

Underground Sun Conversion: work begins on construction of test facility in Pilsbach, Upper Austria

Subhead:

World-first research project headed by RAG will produce renewable natural gas from solar and wind power, 1,000m underground

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“A year ago we launched the Underground Sun Conversion project together with representatives of the federal government and the Austrian Climate and Energy Fund – a research project to produce gas naturally, and the only one of its kind in the world. The extensive preparations and planning are now complete, and construction of the test facility in Pilsbach, Upper Austria is beginning,” said Markus Mitteregger, Chief Executive Officer of RAG.

Construction of the Underground Sun Conversion test facility at Pilsbach in Upper Austria will start in early March at the same site where the forerunner project, Underground Sun Storage, was successfully carried out. “What we have achieved in the laboratory at the University of Natural Resources and Applied Life Sciences will now be tested in situ. Based on the research results so far, we are confident that we will soon be able to harvest natural gas, produced by us from solar energy, from the Pilsbach natural gas reservoir,” explained Mitteregger.

“Our research project is unique worldwide. It is like geological history in fast motion – and has massive potential. It is carbon neutral, solves the huge problem of storing renewable energy, and allows us to use infrastructure that is already in place. Additionally, it is highly environmentally friendly, because it recreates natural microbiological processes in a condensed form, and we can store the resulting renewable natural gas in exactly the same place that it is produced,” Mitteregger added, highlighting the project’s sustainability and environmental friendliness.

The test facility will have an installed capacity of approximately 10 MW (gas). Although not a lot in comparison to a commercial gas storage facility, this is comparable with the nominal power of a photovoltaic installation with an area of 65,000m².

Geological history in fast motion

The Underground Sun Conversion project will enable production of natural gas directly within a gas reservoir for the first time – using a microbiological process initiated specifically for this purpose by RAG – and storage of the gas in the same reservoir. This innovative method is unique worldwide, and recreates the natural process by which gas originates, while shortening it by millions of years by using an existing reservoir – geological history in fast motion.

First, hydrogen is produced from solar or wind energy and water in an above-ground facility, and then injected into an existing sandstone natural gas reservoir, together with carbon dioxide – creating a sustainable carbon cycle. At a depth of over 1,000 metres, in a relatively short time naturally occurring microorganisms convert these substances into renewable natural gas which can be stored in the same reservoir, withdrawn as needed at any time, and transported to consumers via the existing pipeline network.

This environmentally friendly process has three major advantages:

- **CO₂ neutral – sustainable carbon cycle**
Renewable natural gas is carbon-neutral when it is used, because carbon dioxide is introduced and captured in the production process. This creates a carbon cycle.
- **Renewable energy becomes storable**
Solar and wind power output fluctuates seasonally and due to changing weather conditions, meaning that production cannot be adjusted to demand. The problem of storing renewable energy is solved by converting it into renewable natural gas.
- **Existing infrastructure is used**
Infrastructure already in place can be used for the natural production process, as well as for underground storage in natural gas reservoirs, and environmentally friendly transportation to consumers.

Collaborative research project

The aim of the RAG-initiated project, implemented in collaboration with partners, is to carry out research into the principles for producing large quantities of renewable natural gas in the future using a carbon-neutral process, and storing it in environmentally friendly, naturally formed reservoirs, which will in turn provide urgently needed flexibility for renewable energy.

The Austrian federal government's Climate and Energy Fund has granted the Underground Sun Conversion project EUR 5 million in funding as a lead project in energy research. **The Austrian consortium is led by RAG.**

The project partners are the **University of Leoben**; the **University of Natural Resources and Applied Life Sciences, Vienna** (Department of Agrobiotechnology, IFA Tulln); **acib GmbH** (the Austrian Centre of Industrial Biotechnology); the **Energy Institute at Johannes Kepler University Linz**; and **Axiom Angewandte Prozesstechnik**.

The project is scheduled to be completed by the end of 2020.

Detailed information on the research project

In-depth research on methods to sustainably reduce carbon emissions is being carried out worldwide. As the shift to erratic renewable generation gathers pace, the need for storable forms of energy is greater than ever. There is a particularly strong need for energy sources with high energy density, such as methane/natural gas, that are used in industrial processes, to generate heat and to fuel heavy goods vehicles.

Research within the newly launched Underground Sun Conversion project aims to identify a process that will offer a way to produce high-density energy forms as well as finding a solution to the question of storage. Another objective is to make full use of the gas infrastructure already in place in many parts of the world. The starting point is power-to-gas technology, which converts excess power generated from renewable sources (wind or solar) into hydrogen and/or methane by means of electrolysis.

The goal of the research project is to use existing sandstone gas reservoirs as natural “reactors”. The methanisation process and storage take place naturally in an underground pore reservoir, representing a huge source of potential, and providing the urgently needed flexibility that renewable energy currently lacks.

The process replicates and repeats the natural process by which gas originates. Methanisation takes place naturally in existing underground reservoirs, but the process is shortened by millions of years.

Initial laboratory tests conducted as part of the forerunner project Underground Sun Storage – which was also supported by the Austrian Climate and Energy Fund – show that hydrogen injected into the reservoir with carbon dioxide is converted into methane by microbiological processes. This enables the creation of a sustainable carbon cycle. Laboratory tests, simulations and a scientific field test at an existing RAG reservoir will be carried out in collaboration with a group of project partners. A further objective is to test whether the outcomes can also be achieved at many other reservoirs all over the world. Consequently, the results that the project aims to achieve are highly significant to further enhancing Austria’s leading position in seasonal storage of renewable energy in natural gas reservoirs, and for the widespread export of both the technology and know-how underlying the process.

