

Hidrogén tárolási kutatások és kihívások kezelése hazai porózus geológiai tárolókban

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DUNAGÁZ
KONFERENCIA

HGS 
/ Powered by MVM



AQUAMARINE
PROJECT

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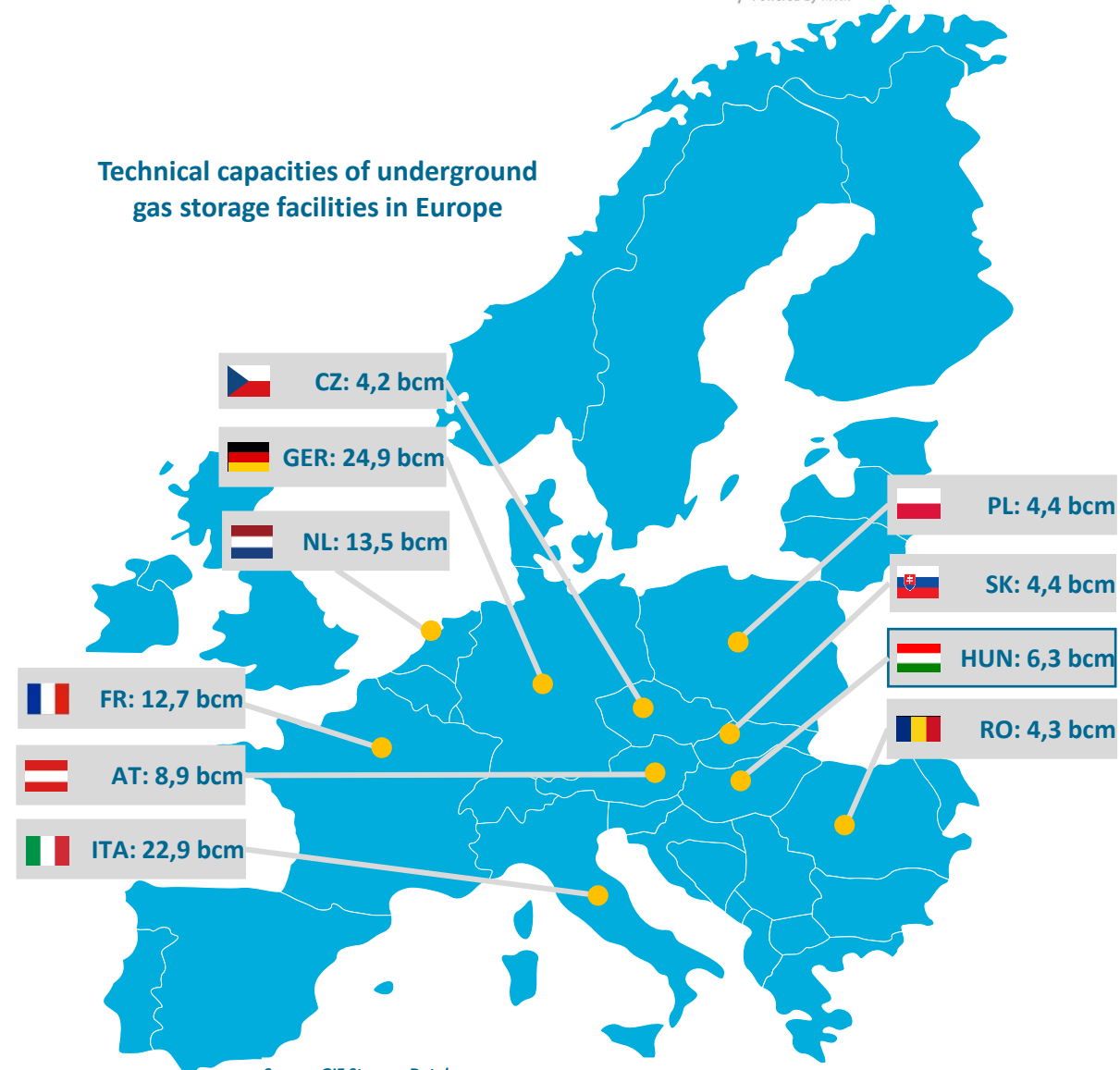
Conclusion

