The new generation of energy storage

AUSTRIA AG
Renewables and Gas

UNDERGROUND SUN.STORAGE

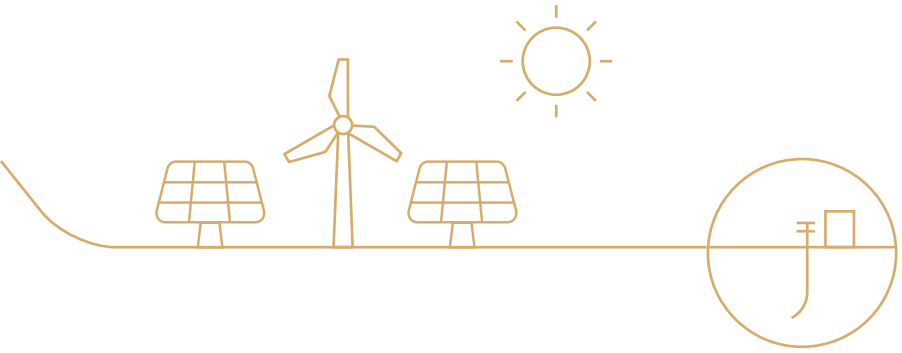
World's first geological hydrogen storage facility in a depleted natural gas reservoir

- Large-volume storage of hydrogen enables energy transition while maintaining security of supply.
- With "Underground Sun Storage", the world's first hydrogen storage facility in an underground porous reservoir, RAG Austria AG – Renewables and Gas – and its project partners are setting new international standards.
- In this unique cross-sector demonstration facility, solar energy is converted into green hydrogen by water electrolysis and stored in pure form in an underground natural gas reservoir in Gampern, Upper Austria.
- The scale of the storage corresponds to the summer surplus of about 1,000 photovoltaic systems on family homes. In summer, this surplus energy is stored and in winter the green energy can be provided again in the form of electricity and heat.

Two years after the start of the project, construction of the underground sun storage facility and the storage facility was completed in April 2023. In our pioneering demonstration facility, we will bring 4.2 million kWh (4.2 GWh) of summer electricity in the form of hydrogen into the winter and thus secure the supply of renewable energies.

We map the entire value chain and focus on a perfect interplay of generation, conversion, storage, and future utilization paths of green hydrogen. In the future, this geological storage facility will be able to convert the solar power surplus of around 1,000 family homes from the summer into hydrogen and store it seasonally.

In Gampern in Upper Austria we are demonstrating what is possible and necessary to ensure a secure supply of green energy throughout the year and thus enable the energy transition.



Energy world of today and tomorrow

2 MW water electrolysis in Rubensdorf

Securing the energy future – making renewables supply-secure

The pioneering work of RAG Austria and its partners is of utmost importance for companies, political decision-makers and authorities for the future transformation of energy systems.
The results of the “Underground Sun Storage“ demonstration project will make it possible to reposition gas storage facilities with their enormous storage volumes in the energy system of the future, also as hydrogen and green power storage facilities. Austria in particular has great potential with its ideal geological structures and existing modern storage capacities. This will make it possible to decouple the generation of renewable energy from immediate consumption and to enable year-round security of supply.

Project description

Store solar energy seasonally and on large scale in the form of hydrogen, use existing infrastructure – for a secure renewable energy landscape

In the lighthouse project "Underground Sun Storage 2030" (USS 2030), the safe, seasonal and large-scale storage of renewable energy in the form of hydrogen in underground gas reservoirs is demonstrated. In addition, all partners involved in the project will jointly gain valuable technical and economic knowledge for the development of a secure hydrogen supply.

In this research project, the only one of its kind in the world, renewable solar energy is converted into green hydrogen in a climate-neutral way by means of electrolysis and stored in a pure form in a depleted natural gas reservoir. Until 2025, interdisciplinary technical-scientific investigations for the energy future will be carried out under real conditions at a small former natural gas reservoir in the municipality of Gampern (Upper Austria) under the leadership of RAG Austria AG together with the project partners – Axiom Angewandte Prozesstechnik GmbH, Energie AG Oberösterreich, Energy Institute at JKU Linz (EI-JKU), EVN AG, HyCentA Research GmbH, K1-MET GmbH, Vienna University of Technology, University of Natural Resources and Life Sciences, Verbund AG, Verein WIVA P&G and voestalpine Stahl GmbH. A customized research facility was built for this purpose. These investigations will be complemented by the development of suitable processing technologies, the modelling of future energy scenarios and techno-economic analyses. The project is funded within the framework of the FTI initiative "Vorzeigeregion Energie" of the Climate and Energy Fund, endowed with funds from the Ministry of Climate Protection (BMK). "USS 2030" was successfully submitted within the framework of the "WIVA P&G" showcase energy region and is now starting.

"Innovative storage of renewable energy will play an important role on the path to climate neutrality by 2040. Climate-friendly innovations are an important tool for more climate protection overall. We support Austrian innovations that contribute to this goal and will be especially important in industry and in parts of heavy goods and air traffic.", says Climate Protection Minister Leonore Gewessler.

"Hydrogen is the missing piece of the puzzle for a completely CO_2-neutral energy system: it can be produced in a climate-neutral way, used directly in industry, produce environmentally friendly heat and electricity, and represent a fuel of the future. But the decisive factor is its large-scale storage and transportability in the existing almost invisible gas infrastructure. Only in this way will we have sufficient and, above all, demand-oriented green energy available even in times of low sun and low wind.", says RAG Austria CEO Markus Mitteregger, emphasizing the importance of energy storage in geological gas reservoirs and its distribution.

