TRANSGEO - Transforming abandoned wells for geothermal energy production

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Abstract

TRANSGEO is a regional development project that aims to explore the potential for producing geothermal energy from abandoned oil and gas wells in Central Europe. Supported by 11 Partner organizations and 10 Associated Partners in 5 countries, TRANSGEO will develop a Transnational Strategy and Action Plan to address this technical and economic opportunity. The project Partners will start by identifying and characterizing thousands of abandoned wells in the North German Basin, the South German Molasse Basin, the Vienna Basin, and the Pannonian Basin. A web-based Well Selection Tool will then be developed to assess the wells’ suitability for 5 thermal storage and energy production technologies. These activities will be supplemented by modelling and pilot studies at sites with existing wells and data, to inform the Well Selection Tool and validate Well Reuse Procedures that will be developed for each reuse technology. Next, we will match well reuse potential with local energy demand and heating networks to highlight redevelopment priorities, with a focus on wells that could support rural communities and industries in the energy transition. Finally, the partnership will propose a legal policy and incentive framework to facilitate and expand reuse of abandoned wells for geothermal energy production and storage across the region. TRANSGEO is co-funded by the European Commission’s Interreg CENTRAL EUROPE programme.

1. Introduction

Large amounts of oil and gas have been produced in Central Europe from thousands of deep wells, but after decades of production, many of the hydrocarbon wells are abandoned now or will be abandoned in the near future. The declining hydrocarbon industry leaves behind an enormous infrastructure and thousands of highly skilled workers, especially in rural areas facing economic and social challenges. Instead of abandoning unused wells, this valuable infrastructure can be used for geothermal energy production and heat storage to support local communities and industries in the energy transition. However, this potential is largely underutilised due to economic uncertainties and non-technical barriers.

The European Union-funded regional development program Interreg CENTRAL EUROPE (CE) seeks to support projects that unite and strengthen Central Europe, an area which has been long divided by the “Iron Curtain.” To make the energy transition, reduce greenhouse gas emissions, and find a new life for old oil and gas wells in the region, the TRANSGEO project seeks to determine the potential for development of geothermal energy from abandoned hydrocarbon wells in Central Europe. By addressing these challenges through cross-border collaboration, TRANSGEO meets the

Interreg CE priority of cooperation for a greener Central Europe and supports the program's objective to support the energy transition to a climate-neutral Central Europe. Transnational cooperation is indispensable because the technological, legislative, economic, and social challenges related to structural change and the heat transition are very similar in our project countries, and the expertise of project Partners operating in science, industry, regional development, and regulation is essential for development of joint innovative well repurposing solutions.

TRANSGEO will provide information and tools to match local energy and heat demand with old wells, so that cities and businesses, including industry and agriculture, can reuse abandoned wells with increased knowledge, thus lowering financial and technical risk. The knowledge produced and the cross-border partnerships that we are developing will increase the capacity for well reuse in Central Europe and ideally accelerate geothermal development across the region. TRANSGEO will help organizations determine which wells are good candidates for reuse, which geothermal technology fits the well and the local needs, and the financial implications of a reuse project. We seek to contribute the expertise we gain through TRANSGEO and share the knowledge we create to facilitate well reuse and geothermal development in the region.

2. Motivations

Why should abandoned oil and gas wells be considered for geothermal development? There are three primary reasons. First, there are tens of thousands of old oil and gas wells in the 5 countries of our project (Germany, Austria, Hungary, Croatia, and Slovenia; Kurevija and Vulin, 2011; Jordan et al., 2022). Reusing abandoned wells certainly presents challenges of well integrity, including corrosion and other issues for boreholes that are often decades old, which may remove many wells from consideration. However, given the numbers of old wells in the region, and their geographic distribution, it is highly probable that dozens or even hundreds of wells may be good candidates for reuse, which could dramatically increase geothermal energy use in the region.