Introduction of Hungarian Gas Storage

Our main activities

- Underground gas storage operations
- **Regulated activities** (Mining authorities, Hungarian Energy Authority, Emergency management)
- **Focus on gas storage services** : not allowed to transport or trading natural gas
- **Flexibility services provider**: Demand-supply balancing operations
- **Crucial pillar** in energy security of supply
- Electricity generation permit
- **4 gas storage sites** in Hungary
- Total of **4,4 bcm working gas capacity** (HU gas consumption is around 10 bcm/year)
- Sole shareholder: MVM Energy (**100% state owned** company)

Technical capacities of underground gas storage facilities in Europe



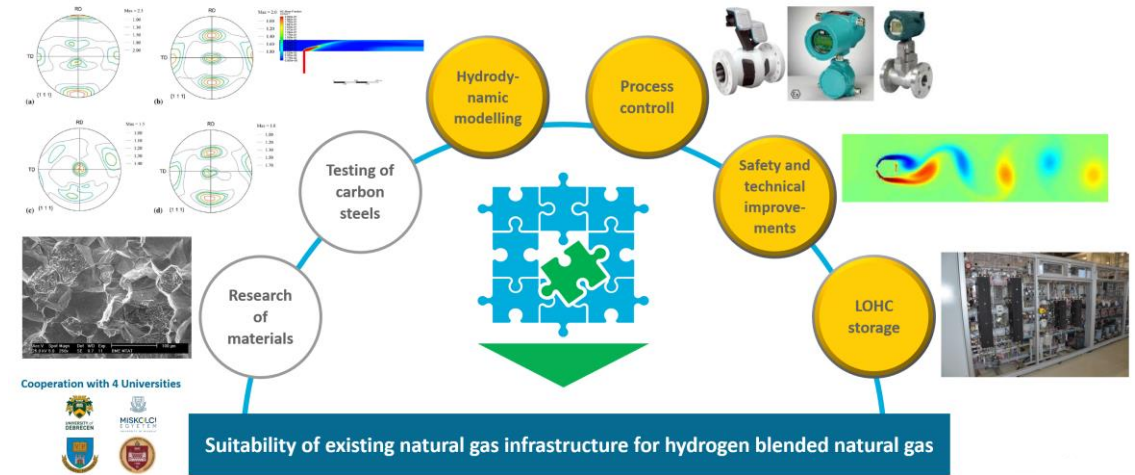
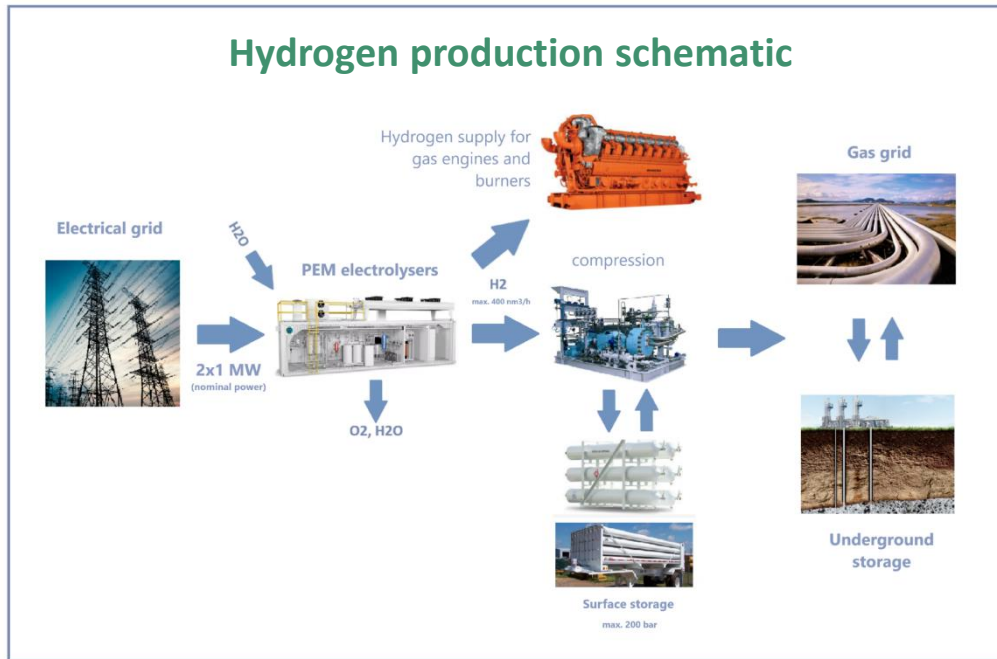
Source: GIE Storage Database
<https://www.gie.eu/transparency/databases/storage-database/>