Hydrogen can be stored in natural gas reservoirs

The predecessor projects "Underground Sun Storage" and "Underground Sun Conversion" have already demonstrated that a hydrogen content of up to 20% can be stored in natural gas reservoirs in a well-tolerated manner. Laboratory tests suggest that the hydrogen content can also be increased to 100%.

Building on this, the project "Underground Sun Storage 2030" is now moving to the real scale and – under the leadership of RAG Austria AG – is investigating the storage of pure hydrogen, generated from solar and wind energy, in former natural gas reservoirs as part of a field trial. Together with renowned partners from industry and the Austrian research community, the project is also investigating other aspects related to stored hydrogen.

These include, for example:

- Hydrogen as a substitute for fossil natural gas
- Direct use in energy-intensive industries
- Processing requirements and technology
- Utilization possibilities of hydrogen with high purity

Hydrogen is indispensable for energy transition – bringing summer sun into winter

In order to be able to achieve the climate targets and a significant reduction in CO_2, actions are needed in the entire energy sector. In addition, affordability and security of supply must be maintained. Without gaseous energy carriers and the associated storage capacities, the energy transition is not possible.

Modelling of the future overall energy system shows that in Central Europe there will be a large surplus of renewable energy in the summer months due to the expansion of renewable electricity generation.

On the other hand, there will be a massive power shortfall during the winter months due to the lower solar radiation and the low water flow on the one hand and the significantly higher energy demand on the other hand.

In Austria, we therefore see an increased divergence between electricity supply and demand, both selectively and seasonally. The transmission system operator APG assumes a seasonal shift requirement of 10 TWh/a (terawatt hours per year) for 2030.

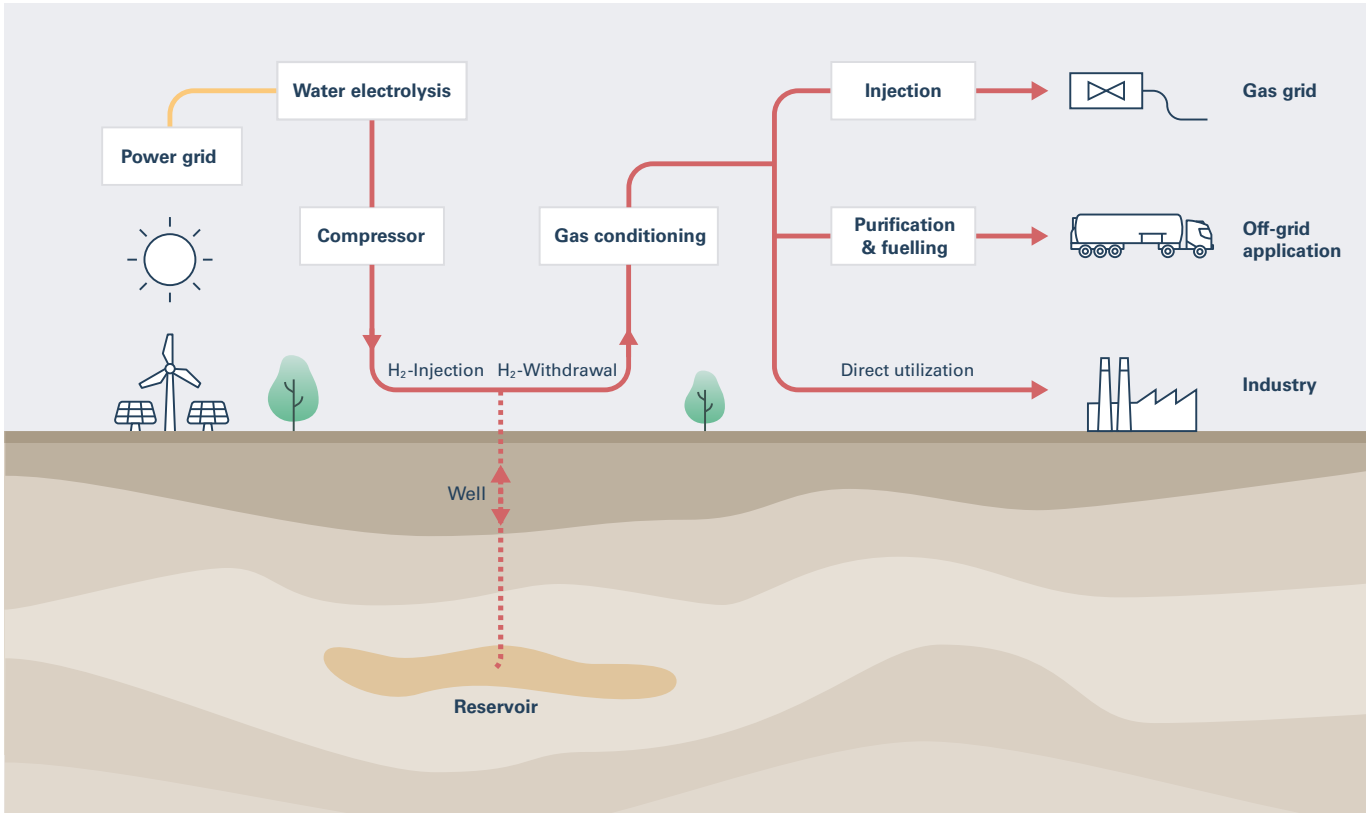
Project manager RAG Austria Stephan Bauer: *"The challenge of a secure power supply in winter becomes even more obvious as the electrification of the heating sector increases."*

It can be assumed that this power shortfall cannot always be easily covered by imports, as Austria's neighbouring countries are facing similar challenges. Energy must therefore be stored in large quantities (on the scale of several TWh) in summer so that sufficient green energy is available for electricity, heat and mobility in winter. Storable gaseous energy carriers, such as hydrogen, are an outstandingly suitable technology for covering this annual storage demand.

