steam to drive a turbine. Scientists use an approximately 60 square metre mirror at the DLR solar furnace in Cologne to beam sunlight onto an area of just 10 by 10 centimetres. Although the solar power concentrated in this way creates temperatures that could easily melt through a bank vault, the researchers exploit this energy to develop methods of producing hydrogen, among other things. The scientists will also use a bowl-shaped mirror to demonstrate the immense power of sunlight by melting coins – assuming that the Sun is shining.

One of the main tasks for the DLR solar researchers is to test the quality of these huge mirrors before they are used in solar power plants. The researchers will use German Aerospace Day to provide a glimpse behind the scenes of this work. The show will feature parabolic mirrors measuring up to six metres, deployed to harness sunlight in solar power plants in Spain, the United States, Asia and North Africa, to name but a few.

Reducing traffic congestion

Whether travelling by road, rail or air, the aim is to get from A to B as quickly, safely and inexpensively as possible, without harming people or the environment. Transport researchers at DLR are working on making this vision come true. At German Aerospace Day, Peter Wagner will speak on traffic jams can be prevented. Solutions to this problem will include driving assistance systems and satellite images to help improve traffic management. Discover more about the solutions this field of research has to offer at 15:00 in the main auditorium of the DLR Casino.

Visitors to the DLR Institute of Transportation Systems stand (located between the Institute of Aerospace Medicine and the :envihab research facility) will be able to play a 'traffic light game' to find out first hand just how complex a task it is to control traffic lights at one single junction. The aim of this computer simulation is to manage the traffic lights at the junction in such a way that vehicles get through with minimal fuel consumption. An 'all-time best' list will record the top scores among visitors.

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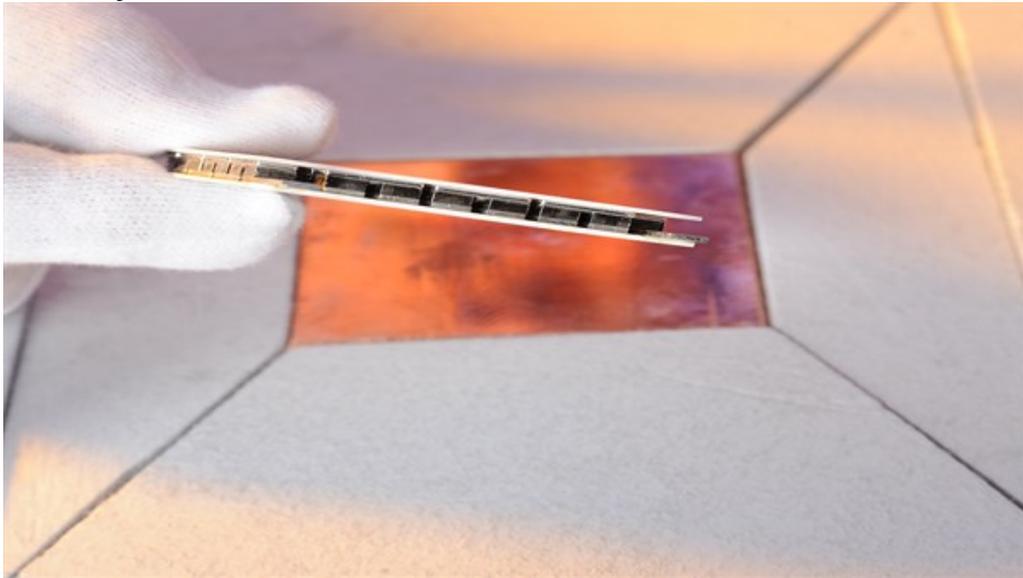
CWS-test facility for thermochemical storage



Thermochemical heat storage systems take in heat using an endothermic reaction and release it again through an exothermic reaction. They have a very high energy density and are ideal for long-term storage. In the CWS (Chemische Wärmespeicherung mittels reversibler Gas- und Feststoffreaktionen – chemical heat storage by means of reversible gas-and solid-state reactions) test facility in CeraStorE at DLR Cologne, such a storage system is being tested on a larger scale for the first time.

Credit: DLR (CC-BY 3.0).

Electricity from heat



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Credit: DLR (CC-BY 3.0).

Cooking made easy



How are ultra-light aerogels made? In their 10-minute 'Science Slam' entitled 'Resorcin-Formaldehyd-Aerogele kochen(d) leicht gemacht' (A simple guide to cooking (up) Resorcinol-Formaldehyde-Aerogels), two materials scientists show how it is done.

Credit: DLR (CC-BY 3.0).

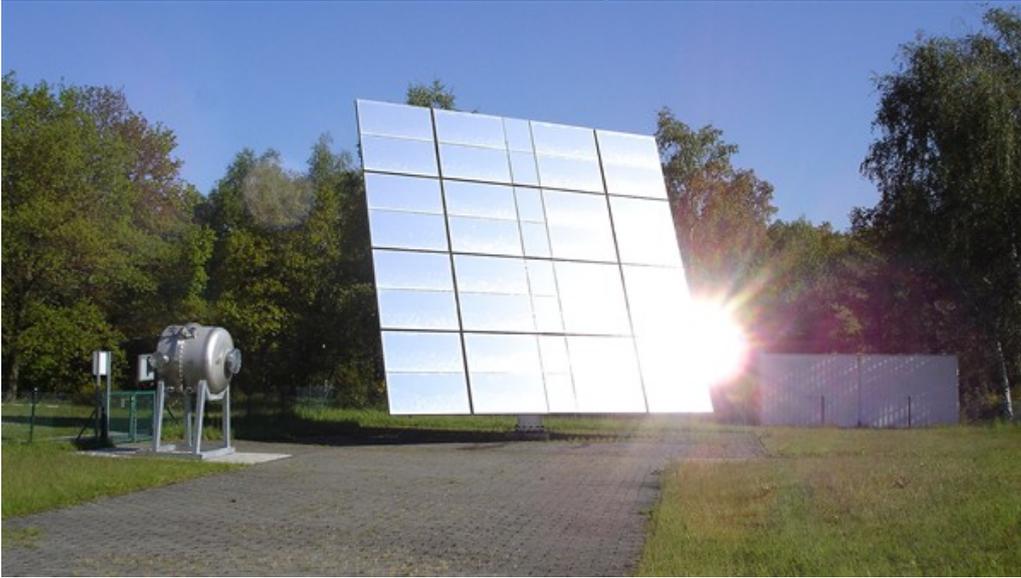
DLR solar furnace in Cologne



A 57 square metre mirror collects sunlight and directs it towards the faceted mirrors (left in the picture). These mirrors concentrate the incoming radiation up to around 5200 times and direct it to the research laboratory of the Cologne solar furnace (the beam of light can be seen on the right of the image).

Credit: DLR (CC-BY 3.0).

The heliostat solar furnace collects the Sun's rays over 57 square metres



The heliostat of DLR's solar furnace in Cologne collects the Sun's rays and reflects them onto the 'concentrator' – 157 separate, slightly curved and precisely aligned mirrors that focus the radiation. The radiation is concentrated by a factor of 5200 and falls on the approximately four-metre by four-metre test chamber of the solar furnace.

Credit: DLR (CC-BY 3.0).

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