Main characteristics of Project Aquamarine

- **2.0 MW electrolyzer** including H₂ compressor unit with buffer tanks
- **Energy storaging** including H₂ production, blended gas to existing methane fueled systems, and also send out to transmission system.
- 1 February 2021 – **31 January, 2024**
- **Long-term R&D** programs with 5 Hungarian universities and research institutes
- Continuous pioneering in the recent regulatory environment,
- **Pilot Project:** effects of hydrogen blended natural gas on the existing gas infrastructure



Hydrogen utilisation schematic in Kardoskut UGS



HyUSPRE consortium



THE HYUSPRE CONSORTIUM

7 EXECUTIVE PARTNERS, 9 INDUSTRY PARTNERS, FUNDED BY THE FCH JU

INDUSTRY

- CENTRICA – United Kingdom
- EBN – Netherlands
- EQUINOR – Norway
- Hungarian Gas Storage - Hungary
- NAFTA – Slovakia
- NEPTUNE – Netherlands
- RAG – Austria
- Shell – Netherlands
- SNAM – Italy



RESEARCH INSTITUTES

- TNO – NL (project coordinator)
- Energy Institute Linz – Austria
- Fondazione Bruno Kessler – Italy
- FZ Jülich – Germany



UNIVERSITIES

- University of Edinburgh – UK
- Clausthal University – Germany
- Wageningen University – Netherlands