Further information on the project can be found at
www.underground-sun-conversion.at

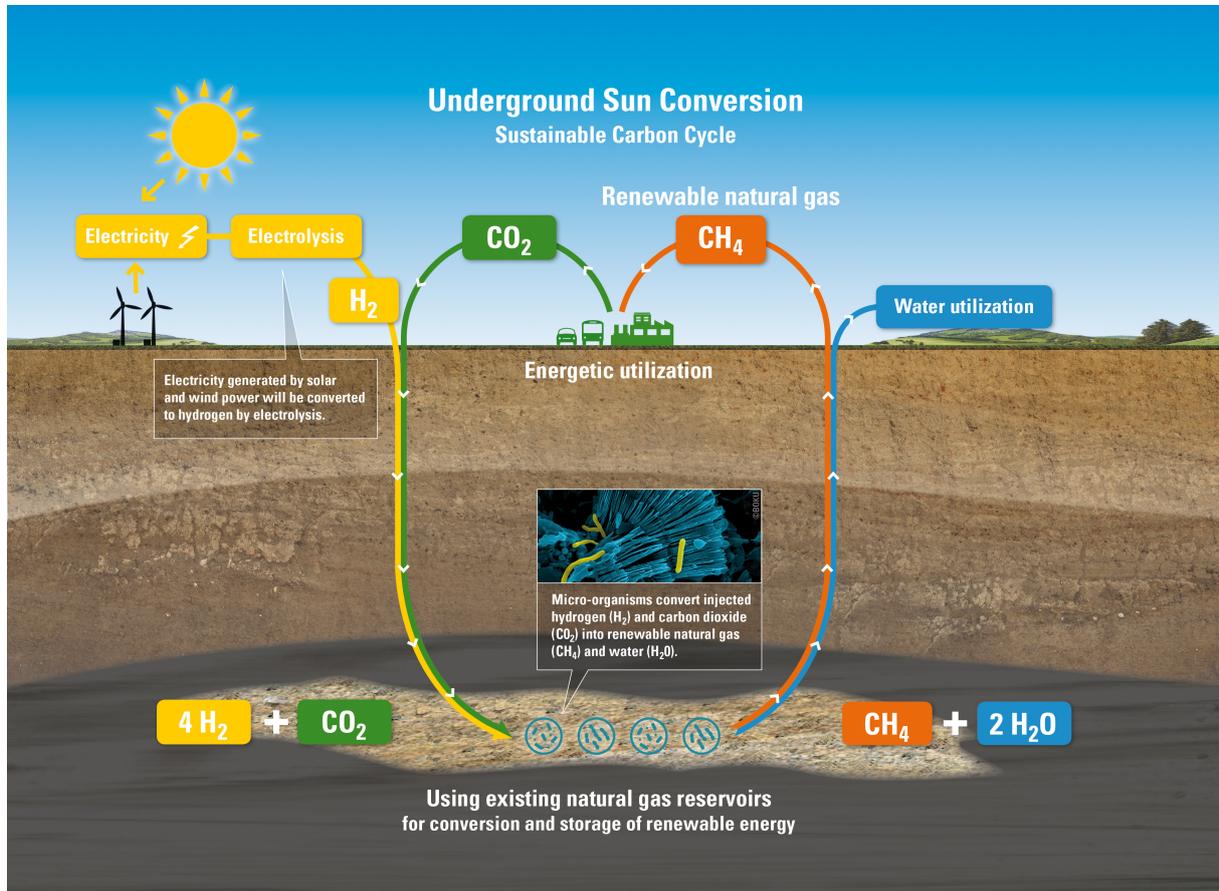
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Underground Sun Conversion: infographic



About RAG

RAG is a long-established innovative energy company. Its core business is gas storage, and it uses its extensive expertise in underground operations to develop sustainable energy solutions for the future. In particular, RAG develops new energy technologies through research into and production of renewable gas.

With storage capacity now totalling around 6 billion cubic metres, RAG makes a major contribution to security of supply in Austria and Central Europe as a whole, and is one of Europe's biggest storage operators. The company has developed and operates its own storage facilities at Puchkirchen and Aigelsbrunn, as well as the Haidach gas storage facility in a joint venture between RAG, Gazprom and Wingas, and the 7Fields storage facility in partnership with Uniper. Both of the latter facilities straddle the border between the provinces of Salzburg and Upper Austria. The company sees itself as a partner to renewables and also develops geothermal energy projects.

RAG is clearly focused on gas, an energy form that is highly versatile and has a bright future. Conventional natural gas, which will play an indispensable role in energy supplies in the future, is only one aspect of this focus. The other comprises green gas – biogas (or biomethane) made from waste products – and synthetic gas produced using power-to-gas technology. Gas already has a broad range of applications, underpinning safe, efficient and sustainable supplies of energy: gas is used to generate electricity and heat, and in transportation as compressed natural gas (CNG) and liquefied natural gas (LNG).

RAG is the lead company and biggest investor in the group that is undertaking the pioneering Underground Sun Conversion project. In addition to its long track record in developing, building and operating storage facilities, RAG will contribute the know-how and insights gained from the Underground Sun Storage project.