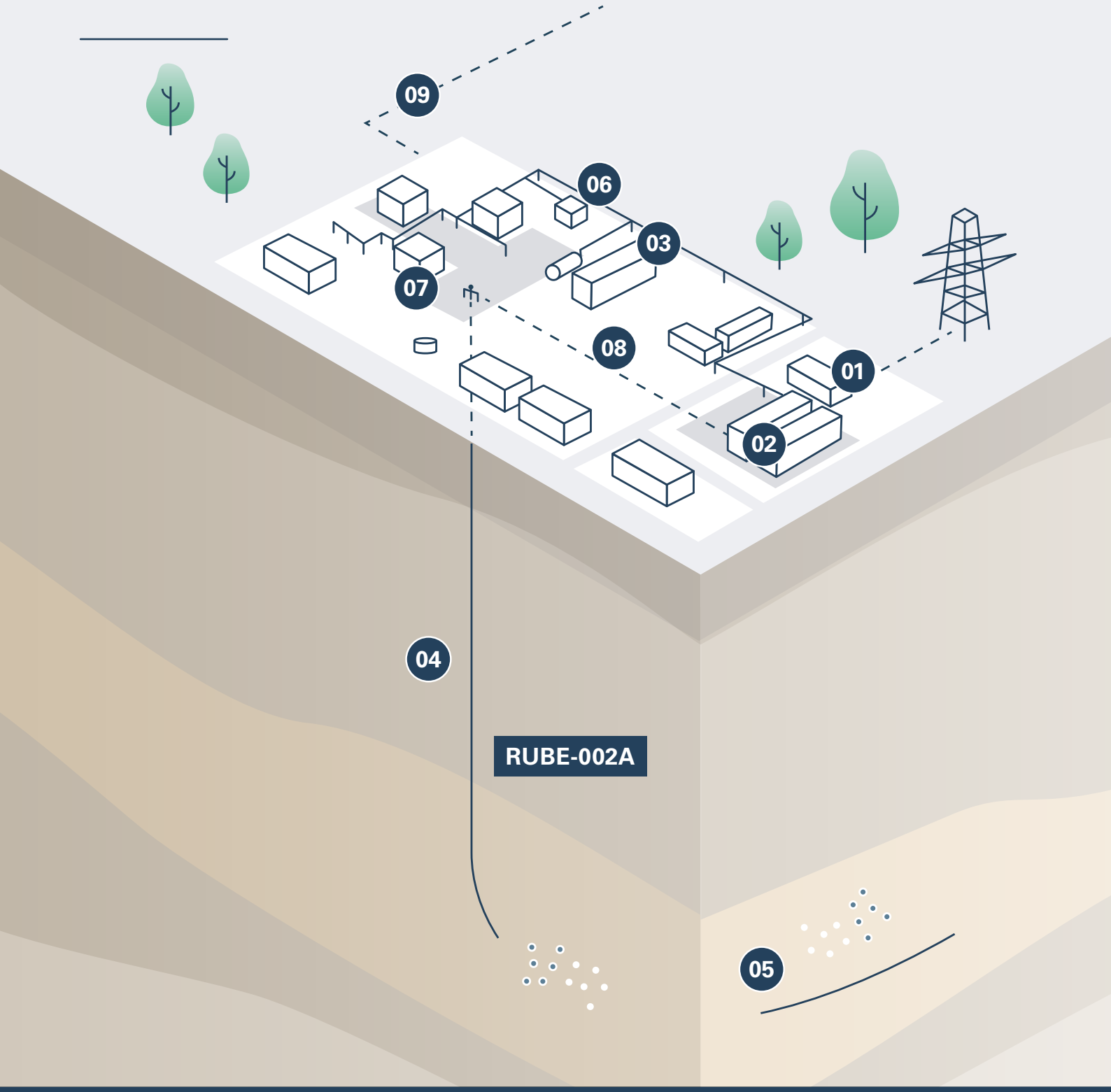
For a rapid and realistic conversion to a climate-neutral energy supply, it is therefore necessary to convert surplus solar and wind power into gaseous energy carriers such as hydrogen that can be stored in large volumes and seasonally.

Aiming to build a secure hydrogen economy

The worldwide unique project "Underground Sun Storage 2030" will provide valuable insights into the seasonal storability of renewable energy in the form of hydrogen, due to this large volume field test. It is part of the energy showcase region WIVA P&G and an important step for the development of a secure hydrogen economy. The use of underground gas storage for hydrogen storage is also included in the Long-Term Strategy 2050 – Austria according to Regulation (EU) 2018/1999 of the European Parliament and of the Council on the Governance System for the Energy Union and Climate Change. The project is funded under the Energy Research Program of the Climate and Energy Fund.