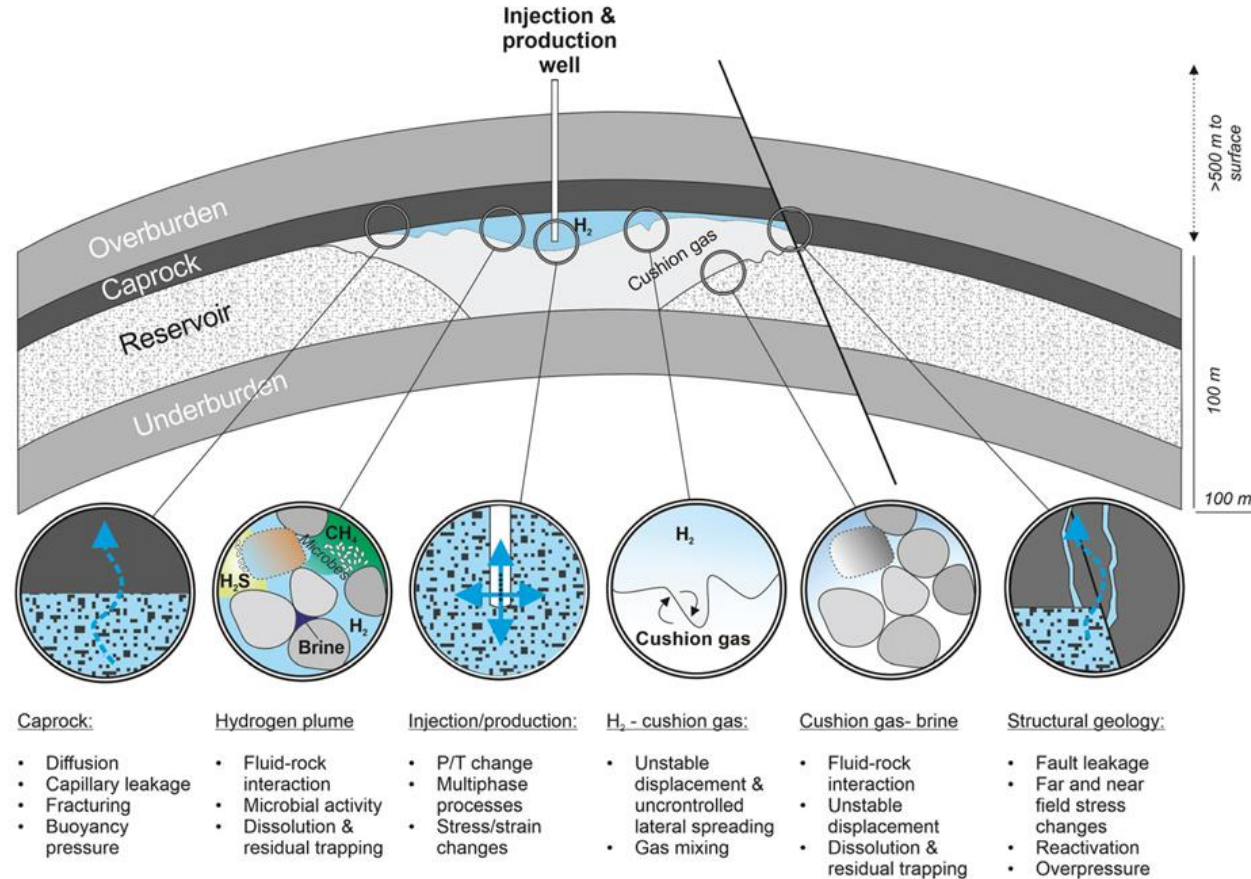
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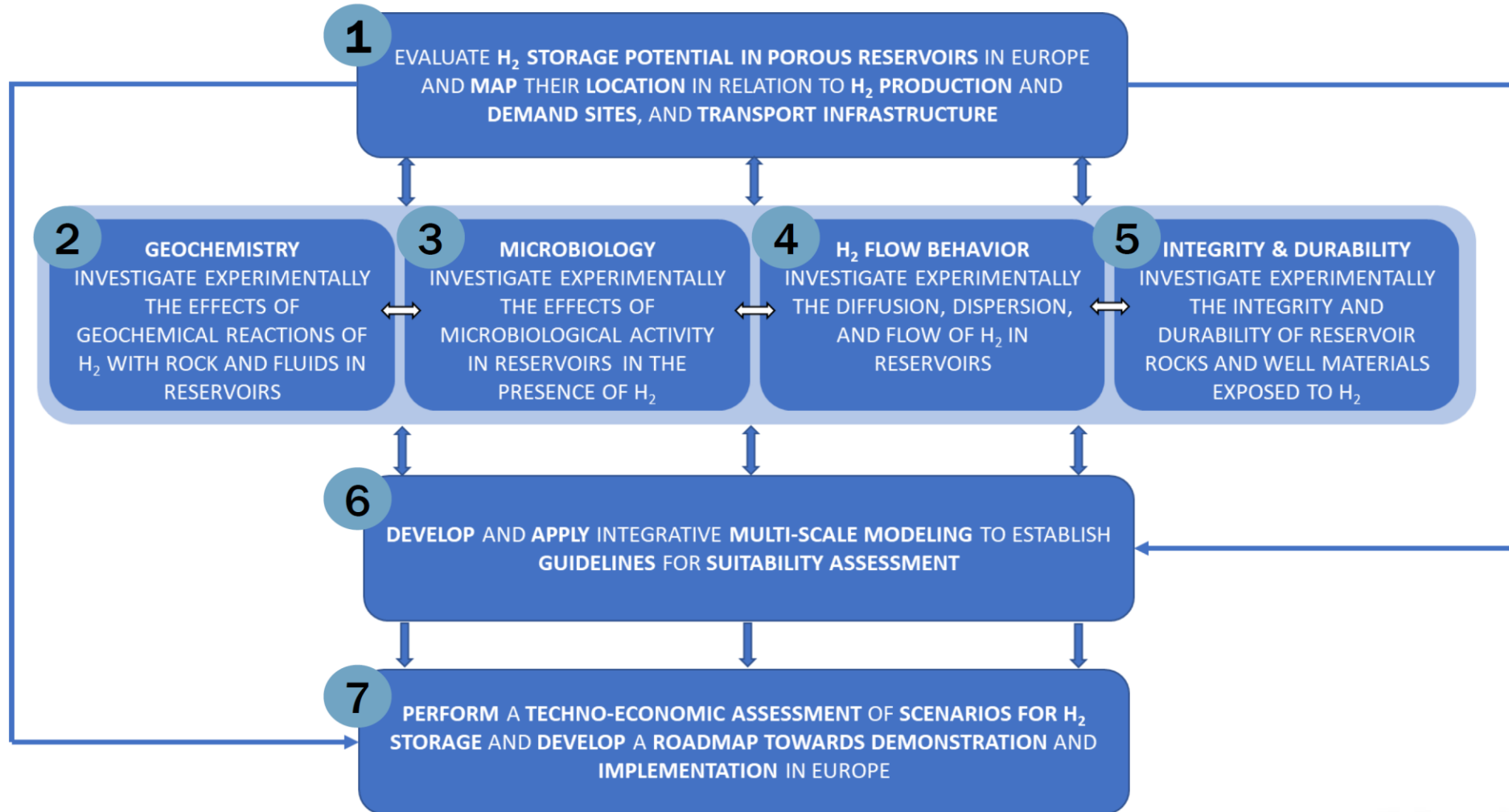
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Geological uncertainties considered in the storage of hydrogen in porous media



