

Interdisciplinary project  
for  
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FAKULTÄT FÜR BAUINGENIEURWESEN  
UND GEODÄSIE

Institut für Strömungsmechanik und  
Umweltphysik im Bauwesen

Date of issue:	...	Editing scope:	...
Last possible date for handing in:	...	Processing time:	6 months
First examiner:	Prof. I. Neuweiler		
Second examiner:	...		
Supervisor:	Gergely Schmidt		

edited by:  
Gergely Schmidt  
Tel. +49 511 762 4205  
Fax +49 511 762 3777  
E-Mail: schmidt@hydromech.uni-hanno-  
ver.de

Topic: Sensitivitätsstudie zu einem modellierten Aquifer-Wasserstoff-Speicher  
Sensitivity study for a modeled aquifer hydrogen storage

...2026

**Project description:**

According to the The German Federal Ministry for Economic Affairs and Energy, 47 TWh to 73 TWh of hydrogen storage will be required to meet greenhouse gas neutrality scenarios. Compared to salt caverns and depleted gas fields, aquifers offer a more widely available option for underground hydrogen storage and – under certain conditions – aquifer storage sites can also be closer to the surface and easier to scale. A numerical model shall be investigated in this work, the parametrization of which is homogenized for separate geological formations with values according to an aquifer close to Hanover, Germany. The model was set up using the software DuMuX and computes well pressures, recovery rates, production purity and gas plume dimensions, all of which are typically of interest when optimizing facilities for safety and revenue. It shall be investigated one factor at a time how uncertain model parameters affect these model outputs. A previous study has revealed that seven factors shall be considered: one geometrical parameter, four flow parameters and two parameters linked to gas cushioning.

The following points are to be dealt with within the frame work of the project work:

- Literature research of the state-of-the art of modeling of hydrogen storage in aquifers
- Document model variations and chosen parameter intervals
- Investigation of gas motion, well pressures and production purities (gas composition and water cut) with different model variations
- Explanation and discussion of results including plausibility assessment

At the beginning of the project, a binding milestone plan with the most important steps and intermediate goals of the thesis must be agreed upon and written down in consultation with the supervisor. The milestone plan is binding for further work. In justified cases, it can be changed by mutual agreement in during the project. The thesis must be preceded by an abstract in German and English. In addition, five keywords describing the content of the thesis are to be stated in each case.

In the preparation of the thesis, particular importance shall be denoted to explanatory comments on the parameters considered, the concise presentation of theoretical principles and the clear presentation of the results obtained. Additional questions that arise during the work can be addressed in consultation with the supervisor. The scope of the individual subtasks is to be coordinated with the supervisor during the course of the thesis. The results of the thesis are to be compiled in a written report and presented in a colloquium. All data (e.g. numerical models, experimental data, drawings, presentation slides etc.) must be submitted digitally.

The following literature is recommended as an introduction to the topic, which should be supplemented with further sources in the course of the work:

- [1] Okoroafor, E.R., Saltzer, S.D., Kovsky, A.R., 2022. International Journal of Hydrogen Energy 47, 33781–33802.

- [2] Hogeweg, S., Hagemann, B., Bobrov, V., Ganzer, L., 2024. *Front. Energy Res.* 12.
- [3] Heinemann, N., Scafidi, J., Pickup, G., Thaysen, E.M., Hassanpouryouzband, A., Wilkinson, M., Satterley, A.K., Booth, M.G., Edlmann, K., Haszeldine, R.S., 2021. *International Journal of Hydrogen Energy* 46, 39284–39296.
- [4] Sitaresmi, D.I.R., 2016. *International Journal of Engineering Research & Technology* 5.

For the successful completion of the thesis, the student will be given the following documents, the contents of which the student will discuss with the supervisor and the transfer of which will be confirmed by both signatures:

- I have received the *project description* (this document).
- I have received the *evaluation form* and I understand the standards by which the ISU evaluates.
- I have received the document *ISU scientific writing* and I understand its content.
- I have received the document *declaration of independence* and I understand its content.
- I have received the word and/or Latex template.

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Date, ...

Date, Prof. Dr. sc. nat. ETH Insa Neuweiler