Plant Overview



01 Transformer station
02 Electrolysis
03 Compressor unit
04 Well
05 Porous sandstone reservoir
06 Drying unit
07 Gas quality measuring
08 Hydrogen purification
09 Hydrogen pipeline

Winter 2023

Description of the facility

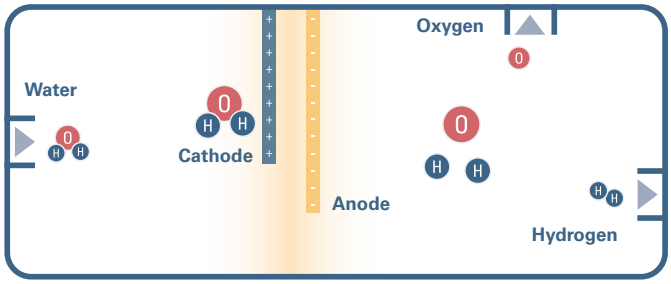
01. Electricity grid connection / Transformer station

The Underground Sun Conversion project is about storing renewable electricity by converting it into a storable energy source. The renewable electricity is sourced from a nearby hydroelectric plant via the power grid and transformed to the required voltage level via a transformer.

02. Electrolysis

This is where hydrogen is generated from electric power. After cleaning the well water through a reverse osmosis system, the water is decomposed into hydrogen and oxygen by green electricity. The hydrogen is transferred to the compressor. The oxygen is released as a by-product to the atmosphere.

The electrolysis of water consists of two partial reactions, which take place at the two electrodes (cathode and anode chambers). In this process a PEM electrolysis (= proton exchange membrane) is used.



Electrolysis

Electrical connection power::	2 MWe
Output:	400 m³ per hour
Transfer pressure:	30 bar
Efficiency: (electricity to hydrogen, for the whole plant incl. auxiliary equipment)	72 %

03. Compressor unit

To bring hydrogen to the required pressure to be able to inject it into the reservoir, a compressor is needed. This is where a so-called piston compressor machine is used.

04. Well

The injection and withdrawal in batch operation take place via a well, which is equipped with appropriate safety features.

05. Porous sandstone reservoir

Millions of years ago, natural gas reservoirs were created in the pores of the sandstone, which are sealed by more than 100 m thick clay layers. Here, large quantities of energy can be stored sustainably, safely and invisibly. In the Underground Sun Conversion project, the microbiological generation of renewable natural gas will be restarted, a process that took place exactly here millions of years ago.

Reservoir

Number of wells	1
Depth below surface	1,091.61 m TVD
Field extension	1.3 km x 0.75 km
Initial reservoir pressure	107 bar(a)
Porosity	16–25 %
Permeability	18–25 mD
Working gas	1.2 m Nm³

06. Drying unit

In a subsurface reservoir gas is absorbing moisture. Therefore, before the gas is distributed into the downstream systems and the pipeline network, a drying is required.

07. Gas quality measuring

Another step in the processing of the gas extracted from the reservoir is the measurement of the gas quality in order to meet the high standards.

08. Hydrogen purification

The hydrogen injected into the reservoir needs to be prepared for the various utilization paths when it is extracted and must therefore be purified again.

09. Hydrogen pipeline

In the course of the project, a hydrogen pipeline is being constructed to the RAG facilities in Gampern in 2023.

Sun and Wind = Gas

This will make it possible to economically transport and store the renewable solar and wind energy in large quantities and thus to have it available at all times.

Intermittent renewable electricity output is not the only problem. Something will also have to be done with all the surplus electrical power generated by giant wind and solar parks at times when demand is low. This surplus energy needs to be stored so that it can be made available during peak periods.

If we want 100% of the electricity generated in Austria to come from renewable sources, we will need storage facilities with a total capacity that is more than 100 times greater than the potential offered by pumped storage. (Source: Vienna University of Technology, ESEA/EA (ed.): 'Super-4-Micro-Grid', research project final report, Vienna 2011).

The combined capacity of pumped storage plants and battery storage used to date is far from sufficient. Additionally, such facilities can only release electricity. The answer is hydrogen.

Besides power generation, hydrogen can also be used for heating, in vehicles and as a raw material. The gas transportation and storage infrastructure in place already meets all the requirements, to be used in the future as a storage system for green energy.

