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# **REPP-CO2** – Czech-Norwegian research project to prepare a CO, storage pilot in the Czech Republic

#### INTRODUCTION

REPP-CO2 is a Czech-Norwegian research project focusing primarily on the development of the CO<sub>2</sub> geological storage technology in the Czech Republic. The project represents a major step in the advancement of the Technology Readiness Level (TRL) of CO, geological storage in the Czech conditions from TRL4 (technology validated in laboratory) to TRL5 (technology validated in relevant environment). For CO<sub>2</sub> storage, TRL5 means its validation by means of a pilot project in geological settings similar to possible future commercial storage sites.

The project builds on a long-term partnership between the Czech Geological Survey and the International Research Institute of Stavanger that form the core of the project consortium. This comprises five more Czech institutions, mostly research-oriented, with complementary competences. In total, more than 100 researchers and technicians from 7 institutions participate in the REPP-CO2 project.



General overview and distribution of oil and gas fields in the Circum-Carpathian Region of Central Europe (Golonka & Picha 2006); Vienna Basin marked by a circle

#### PROJECT OBJECTIVES

The main project objectives include:

- Assessing the selected geological structure (a depleted and recently abandoned oilfield) as a possible geological storage site for a research CO<sub>2</sub> storage pilot project, utilising the methodology according to the Czech national law No 85/2012 Coll. on the storage of carbon dioxide in natural geological structures (equivalent to the EU CCS Directive);
- Strengthening the Czech-Norwegian cooperation in the area of CO<sub>2</sub> geological storage and related research and development that was initiated from our previous TOGEOS research collaborative effort, which investigated the feasibility of storing CO<sub>2</sub> in deep saline aquifers in the Czech Republic;
- Testing the methodology, procedures and criteria for the description and assessment of a planned CO<sub>2</sub> storage complex as specified by the law No 85/2012 Coll. on the storage of carbon dioxide in natural geological structures under real (field) conditions of a concrete storage site preparation;
- Integrating existing geological, geophysical, well, reservoir data and knowledge into deve-

#### MAIN PROJECT COMPONENTS

The core part of the project focuses on the first preparatory phase of the research pilot project on CO, geological storage. This consists of obtaining the necessary data (geological, geophysical, well log), constructing a three-dimensional geological model of the storage complex, subsequently conducting a dynamic modelling of the storage complex behaviour during the site's operational (CO<sub>2</sub> injection) phase and post-injection one, executing a risk analysis, and compiling a monitoring plan. In future stages of the pilot project development, these outcomes will be used – after any necessary replenishment – as a basis for a future Storage Site Permit Application.

Further project activities focus on methodological research on important aspects of CO<sub>2</sub> geological storage, professional capacity building at Czech project partner institutions, and knowledge dissemination activities.

All project results including legacy and newly gathered data, maps, models, text reports, etc., will be stored into the project's geo-database, in a transparent and structured manner, so that they are ready for further utilisation in subsequent stages of the pilot project development.

### LEGACY WELLS

More than 100 legacy wells exist in the vicinity of the LBr-1 site. All these wells have been abandoned, and some of them are currently subject of a re-abandonment procedure. In any case, the archive well data and cores represent important input to the construction of the static geological model that will be performed in the second activity of the project.



loping an upgraded geological (static) model of the storage site;

- Conducting laboratory measurements and modelling to investigate rock/fluids interactions in terms of geochemical evaluations and geomechanical behaviour of both the storage formation and overlaying cap rock;
- Utilizing the new static model to developing a dynamic full-field simulation model that integrates geomechanical and geochemical knowledge (data) that will be used to history match the past field performance using available production data and subsequently apply it to conduct numerical simulation studies of CO<sub>2</sub> injection into the given oilfield;
- Performing a risk analysis of the storage site, including assessment of conflicts of interest, proposal of risk mitigation measures and compilation of storage site monitoring plan;
- Developing a monitoring program to monitor the post-CO<sub>2</sub> injection storage site behaviour to identify timely any potential unwanted CO<sub>2</sub> leakage out of the geological storage formation;
- Modelling any unwanted potential CO<sub>2</sub> leakage to overburden strata either through an existing abandoned wellbore or through the cap rock and assess any risks of contaminating potable water resources or reaching the atmosphere;
- Re-assessing the potential of the Czech Re-

## STORAGE SITE



3D image of selected legacy wells penetrating the LBr-1 field with marks showing available cores and their quality

The LBr-1 site, chosen for the prepared storage pilot, is a depleted hydrocarbon field situated in the Vienna Basin, in the south-eastern part of the Czech Republic. The research geological target for CO<sub>2</sub> storage is the Miocene (Badenian and Sarmatian) oil- and gas-bearing sandstone sediments that were exploited for oil and gas production in the 1960s – 1970s, as well as the adjacent saline aquifer. The reservoir is laterally bound by impermeable faults, while on

Example of processing of a typical legacy well data for sequence stratigraphy analysis and models of the field

#### MODELLING AND SIMULATIONS

A static three-dimensional geological model of the storage complex will be developed, with a particular focus on the storage reservoir properties, using the existing well and geophysical data, geological interpretations and reservoir information. The model will cover the whole storage complex, i.e. the target storage formation, the overlying caprock horizons and surrounding formations, in particular communicating aquifers, the local fault system, etc. The subsequent dynamic modelling will analyse the dynamic behaviour of the planned storage site during and after carbon dioxide injection. The assessment will involve dynamic modelling and a simulation of carbon dioxide injection into the reservoir and post-injection behaviour of the gas in time. In addition, the changes of the reservoir's properties and parameters will be analysed and a sensitivity analysis conducted.