Second, repurposing an old well, rather than drilling new, can save millions of Euros and put redevelopment into the realm of financial possibility for small companies and cities interested in green solutions. Well reuse also saves time in obtaining development permits and community buy-in. In addition, if the knowledge and tools from TRANSGEO can be applied to link new developers with owners of a well before it is abandoned, additional expenditures that would be required to close a well may be avoided. This may be attractive to a well owner and further facilitate effective reuse.

Finally, using data from abandoned wells can dramatically reduce exploration risk. Along with the financial investment and risk, the large uncertainty related to the subsurface environment is a barrier to efficient geothermal development. Reuse of existing data and local experience with individual wells reduces the technical risk and increases the probability of a successful repurposing project. TRANSGEO aims to integrate the physical infrastructure with valuable information and human resources for geothermal development which will support rural communities and industries in the energy transition.

3. TRANSGEO Activities and Outputs

The overall objective of TRANSGEO is to enable a structural change from a fossil-fuel producing hydrocarbon industry to sustainable green energy provision from geothermal energy sources within Central Europe. To provide the foundation for the tools and knowledge that will be developed in the

project, we will build databases of existing wells and local heat and energy demand in 4 different basins: the North German Basin, the Molasse Basin, the Vienna Basin, and the Pannonian Basin (see Fig. 1 for locations). These databases will form the basis for development of a publicly-available online Well Selection Tool that will guide users in selecting candidate wells to match their needs for geothermal resources. We will perform site-specific feasibility studies on 8 Pilot Sites with abandoned hydrocarbon wells (locations in Fig. 1) to test the online Tool and demonstrate the potential of repurposing old wells. The related output will be a Transnational Well Repurpose Potential Assessment to support the transition of fossil energy-based rural areas of Central Europe to geothermal energy use.