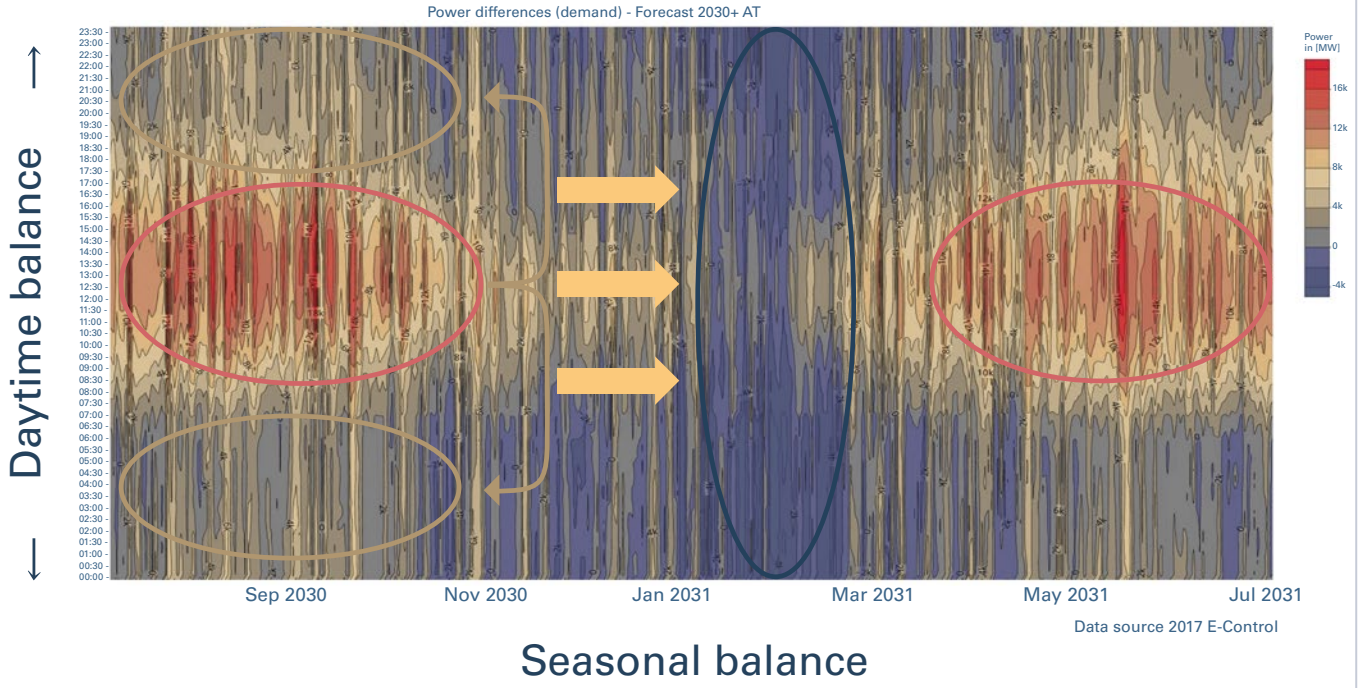
2030+ Residual scenario for power in Austria

I. Production
+ 12,000 MW over summer months

II. Daily Stabilization
between day and night

III. Large Scale Storage
Seasonal for winter demand

IV. Utilization
- 8,000 MW over winter months



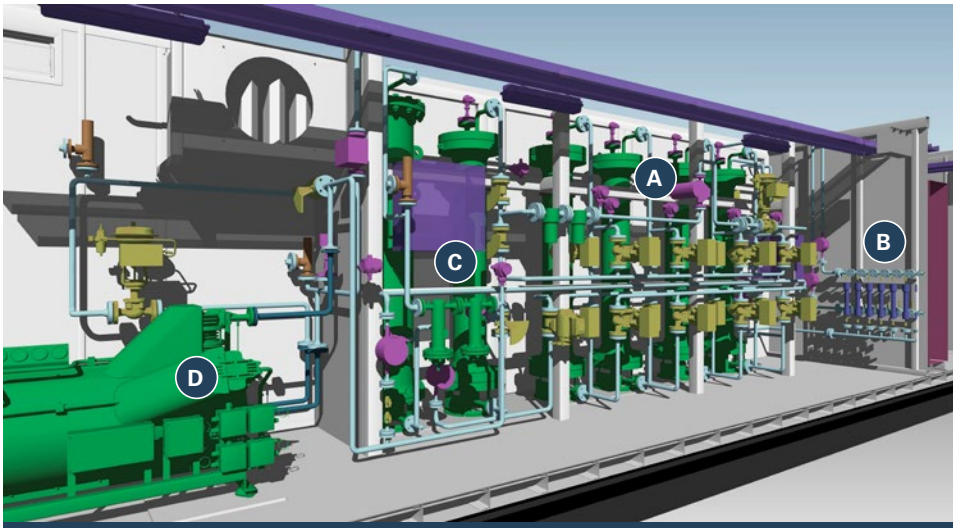
Varying purity and diverse utilization paths

Purification of hydrogen

An essential part of the utilization paths consists of the processing or purification of the gas mixture that is brought back to the surface. The project's goal is to find out what quantities of hydrogen are needed as cushion gas so that high-purity hydrogen can be recovered in an efficient operation in underground pore storage facilities.

Purity levels of hydrogen

Hydrogen can be used in different ways depending on its purity. In the use of hydrogen in fuel cells or in the production of semiconductors, a particularly high purity is required. In industrial processes for heat or other applications, however, the degree of purity required is relatively low.



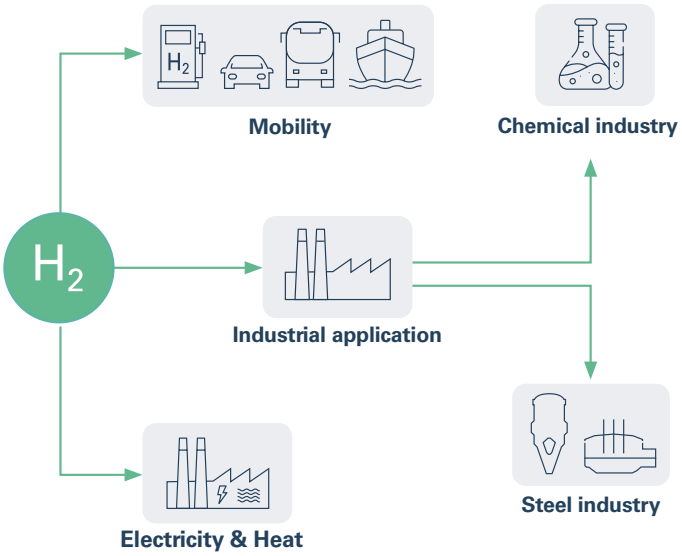
A Pressure swing adsorption
B Membrane unit
C Desulphurization
D Desorbate recompression

Description	H_2 - Purity
Hydrogen 3.5	≥ 99.95%
Hydrogen 5.0	≥ 99.9990%

The purity of hydrogen is indicated by designations that are common in the industry, such as 3.5 or 5.0. This allows the purity of hydrogen to be derived as a percentage. The first amount in the designation indicates the number of the digit 9 in the percentage (here: "99.9"). The second amount in the designation in the example (here: "5") defines the last digit in the percentage, here: "99.95". The designation 5.0 therefore stands for the corresponding purity of = 99.999%.