Source : Heinemann, N., Alcalde, J., Miocic, J. M., Hangx, S. J. T., Kallmeyer, J., Ostertag-Henning, C., Hassanpouryouzband, A., Thaysen, E. M., Strobel, G. J., Schmidt-Hattenberger, C., Edlmann, K., Wilkinson, M., Bentham, M., Haszeldine, R. S., Carbonell, R., & Rudloff, A. (2021). Enabling large-scale hydrogen storage in porous media – the scientific challenges: Energy & Environmental Science. Energy Environ. Sci.. <https://doi.org/10.1039/D0EE03536J>

Research activities



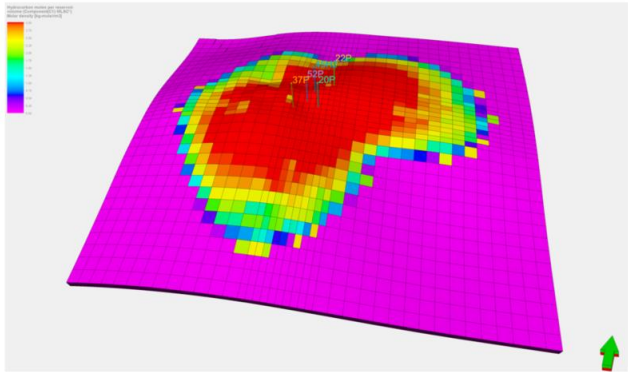
HyUSPre project briefing, Nov. 30, 2021

Microbiological activity in the reservoir

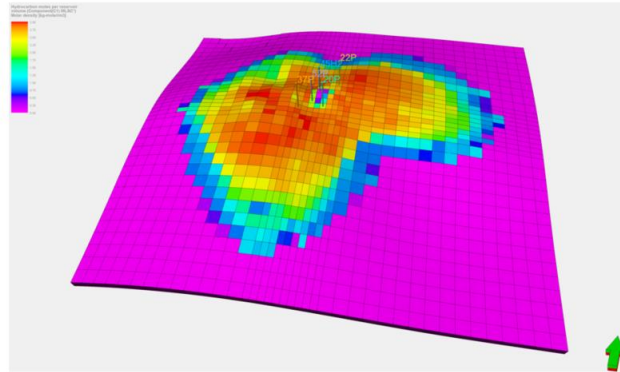


- Loss of H_2 through microbial metabolic processes (methanogenesis, sulfate-reduction and acetogenesis)
- Generation of H_2S through microbial sulfate-reduction
- Loss of H_2 injectivity due to near well bore plugging by bio-based solids (microbes, Extracellular Polymeric Substances (EPS), FeS , etc.)