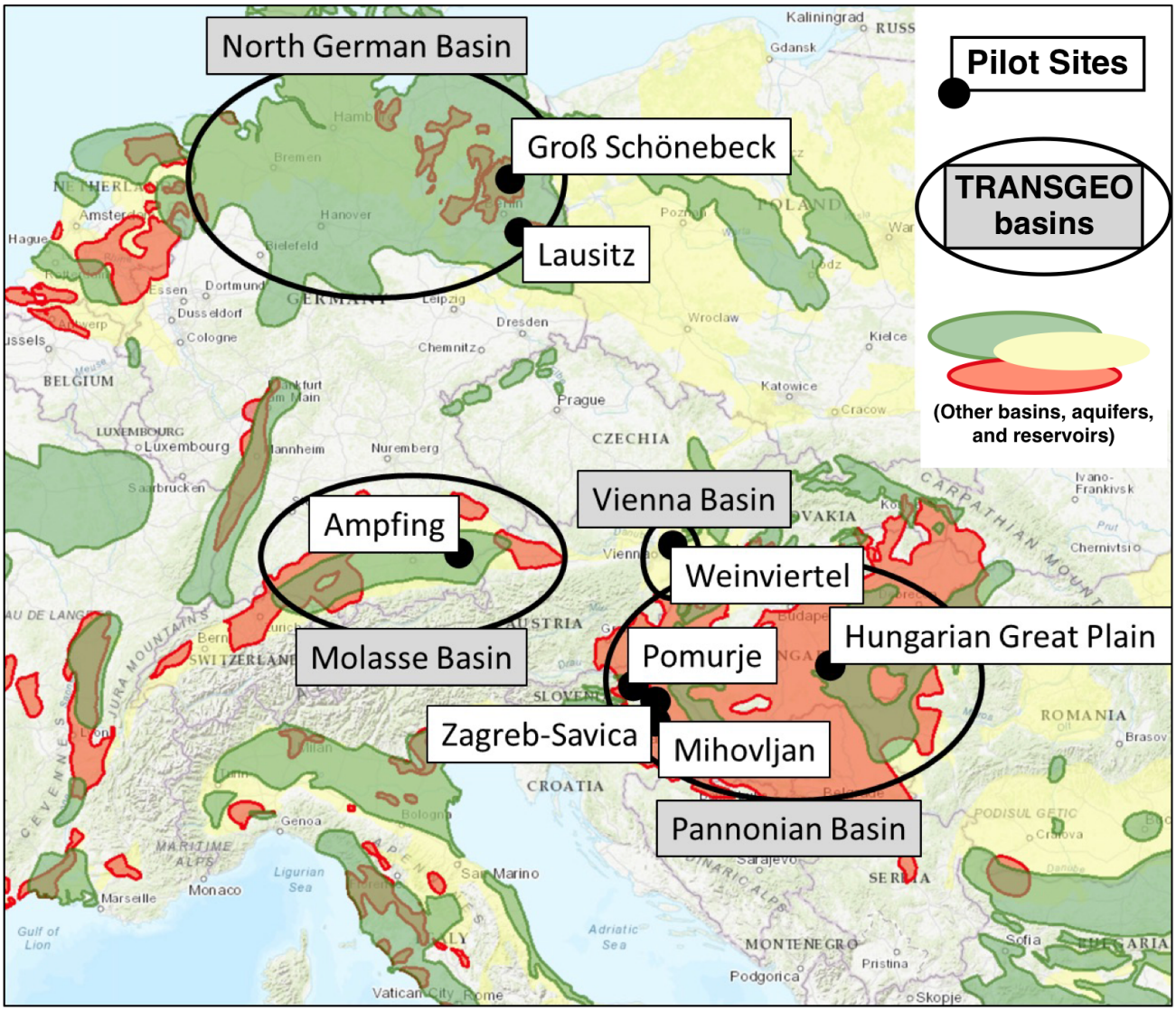

Fig. 1: TRANSGEO pilot sites and basins, overlaid on a map of regional reservoirs, aquifers, and sedimentary basins. Basemap from the Geothermal District Heating (GeoDH) Geographical Information System, https://map.mbfsz.gov.hu/geo_DH/

Using data from existing wells, project Partners will model the procedures for reusing old wells, so that the conditions and steps for repurposing are clearly defined. Five different open and closed-loop geothermal technologies will be modelled: Borehole Heat Exchanger (BHE), Borehole Thermal Energy Storage (BTES), Aquifer Thermal Energy Storage (ATES), Hydrothermal systems (HT), and Enhanced Geothermal Systems (EGS). Models to be used include CMG-STARS, FeFlow, and Pantera. One of our test locations is Groß Schönebeck, a well doublet consisting of an abandoned gas well and a newly-drilled geothermal well. The site has been used as a research testbed for EGS for more than 20 years, offering extensive data and for model building, interpretation, and validation. Groß Schönebeck will therefore be used as the test well for modelling EGS, with other existing wells being used for modelling the other 4 technologies. A literature review and modelling sensitivity study will be performed on each technology-well combination to identify which wellbore and reservoir parameters lead to higher chances of success for each geothermal technology. Detailed Engineering Workflows and Well Reuse Procedures will be developed as guidance for future well repurposing for each of the 5 technologies. These project deliverables will be shared widely, including with stakeholders and potential future users.

In addition to the technical knowledge and tools created through the project, TRANSGEO partners will conduct a Socio-Economic Analysis to understand the barriers and risks of well reuse as well as a Legal Analysis to compare the governmental policy and regulatory environments in the 5 project countries. We will also incorporate a variety of opportunities for engagement through webinars and workshops across the 4 basins, 8 Pilot Sites, and 5 countries. By engaging with stakeholders and potential users, we seek to share our results and receive feedback to improve our final tools and other deliverables. In addition to in-person and online meetings, communications and outreach will take place via email, our website (https://www.interreg-central.eu/projects/transgeo/), LinkedIn (https://www.linkedin.com/company/transgeoproject/), and Twitter/X (https://twitter.com/TRANSGEO_CE). We welcome new contacts for collaboration, input, and sharing news and information.

Finally, we will use all project results to create a Transnational Strategy and a Transnational Action Plan to guide alignment of relevant governmental policy across the Central European region and encourage new geothermal development projects. At the end of TRANSGEO, we aim to sign 3 Letters of Intent with organizations committing to 3 geothermal reuse projects, and the project Partners will sign a Cooperation Agreement to support well repurposing in Central Europe.

4. Acknowledgements

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5. Sources

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