A GIS-based 3D online information system for underground energy storage in northern Germany

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We would like to present the concept and current state of development of a GIS-based 3D online information system for underground energy storage. Its aim is to support the local authorities through pre-selection of possible sites for thermal, electrical and substantial underground energy storages.

Since the extension of renewable energies has become legal requirement in Germany, the underground storing of superfluously produced green energy (such as during a heavy wind event) in the form of compressed air, gas or heated water has become increasingly important. However, the selection of suitable sites is a complex task.

The presented information system uses data of geological features such as rock layers, salt domes and faults enriched with attribute data such as rock porosity and permeability. This information is combined with surface data of the existing energy infrastructure, such as locations of wind and biogas stations, powerline arrangement and cable capacity, and energy distribution stations. Furthermore, legal obligations such as protected areas on the surface and current underground mining permissions are used for the process of pre-selecting sites suitable for energy storage. Not only the current situation but also prospective scenarios, such as expected growth in produced amount of energy are incorporated in the system.

While the process of pre-selection itself is completely automated, the user has full control of the weighting of the different factors via the web interface. The system is implemented as an online 3D server GIS environment, so that it can easily be utilized in any web browser. The results are visualized online as interactive 3d graphics.

The information system is implemented in the Python programming language in combination with current Web standards, and is build using only free and open source software.

It is being developed at Kiel University as part of the ANGUS+ project (lead by Prof. Sebastian Bauer) for the federal state of Schleswig-Holstein in northern Germany.