Purity levels: Hydrogen 3.5, Hydrogen 5.0, Hydrogen 6.0, Hydrogen 7.0

Various utilization paths



Chemical industry
In the chemical industry hydrogen is used, for example for the production of ammonia and methanol. Both chemicals are the starting basis for fertilizers, acetic acid and a variety of other substances.

Steel industry
The steel industry is dominated by coal and coke as reducing agents in the production of iron. In direct reduction plants natural gas is used to produce sponge iron, which is melted into steel in electric arc furnaces. In the long term, green hydrogen can replace fossil reducing agents and contribute quantitatively to decarbonization.

Project partners

RAG Austria AG

RAG is Austria's largest energy storage company, and one of Europe's leading gas storage facility operators. The company also develops leading edge energy technologies related to green gas and hydrogen that partner renewables. Our focus is the storage, conversion and demand-based conditioning of energy in gaseous forms.

This enables RAG to play a vital role in attaining Austria's ambitious climate goals, and in the sustainable stewardship of the country's raw material and energy supplies. Our goal is to provide our customers with safe, efficient, environmentally friendly and affordable energy and gas storage services – sustainably and responsibly.

Project goals

Field test and operational experience for field testing and in-depth know-how of hydrogen behaviour in natural gas reservoirs.

"Hydrogen is the missing piece of the puzzle for a completely CO_2-neutral energy system: it can be produced in a climate-neutral way, used directly in industry, produce environmentally friendly heat and electricity and represent a fuel of the future. But the decisive factor is its large-volume storage and transportability in the existing almost invisible gas infrastructure. Only in this way will we have sufficient and, above all, demand-oriented green energy available even in times of low sun and low wind.", says RAG Austria CEO Markus Mitteregger, emphasizing the importance of energy storage in geological gas reservoirs and its distribution.

Axiom

Axiom angewandte Prozesstechnik GmbH is a family-owned, medium-sized, technology-oriented company with a focus on separation technologies, in particular on the application of membranes for various gas and liquid separation processes. Axiom has developed and successfully commercialized numerous new separation processes such as biogas upgrading, hydrogen recovery and EOR systems. Company activities cover the entire process implementation: Basic engineering, process integration, detail engineering, construction, commissioning and service. In addition, Axiom dedicates a significant part of its work to applied research and development with the aim of offering optimized separation processes for the modern and sustainable energy industry.

Project goals

As part of the research activities in work package 5, Axiom is developing a new process for conditioning the stored hydrogen in close cooperation with the project partners Verbund AG and Vienna University of Technology. This is a hybrid process in the form of a combination of pressure swing adsorption and membrane. The ultimate goal of the work package is the implementation of the above-mentioned process at the RAG Austria gas storage facility.

"Hydrogen is the key to environmentally friendly and sustainable economic activity. Hydrogen produced by electrolysis can be stored in large quantities and is immediately available for metallurgy, mobility and chemical synthesis. Renewable generation and clever integration into diverse industries enable a successful transformation towards a modern, climate-neutral and competitive economy. With the Underground Sun Storage 2030 project, we are making a major contribution to this by demonstrating new ways of achieving the desired circular economy."

Energie AG

Energie AG Oberösterreich is a modern and efficient energy and services group. As a provider of electricity, gas, heat, water as well as waste management and ICT services, Energie AG stands for the highest quality and reliability of our products, processes and services. As a competent and competition-oriented company, customers are offered a fair price/performance ratio and regional availability, which ensures a cooperative relationship with customers, employees, suppliers and the public.

Project goals

Energie AG Oberösterreich is responsible in the "Underground Sun Storage 2030" project for enabling the feed-in of the generated, stored and purified hydrogen into existing natural gas grids. In doing so, it is necessary to create the conditions to meet the legal, normative and regulatory requirements. Energie AG Oberösterreich supports the project goals through its work package, which includes setting up the necessary equipment and calculation models for this.

"The storage of surplus renewable energy from the summer months will hold a key position in the decarbonization strategy. Hydrogen technology represents an ideally suited solution for this purpose. The Underground Sun Storage 2030 project will also demonstrate that feeding hydrogen into existing gaseous energy networks is necessary and feasible."

Energy Institute at the Johannes Kepler University Linz

As an interdisciplinary research institution the Energy Institute at JKU Linz (EI-JKU) has comprehensive competence in the fields of energy law, energy economics and energy technology can look back on many years of intensive research in the field of power-to-gas. During this time the Energy Institute has built up extensive expertise in techno-economic and ecological assessment as well as legal analysis in connection with the development of power-to-gas value chains. This know-how is rounded off with the competence to carry out qualitative environmental analysis to develop recommendations for action for successful technology implementation.

