

## Media Release

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*International symposium as the "launch pad" for the new Empa 'Hydrogen & Energy' laboratory*

### **Urgent action needed to bring about the "hydrogen society"**

***Researchers and industry representatives met at Empa on Friday at the international 'Hydrogen & Energy' symposium organized by the laboratory of the same name in order to compare notes on the progress of work in the field of hydrogen technology and to discuss the potential of hydrogen as a sustainable energy source for the future. The conclusion: As a "clean" energy source, hydrogen does indeed have the potential to dramatically change our energy supplies within a few decades. Given the declining stocks of fossil resources, we need to press ahead with research with the aim of making hydrogen available as an efficient and economic source of energy as soon as possible.***

The way we currently use energy is anything but sustainable: We are burning our limited reserves of fossil fuels such as oil, gas and coal at an ever faster pace, thereby releasing the greenhouse gas carbon dioxide (CO<sub>2</sub>) and continuing to heat up the earth's atmosphere. The latest climate report issued by the UN's "Intergovernmental Panel on Climate Change" (IPCC) predicts a global temperature rise of up to 4.5 degrees Celsius by the year 2100. Moreover, fossil-based energy supplies – including uranium – will start to decline in just a few years. Curbing our voracious "appetite for energy" is an unlikely prospect, particularly given the growing energy requirements of countries such as China and India. Although research is focusing on renewable sources such as solar energy, wind power and geothermal energy (utilizing the earth's heat), these sources are not yet available and are also difficult to store.

#### **Metal sponges store hydrogen**

This is precisely where hydrogen comes into play as a storage medium for renewable energy sources. Since it does not occur naturally in the atmosphere, it must first be created by electrolysis, the electrochemical splitting of water into oxygen and hydrogen. The energy for this process will one day be supplied by renewable energy sources. So far, so good. But the problem of how to transport and store the gas is proving a really difficult nut to crack. Hydrogen is currently transported in compressed gas cylinders or in liquid form using "cryo-containers" at -253 degrees Celsius. An interesting alternative is to store hydrogen in certain metals that are capable of storing hydrogen atoms in a metal matrix and thus bind them chemically. These metal hydrides can "suck up" hydrogen like a sponge and then release it again as required. Certain knotty problems still need to be solved however before the metal hydrogen sponges can be used in practice and their storage potential increased.

## **Empa – Swiss focal point for hydrogen technology**

To address these problems Empa set up its '*Hydrogen & Energy*' laboratory last year, appointing Andreas Züttel as its head. "The greatest challenge is to pack gaseous hydrogen into the metal hydrides as compactly as possible so as to achieve maximum energy density", explained the hydrogen expert. To this end, he and his team are investigating, for example, the specific structural changes caused by hydrogen when it is stored in the metals, or the behaviour of hydrogen in carbon nanostructures and metal nanoclusters. To mark the formal opening of his new laboratory, last Friday Züttel organized an international hydrogen symposium at Empa. Research colleagues from Germany, Denmark, Great Britain, the Netherlands and Japan presented their latest findings, for example on new hydrides which, thanks to their particularly high storage capacity, can be used to power emission-free vehicles, portable electronic equipment or provide energy in a decentralized system. Ronald Griessen of the Free University of Amsterdam presented an optical technique that can be used to investigate the properties of thousands of different hydrides at the same time, thus providing the basis for hydrogen sensors or ingenious solar collectors. One example of how experience with hydrogen-based forms of transport can be obtained cost-effectively was demonstrated by Rex Harris of the University of Birmingham and his converted canal boat, for which Züttel has developed a metal hydride cell with a storage capacity of 5 kilograms of hydrogen.

Four members of Andreas Züttel's team then provided some insights into the activities of the new Empa laboratory. Andreas Borgschulte's group is working on a low-energy method for charging and discharging the hydrogen storage media by improving the stability of the hydrides and obtaining a more detailed knowledge of the processes of hydrogen absorption. Zbigniew Łodziana and his colleagues are focusing on the theoretical modelling of complex metal hydrides. The computer calculations for the atomic and electronic structures of hydrides and oxides enable the researchers to describe the observed phenomena using theoretical models and thereby identify new, highly promising metal alloys. The team headed by Michael Biemann is developing new methods and equipment for monitoring, for example, hydrogen absorption. Finally, Arndt Remhof's team is investigating the physical properties of storage metals based on the structural arrangement of their atoms.