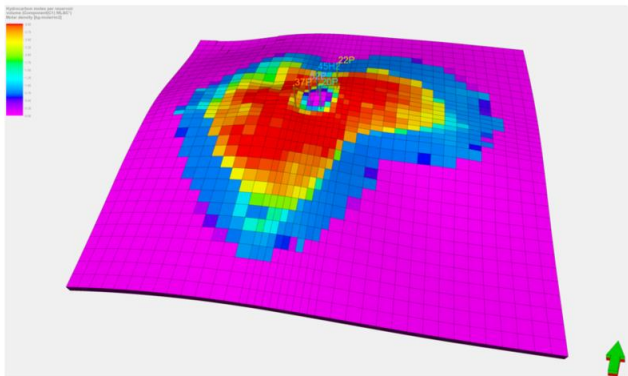
Molecular diffusion



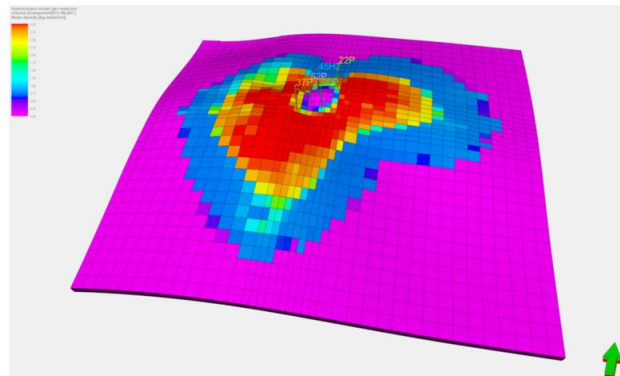
$t = 0$



$t = 12$



$t = 14$

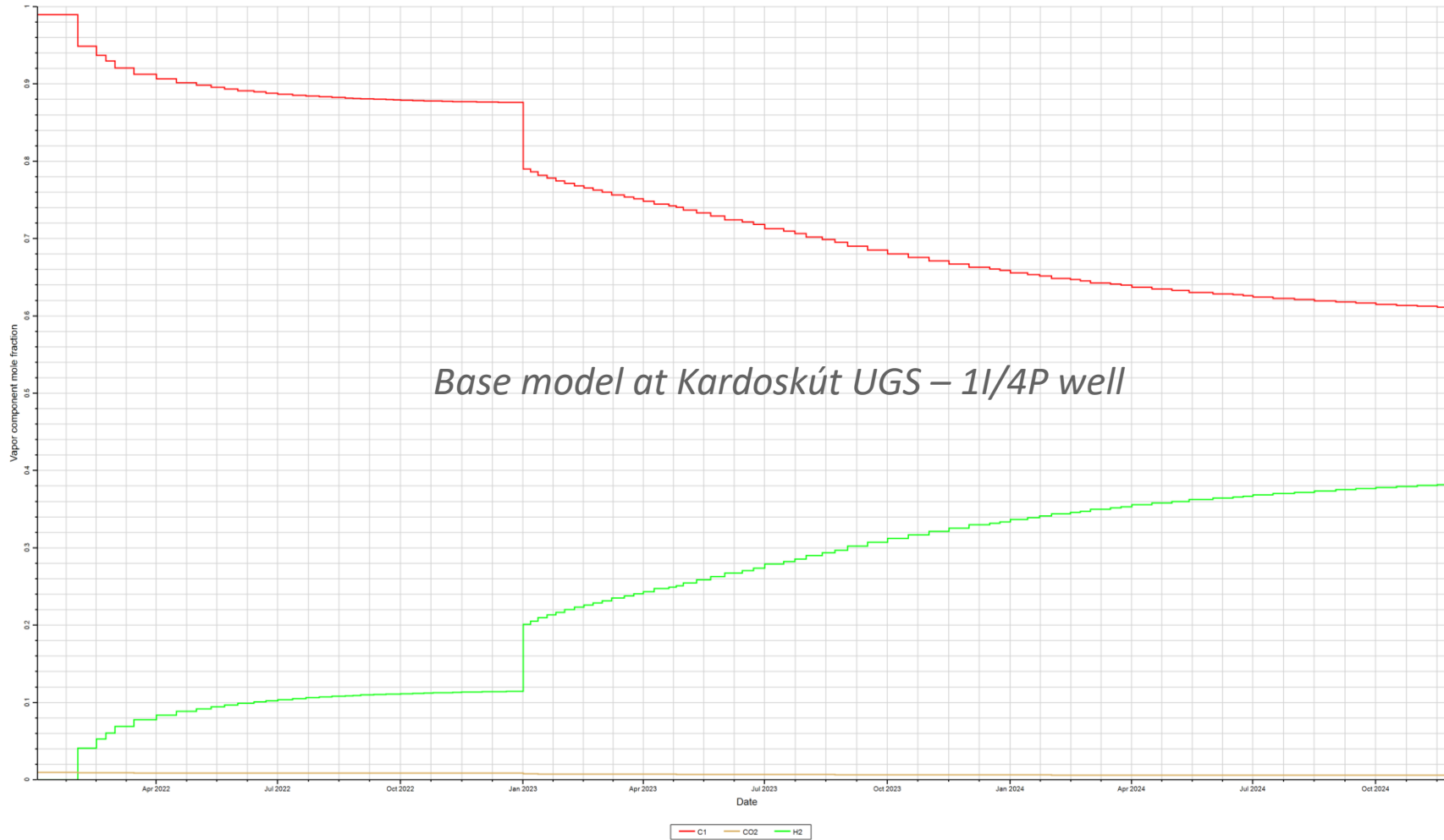


$t = 24$

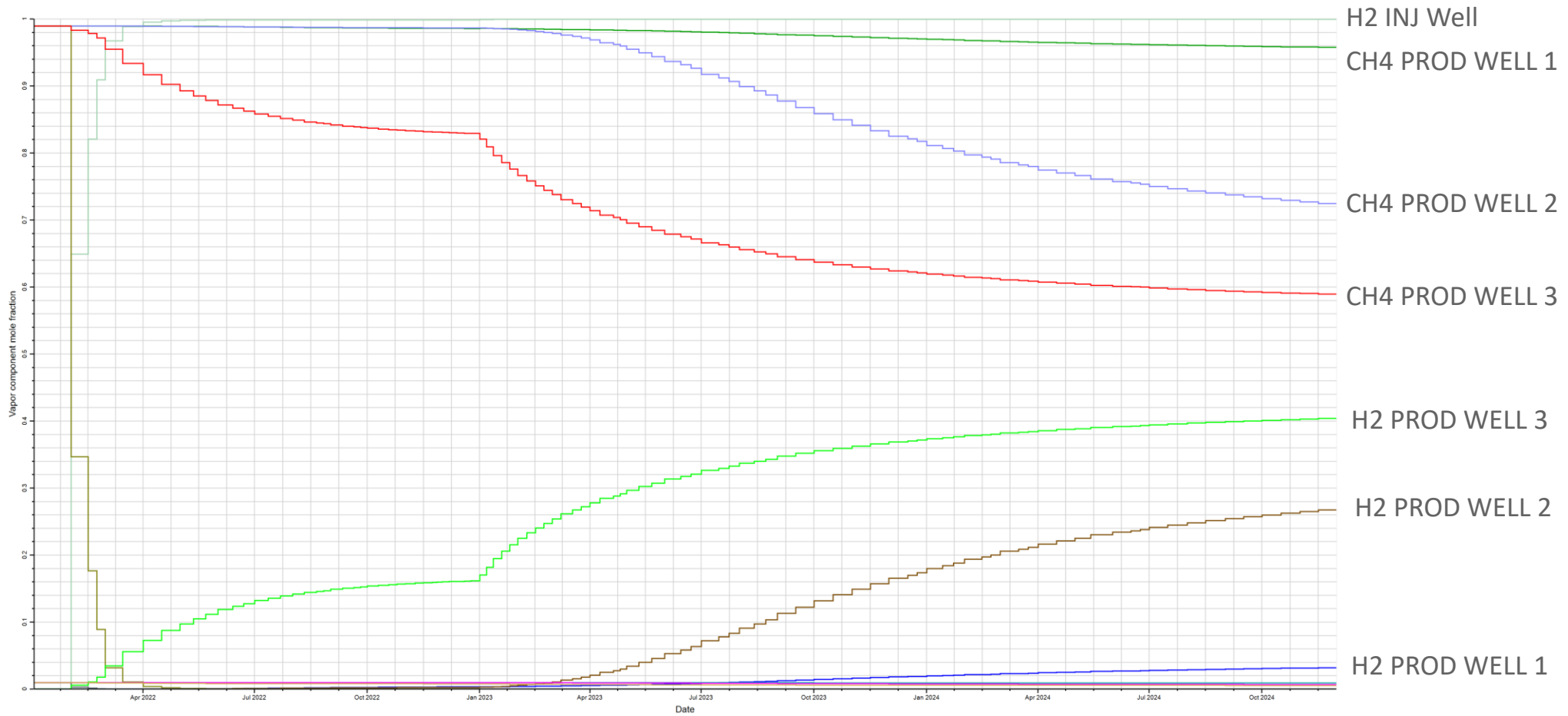


- Effective molecular diffusion coefficients
- Mechanical dispersivities
- Relative permeability curves
- Validate compositional modelling

Methanation – 1st step



Vapour component mole fraction



Conclusion



Hydrogen storage is one of the **main pillars** of Hungary's National Hydrogen Strategy



Long-term collaboration with European Research Institutes, Universities and Gas Storage Companies



Consortium for **developing hydrogen technologies** in UGS circumstances



Amendment of the mining law – in progress



Matchmaking of our ongoing projects – fuel cells, deblending, methanation, LOHC

Demonstration plant in Kardoskút UGS



Our partnerships



UNIVERSITY of DEBRECEN



MISKOLCI EGYETEM
UNIVERSITY OF MISKOLC



Thank you for your
kind attention

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