THE CONSORTIUM

MONTANUNIVERSITÄT LEOBEN
Austria

Chair of Subsurface Engineering
www.subsurface.at

Industrial Liaison Department
www.ausseninstitut-leoben.at

SINTEF
Norway

Department of Polymer and Composite Materials
www.sintef.no

ETH Zürich
Switzerland

Professorship of
Renewable Energy Carriers
www.ethz.ch

HBI Haerter GmbH
Germany

www.hbi.eu

BAYERISCHES LASERZENTRUM
Germany

System Technology
www.blz.org

GE Power
Switzerland

www.ge.com

ACONDICIONAMIENTO TARRASENSE ASSOCIACION (LEITAT)
Spain

Sustainability Unit
www.leitat.org

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www.ricas2020.eu

Design Study for the European Underground Research Infrastructure related to Advanced Adiabatic Compressed Air Energy Storage

RICAS
- 2020 -

THE CHALLENGE

Challenges like climate change, economic, social and sustainable development as well as security are closely linked to the energy supply of European societies. According to the climate related key targets of the European Union at least 27% of EU gross final energy consumption shall come from renewable energy sources by 2030. The challenge of RICAS2020 is given by intermittent renewable energy sources like solar or wind energy which require energy storage to time shift the produced energy to times where high demand exists.

The RICAS2020 Design Study for the European Underground Research Infrastructure related to Advanced Adiabatic Compressed Air Energy Storage (AA-CAES) will provide concepts to set-up a research infrastructure dedicated to underground storage of very high amounts of green energy. The big advantage of the new concepts will be that the underground energy storage can be performed independently from the encountered geological conditions.

> 27% of EU gross final energy consumption shall come from renewable energy sources by 2030

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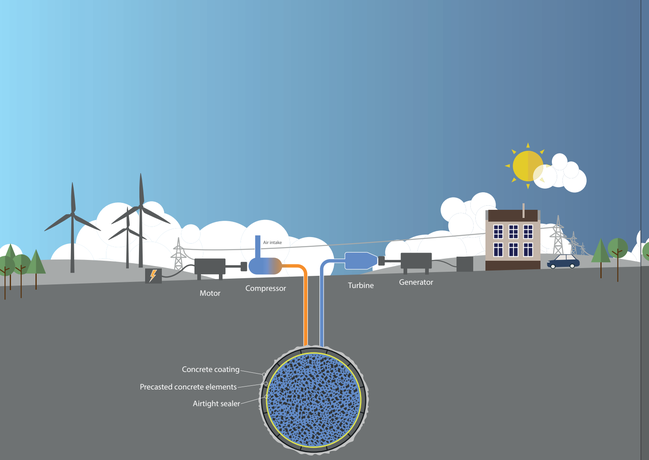


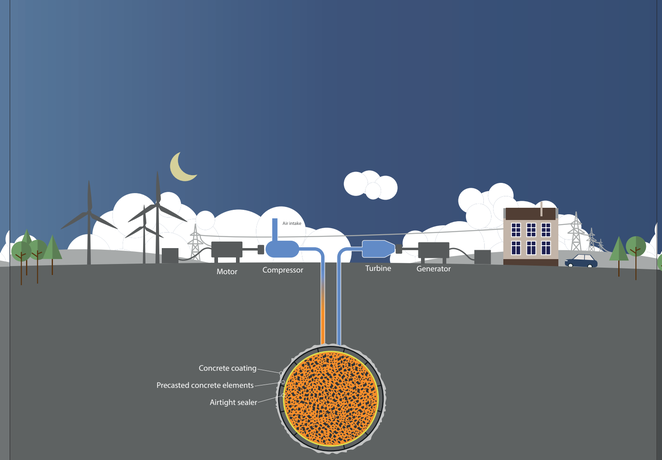
THE RICAS2020 APPROACH

The Design Study RICAS2020 aims to create an underground large-scale research infrastructure for Advanced Adiabatic Compressed Air Energy Storage of European interest.

AA-CAES collects the heat produced by compression and returns it to the air when the air is expanded to generate power and thus delivers higher efficiencies via a zero-carbon process. The Design Study RICAS2020 will provide concepts on the key criteria of the technology and focuses on technical, legal, institutional and financial requirements of such a research facility.

