

PERFORM

Taking on challenges of GEOTHERMAL plants

CHALLENGES

Geothermal plants often face challenges that reduce the plant performance. The **PERFORM** platform provides recommendations to help operators to avoid or mitigate the following issues:

- ↻ Corrosion (Uniform, Pitting and Crevice, Galvanic, CO₂, Microbial induced and H₂S induced)
- ↻ Scaling (Carbonate and Heavy metal scales)
- ↻ Fines migration and filtering
- ↻ Reservoir injectivity

PERFORM especially focuses low enthalpy geothermal systems targeting 1-4 km deep sedimentary reservoirs.

TOOLS and SOLUTIONS

- ↻ **Coupled flow-chemistry models:** evaluate scaling and reservoir injectivity.
- ↻ **Web-based toolbox:** An interactive web tool developed for operational advice. With this web tool, geothermal operator can plan future operations, see which mitigation measures can reduce their challenges and optimize production/injection. The web tool is designed in such a way to guarantee maximum and economical energy production.
- ↻ **Best Practice Guide:** It is an easy-to-use document showing best practices to minimize scaling and corrosion.



The identified challenges linked to geothermal operations that are investigated:

Developed/practiced methods to face these challenges:

Challenges	Suggested Solutions
Calcite scaling	Limit CO ₂ outgassing by maintaining a high enough top side pressure with sufficient CO ₂ remaining in solution
Heavy metal scaling	Use element specific adsorption materials (cation filters e.g. zeolite, chitosan) to remove heavy metals from solution
H ₂ S-induced corrosion	Remove H ₂ S by reaction with added iron-based substances and removal of the particles by filtering
Galvanic corrosion	<ul style="list-style-type: none"> ▪ Use high-alloyed materials for devices in contact with the geothermal fluid ▪ Use element specific adsorption materials (cation filters e.g. zeolite, chitosan) to remove Pb²⁺ and Cu²⁺ from solution

Examples of CHALLENGES and SOLUTIONS investigated in PERFORM

PERFORM established a single and shared knowledge database, build predictive models and demonstrated new and improved, cost-effective technologies which will reduce or even eliminate flow-obstructive scaling, corrosion and resistance to fluid (re)-injection at geothermal plants.



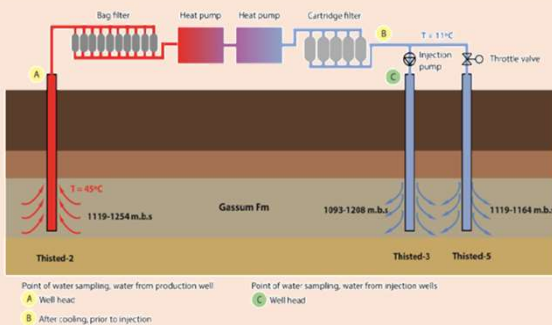
TO IMPROVE THE PERFORMANCE OF GEOTHERMAL SYSTEMS

EXTEND INFRASTRUCTURE LIFECYCLE

REDUCE OPERATIONAL COSTS (OPEX)

A comprehensive KNOWLEDGE Database and WEB Application

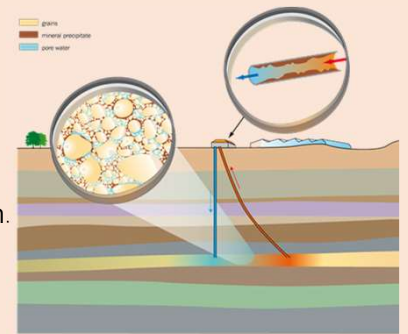
- 🔄 Data from several sites (6 key sites)
- 🔄 State-of-the-art data mining and machine learning techniques
- 🔄 Lessons learned from operations
- 🔄 Open access database



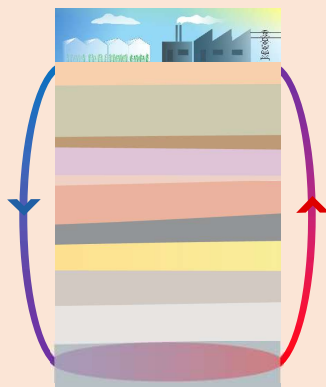
www.GeothermPerform.eu

Integrated Predictive Models

To make **PREDICTIONS** for **PRODUCTIVITY** and **INJECTIVITY** based on the **CURRENT** and **MODIFIED** operation.



- 🔄 Enhance reservoir performance
- 🔄 Optimize geothermal operations for scaling prevention
- 🔄 Improve modelling tools and the selection of thermodynamic databases
- 🔄 Assess risks of seismicity



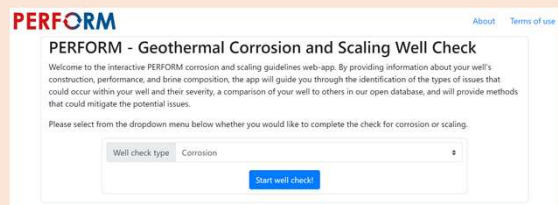
- 🔄 Control of the pressure, CO_2 content and/or pH
- 🔄 Injection temperature optimization
- 🔄 H_2S removal by flocculation
- 🔄 Cation filter
- 🔄 Particle filters

Performing Experiments and Field Tests

- 🔄 Best practice for scaling and corrosion minimization

- Mechanisms and types | Monitoring methods
- Sampling procedures | Mitigation measures
- 🔄 Interactive well check for scaling and corrosion
- 🔄 Economic assessment tool for the scaling and corrosion mitigation measures

www.geothermperform.eu/toolbox



Designing an Operational Advice TOOLBOX