Project goals

The Energy Institute pursues the following goals in the project:

- Qualitative analysis of existing barriers and opportunities for the implementation of large-scale H_2 storage.
- Development of use cases for large-volume H_2 storage in the energy system of the future.
- Evaluation of techno-economic feasibility and economic relevance.
- Analysis of the regulatory and legal aspects.

"Large-volume H_2 storage will ensure security of supply with renewable electricity and thus contribute to decarbonization. In order for this to be successful, in addition to the technical feasibility, the answer to the question of an advantageous systemic integration of large-volume H_2 storage into the energy system is also central."

Project partners

EVN AG

EVN is a leading, international, listed energy and environmental services company based in Lower Austria, the largest Austrian federal state.

In its home market, EVN offers electricity, gas, heat, drinking water supply and wastewater disposal as well as thermal waste utilisation "from a single source" on the basis of state-of-the-art infrastructure. The product range also includes the operation of cable TV and telecommunications networks as well as the provision of various energy services for private and business customers and municipalities.

Around 4.8 million customers relied on the secure supply of energy and environmental products and services from EVN in the 2019/20 financial year.

Project goals

With this project we want to show that "green gas" is an energy source with a future. Because the end of natural gas does not necessarily mean the end of gas. "Green gases" (including hydrogen) not only offer the possibility of saving CO_2 in sectors that are otherwise very difficult to decarbonize via sector coupling, "green gases" enable the use of infrastructure that use the infrastructure that has been built over decades.

"We are already well on the way to expanding renewable energies. Important building blocks on the last few metres are the storage facilities. While day/night fluctuations can already be balanced with batteries today, innovative solutions are still needed for seasonal storage. The conversion of surplus solar and wind power into large-volume and seasonally storable gaseous energy carriers such as hydrogen can make a major contribution here."

HyCentA Research GmbH

For more than 15 years, HyCentA has been involved in the research and development of hydrogen technologies. 45 experts in the fields of mechanical engineering, chemistry, physics, electrical engineering, process engineering and industrial engineering cooperate with industry and research in national and international projects for the production, distribution, storage and applications of hydrogen. Areas of activity include research, engineering, simulation and testing of electrolysis technologies, gas storage systems, fuel cells, refuelling, measurement and safety systems. State-of-the-art R&D infrastructure includes test benches up to 1,000 bar, a refuelling facility for cars, buses/trucks and the fuel cell test bench up to 160 kW.

Project goals

HyCentA will contribute its many years of experience for the planning, simulation and operating strategy of hydrogen production by electrolysis. In addition to safety aspects, this also includes optimizing costs and efficiency in the context of the overall plant. A technical and economic analysis will improve the understanding of future plants and determine influences on availability, service life and costs.

"Hydrogen will play a crucial role in the future energy supply. HyCentA sees itself as a reliable partner of the industry to drive systemic and technological improvements and support the transformation towards a climate-neutral hydrogen economy."

K1-MET GmbH

K1-MET is one of the leading international metallurgical competence centers for ferrous and non-ferrous metallurgy based in Austria. The cooperation partners are renowned national and international partners and deal with topics such as energy efficiency, circular economy and climate-neutral metal production. Only through cooperative research in these technological areas can resource efficiency and product quality be increased. In addition, the K1-MET GmbH is committed to global climate goals. Topics such as increased use of renewable energy or decarbonisation must remain in focus in order to reduce CO_2 emissions and achieve climate goals.

Project goals

After the extraction of the hydrogen-gas mixture from the depleted natural gas deposit, the direct use of this mixture without further processing will be tested. A possible field of application is the use as a reducing agent in iron and steel production. For this purpose, pilot plant trials are being carried out and process simulations are being used to support this.

"One focus of our research is hydrogen-based steel production. Not only does the sustainable production of hydrogen play a role here, but also storage to ensure a continuous supply. Therefore, USS 2030 is of utmost interest for us to test depleted natural gas deposits as storage for hydrogen."

Vienna University of Technology

The Vienna University of Technology is Austria's largest research and educational institution in the field of technology and natural sciences. More than 4,000 scientists are researching "technology for people" in five main research areas at eight faculties. The content of the studies offered is derived from the excellent research. More than 27,000 students in 55 degree programmes benefit from this. As a driver of innovation, TU Vienna strengthens the business location, facilitates cooperation and contributes to the prosperity of society. The participating institutes have many years of project experience and their research focus in the fields of renewable energies, circular economy and hydrogen.

Project goals

At the TU ICEBE, a highly flexible, innovative hydrogen treatment process for the discharged storage gas is to be tested and dimensioned on a laboratory scale. The findings will serve as the basis for the design and construction of a demonstration plant directly at the gas storage facility.
At the TU EEG, various medium-term electricity supply scenarios will be modelled and seasonal operating strategies for the electrolyzer will be developed from them.

"By participating in this Austrian lighthouse project, the researchers at TU Wien are pleased to make an important technological contribution to the European Green Deal and the goal of developing hydrogen as a central element of a decarbonisation strategy for the energy sector and the entire Austrian economy."

Project partners

University of Natural Resources and Life Sciences

Department of Agrobiotechnology, IFA Tulln
Institute of Environmental Biotechnology

At the IFA-Tulln, University of Natural Resources and Applied Life Sciences Vienna, microbial metabolic pathways are researched to safeguard the quality of life and preserve natural resources. The institute has well-equipped laboratories with state-of-the-art analytical equipment and corresponding infrastructure such as anaerobic high-pressure reactors and incubators, large-scale test facilities and a pilot plant for fermentations. These prerequisites enable numerous research cooperations with industrial partners and successful implementation of scientific results.