DESIGN CONCEPT

The RICAS2020 design concept is in a first step based on a small-scale test facility with an estimated power output of 5 MW. The power output, together with the operating time, determines the size and design/dimensions of the cavern system. These parameters constrain the capacity of the pressure cavern and the TES (thermal-energy storage) units.

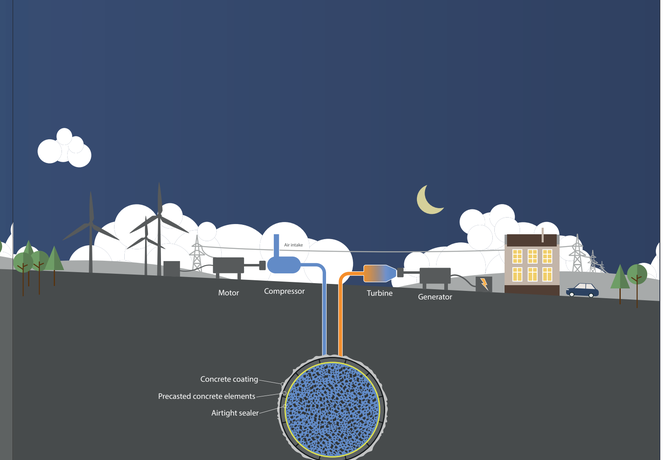


RICAS2020 MAIN OBJECTIVES:

By bringing together the leading researchers and research organisations with long-term experience in the area of thermal storage design with researchers who will introduce very new and innovative aspects of underground construction including materials, innovative excavation methods and environmental impact, an advanced, integrated and therefore cost-efficient concept and approach of building AA-CAES caverns resistant to high temperature and high pressure will emerge.

THE MAIN OVERALL GOALS OF THE DESIGN STUDY ARE:

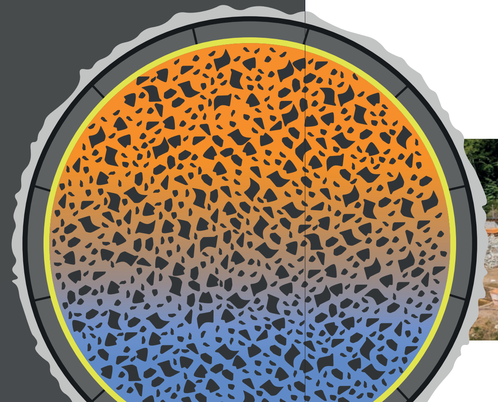
- Aggregation of long-term international expertise and know-how to form a common understanding and knowledge of Compressed Air Energy Storage to promote the development of renewable energy technologies and to increase the (public) awareness of energy issues.
- Providing a first step to a unique underground research infrastructure in order to find economic solutions for the storage of heat in excavated materials and to create high-capacity and high-efficient underground structures for AA-CAES, which can later on also be developed close to big cities and to other high capacity energy consumers like industry.
- Enabling realistic conditions for research on questions of thermo processing, thermodynamics, high-temperature and high-pressure resistant lining materials as well as security and safety of Compressed Air Energy facilities.



RICAS2020 MAIN INNOVATIONS:

- **Location free:** the underground air storage can be located anywhere – no limitation on the geological conditions
- **Efficiency:** high round-trip system efficiency by using a thermal-energy storage (TES) system and machinery optimization

> The main aim of RICAS2020 is to achieve high energy storage efficiencies independently from geological conditions.



ABOUT RICAS2020

BENEFITS

On the long run the main goal of the planned RICAS2020 research infrastructure is to bring AA-CAES very close to big cities and large consumers of energy like industry; thus it is essential to be able to

- install the AA-CAES completely underground to avoid the obstruction of floor space;
- design the necessary underground structures in a most economical way for a cost efficient solution to store high amounts of energy e.g. by reusing part of the tunnel/cavern excavation material directly in the cavern to store the heat and to build up the lining;
- to excavate the underground structures in a safe way without producing significant amounts of vibrations, noise and dust.

LOCATION

RICAS2020 will be located as an extension of the independent underground research infrastructure "research@ZaB" in Eisenerz, Austria.