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How AI can help us make progress on the energy transition

Artificial intelligence is already being used to control our grids and helps align different parts of our energy system. **Find out more**

Using green hydrogen – a test run

Hydrogen is hailed as a game changer for the energy transition. It could help solve many of the challenges we are currently facing with regard to climate change. However, handling hydrogen is not that easy. A team of researchers has now come up with a new system – Metha Cycle – to change that and a test run for the project has been launched.

Storing excess renewable energy as green hydrogen sounds like a straightforward idea, but it isn't. This is because we currently lack the infrastructure we need to safely store large amounts of liquefied hydrogen over long periods of time, transport it over long distances or distribute it.

The Metha Cycle project therefore has developed a virtually closed cycle which makes this possible. The researchers are relying on a tried-and-tested principle: they are using a catalyst to convert hydrogen and carbon dioxide (CO_2) into methanol. This is the first time that electricity from wind farms, electrolysis (the splitting of water into hydrogen and oxygen) and the artificial production of methanol are being directly combined. What makes this method so special is that in contrast to hydrogen, methanol – sometimes also called methyl alcohol – is less difficult to store.

Hydrogen is stored in the form of methanol

When contained in methanol, green hydrogen can be transported using the existing petrol and diesel infrastructure and stored over longer periods of time. Once the energy is needed, the methanol can be converted back into hydrogen and carbon dioxide and the hydrogen then converted into electricity. The analyses conducted by the team of researchers show that the amount of energy that is made available using the Metha Cycle technology is very similar to that made available by pure hydrogen. The idea to use methanol as a source of energy is not new. Every year, 70 million tonnes of the liquid – which is one of the alcohols – are produced, making it one of the most widely produced organic chemicals.

Methanol from climate-friendly sources

Marco Haumann, professor at the Erlangen-Nuremberg University, explains that what distinguishes Metha Cycle from other methods to produce methanol is that the carbon dioxide – one of the base substances for the reaction – is taken from industrial emissions or biogas plants. 'This means that not only is no additional carbon dioxide released, but also that carbon dioxide is removed from emissions and then stored', he says. Usually, fossil fuels such as coal, oil or natural gas are used to produce methanol.

The hydrogen is produced with the help of electrolysers. The energy for this is provided by wind farms. In the future, biogas plants could also be used to supply green hydrogen. The Metha Cycle project has developed a low-temperature catalyst to split the methanol back into hydrogen and carbon dioxide. This type of catalyst can be used at lower temperatures and requires less energy than conventional models. Finally, Metha Cycle uses its own fuel cell system for converting the hydrogen back into electricity. 'The carbon dioxide serves as a transport medium for the hydrogen and, if necessary, can be reused as many times as needed,' explains Henrik Junge, who is the coordinator of the Metha Cycle project.

Test run a great success so far

The researchers are very pleased with the results the test run of their demonstrator has yielded thus far. The demonstrator is highly energy efficient because it reuses the heat that is produced as a side product of the process of converting hydrogen into electricity in the fuel cell to produce more hydrogen. The catalyst the researchers use has one key advantage, as Marco Haumann explains. 'Our solid catalyst has a very high selectivity and only releases very small amounts of carbon monoxide. This means that less strain is put on the fuel cell, resulting in a longer life.'

In order for the Metha Cycle system to be used in practice, it needs to successfully complete the 500-hour test run. Only after the experts have analysed the results of the test will they be able to tell which improvements will be necessary. And more tests are planned: for example, the researchers seek to run Metha Cycle's methanol cycle by using highly efficient low-temperature fuel cells – which are particularly efficient.

New technology can be used in many different areas, researchers say

The researchers believe the Metha Cycle system can be used for a wide range of different applications. According to Haumann, the system could be used as a container solution by farmers or small businesses who operate large solar PV installations or wind turbines on their premises. 'In cases where energy generation exceeds demand, the surplus electricity can simply be converted into methanol and stored in tanks, and then be reconverted into electricity whenever necessary. This means more autonomy and lower costs. And it also takes some of the strain off the distribution network.'

FURTHER INFORMATION

[→ More information about the Metha Cycle research project can be found here (in German only)

Quote of the week

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'Gaseous sources of energy, including in particular hydrogen, will be key to the long-term success of the energy transition. In addition, the production of carbon-free and carbon-neutral hydrogen offers great potential for industry. We need to make use of this potential and take swift action so that Germany becomes the global leader on hydrogen technology.'

Peter Altmaier, Federal Minister for Economic Affairs and Energy, at the 'Hydrogen and the energy transition' conference at the beginning of November

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