In the Department of Geobiotechnology (Andreas P. Loibner), microbial processes that occur naturally in soils, aquifers and oil/natural gas reservoirs are investigated with regard to technical applications. Metabolic capabilities and interactions of specific microorganisms are systematically analyzed and optimized for large-scale technical application.

Project goals

Within the framework of "Underground Sun Storage" and "Underground Sun Conversion", a well-founded portfolio of methods was developed, which is now being used for microbial monitoring within the framework of "USS 2030". The data collected from laboratory and field tests should enable conclusions to be drawn about potential microbial processes during the underground storage of hydrogen in order to be able to further formulate optimal process parameters for the loss-free storage of this energy carrier.

"Seasonal storage of renewable energy is a key element for a sustainable and climate-friendly energy supply. Underground storage facilities offer enormous storage capacity for gaseous energy carriers such as hydrogen. A comprehensive understanding of microbial processes in storage is a prerequisite for the safe use of existing capacities."

Verbund

VERBUND is Austria's leading energy company and one of the largest producers of electricity from hydropower in Europe. The Group generates around 95% of its electricity from renewable energy, primarily from hydropower. VERBUND trades electricity in 12 countries and generated around €3.2bn in annual revenue in 2020 with approximately 2,900 employees. With its subsidiaries and partners, VERBUND is active in the generation of electricity, transmission and in international trading and sales. VERBUND has been listed on the Vienna Stock Exchange since 1988 with 51% of the share capital being held by the Republic of Austria.

VERBUND is the key player for the success of the energy transition in Austria. The challenges that have to be met call for a unified focus throughout the entire company, which VERBUND is driving forward with Mission V. Mission V is a long-term and comprehensive transformation program and stands for the will to confront the climate crisis as a force for change. This program is based on the VERBUND Strategy 2030 with its three pillars: Strengthening the integrated home market, expanding renewable energies in Europe and establishing itself as a European hydrogen player. With Mission V, VERBUND is pushing the achievement of the strategic goals 2030 and ensuring their implementation.

Project goals

VERBUND is in charge of WP 5 (development of hydrogen processing). In cooperation with the project partners Axiom and Vienna University of Technology, this involves the processing and conditioning of hydrogen for use by potential industrial customers. VERBUND is involved in five further work packages, which are mainly concerned with the engineering, construction and operation of the electrolysis plant, with the reliable supply of hydrogen to resource-intensive industries, as well as with the modelling of electricity generation and the modes of operation of the electrolysis. The development of a model for the implementation of seasonal storage in the future energy system deserves special mention.

"With the USS 2030 project, we are generating knowledge on the processing and conditioning of hydrogen from from porous subsurface reservoirs for use by potential industrial customers. And we are gaining new knowledge about seasonal storage in an energy system that is supplied 100% from renewable sources.", says Robert Paulnsteiner.

voestalpine Stahl GmbH

voestalpine Stahl GmbH is the lead company of the Steel Division of the voestalpine Group. As a globally active manufacturer of high-quality steel products, the Steel Division plays a driving role in shaping a clean and livable future. In steel production, the Steel Division sets benchmarks in the current production route and is pursuing an ambitious step-by-step plan for climate-neutral steel production with greentec steel. With its high-quality steel strip, the Steel Division is the first port of call for renowned auto manufacturers and suppliers worldwide. It is also one of the most important partners to the European domestic and engineering industries. For the energy sector it produces heavy plate and cast products for applications in the most difficult conditions and offers tailored solutions for the expansion of renewable energy.

Project goals

For voestalpine, the possibility of using the stored hydrogen for "green steel production" is of great importance. In the project, the gas flows generated will be examined in this regard, with the aim of developing a concept for optimal large-scale use.

The future hydrogen infrastructure places high demands on the materials required. The project also aims to find and evaluate suitable steel grades for this purpose.

"With greentec steel, voestalpine has a clear plan to decarbonize steel production: in a first step – starting in 2027 – the existing blast furnace process will be partially replaced by a hybrid electric steel process, and subsequently the use of green hydrogen in the steelmaking process will be gradually increased in order to be able to produce CO_2-neutral steel by 2050. The Group is conducting research into various technologies, and the "USS 2030" project will also provide important findings for this."

WIVA P&G

The research association WIVA P&G (Hydrogen Initiative Austria Power & Gas) has set itself the task of promoting climate-neutral hydrogen and green gases in Austria. An important point here is to coordinate the showcase energy region of the same name. As a central energy storage region, energy transport hub and important location for renewable energy sources, Austria is ideally suited as an energy model region.

In the coming years, WIVA P&G will demonstrate how Austrian technologies tested on the domestic market can contribute to the reduction of greenhouse gases and thus not only serve the Austrian economy as an export success, but also make a significant contribution to the global reduction of greenhouse gas emissions (www.wiva.at).

"Due to the increasing production of fluctuating electricity from wind and sun, there is a need for annual balancing in the power supply. Energy storage in the form of molecules, and here especially hydrogen, is well suited for this. The USS 2030 project is an important step towards the long-term storage of electricity from renewable energies in order to create the seasonal balance.", says Horst Steinmüller.

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