## **Hydrogen, an energy source with potential**

In the subsequent podium discussion chaired by Empa Head of Communications Michael Hagmann, representatives from the worlds of research, science and politics debated the technological and economic opportunities presented by hydrogen for Switzerland and Europe. The first, deliberately provocative, question: When will the hydrogen economy era actually begin? According to Ronald Griessen, who was honoured at the symposium with the first ever "*Science of Hydrogen & Energy*" award, it will probably be quite a few years yet, although he believes that hydrogen will definitely play an important long-term role in the way our energy is supplied: "Initiatives are already under way in the USA and Europe, for example the DaimlerChrysler Citaro bus that is in service with the Reykjavik public transport authorities". Empa CEO Louis Schlapbach believes that there was a difference between the hydrogen economy and hydrogen technology. "We are still a long way from being able to use hydrogen as an energy source. But hydrogen

technology can be used even today, for example in sensor technology, material processing and the production of functional materials", explained Schlapbach. Given the IPCC Climate Report and the impending exhaustion of natural energy stocks, Schlapbach sees a massive need for action: "We must help aspiring nations such as China and India develop efficient energy technologies. These countries shouldn't be left to make the same mistakes that we have made in Europe and the USA."

Zurich National Councillor and Dübendorf City Councillor Martin Bäumle argued for greater urgency at the political level. Faced with rising energy prices, Switzerland should act immediately by taking the decision to switch to hydrogen and invest heavily in this technology. He believed that this was the only way of safeguarding Switzerland's economy for the future. Finally, the two industry representatives also urged Switzerland to take an active role in promoting hydrogen. According to Ernest Burkhalter, CEO of IHT SA in Monthey, "pilot systems for hydrogen are being set up everywhere across Europe, except in Switzerland, where there appears to be a lack of will to take an active role", while Fridolin Holdener, Director of WEKA AG in Bäretswil, believed that hydrogen ultimately offered a political opportunity: "We in Switzerland have the potential to develop pioneering models, but risk missing this opportunity yet again."

Ronald Griessen noted helping a new technology make the breakthrough required not just money, but also time and stable (funding) conditions. "In Holland we consider energy to be a subject for long-term basic research. Funding for hydrogen technology amounts to €18 million, a quarter of which comes from industry." The hydrogen pioneer relies on open communication to help consumers rethink their approach. "People can get enthusiastic about something useful if someone explains the context and takes the trouble to convince them." If they are able to make a contribution to reducing environmental pollution by using clean energy sources, they are also willing to shoulder higher energy prices.

*Author: Elisabeth Heinzelmänn, freelance science journalist*

#### **Technical information**

Prof. Andreas Züttel, Hydrogen & Energy, Tel. +41 44 823 40 38, [andreas.zuettel@empa.ch](mailto:andreas.zuettel@empa.ch)

#### **Editor**

Dr. Michael Hagmann, Communications, Tel. +41 44 823 45 92, [michael.hagmann@empa.ch](mailto:michael.hagmann@empa.ch)



The presentations on "Hydrogen as an energy source" were listened to attentively by a large audience of specialists.



Participants in the podium discussion (seated left to right): National Councillor and Dübendorf City Councillor Martin Bäumle, Cantonal Council contender Jacqueline Hofer, Empa CEO Louis Schlapbach, Ronald Griessen of the Free University of Amsterdam, Fridolin Holdener, Director of WEKA AG in Bäretswil, Ernest Burkhalter, CEO of IHT SA in Monthey. Standing: Presenter Michael Hagmann, Empa Head of Communications.



Ronald Griessen of the Free University of Amsterdam (right) believes that hydrogen will play an important role in energy provision in the long term. Left: Empa CEO Louis Schlapbach.