DESTRESS
Demonstration of Soft Stimulation Treatments of Geothermal Reservoirs

Task 2.3 Cost accounting and business case calculation model

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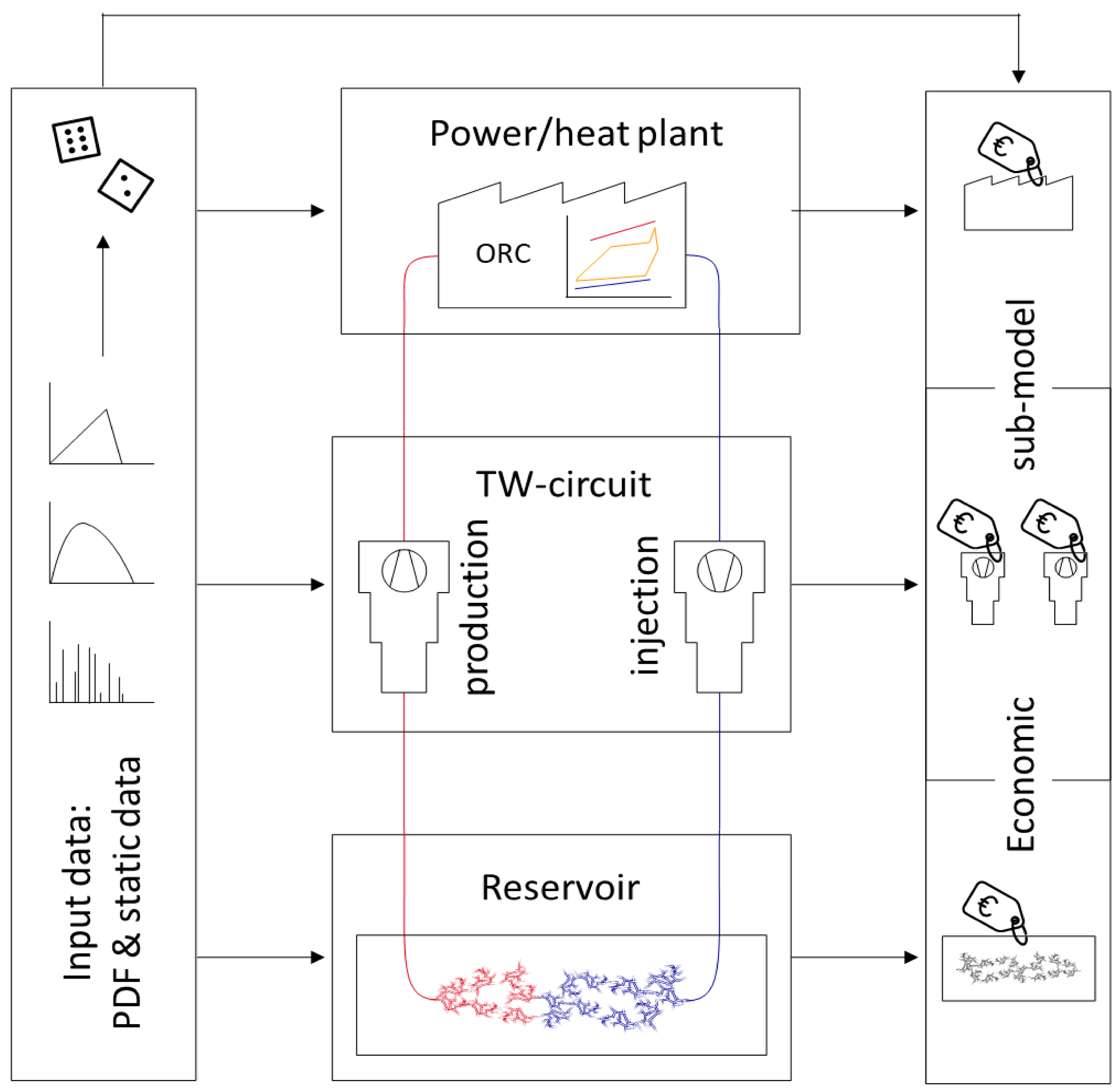
Introduction

- The business case calculation model is based on the techno-economic model used in (Welter, Technisch-ökonomische Analyse der Energiegewinnung aus Tiefengeothermie in Deutschland, 2018) and has been further developed by the DESTRESS-partners
- Monte Carlo approach is used in the model for the integration of uncertainty and simulation and optimization of power plant designs.
- The aim of the model is computing a series of well-founded time-series of state variables and Key Performance Indicators (KPIs), to compare alternative investment options for developing a geothermal field
- The model primarily assesses situations where uncertainties are large and, therefore, precision of the predicted physical processes cannot be obtained.
- The absolute value of the model's output and the comparative difference between alternative development options should help decision-makers to further mature a project until Final Investment Decision

Integrated Geothermal Energy Model



Model overview on the integrated geothermal energy model

In the technical sub-model all possible uses of geothermal energy is considered:

1. Pure power generation
2. Pure heat supply
3. Combined heat and power generation (CHP)

Developments compared to the previous techno-economic models

✓ *Reduction of computation time for enabling the Monte-Carlo approach*

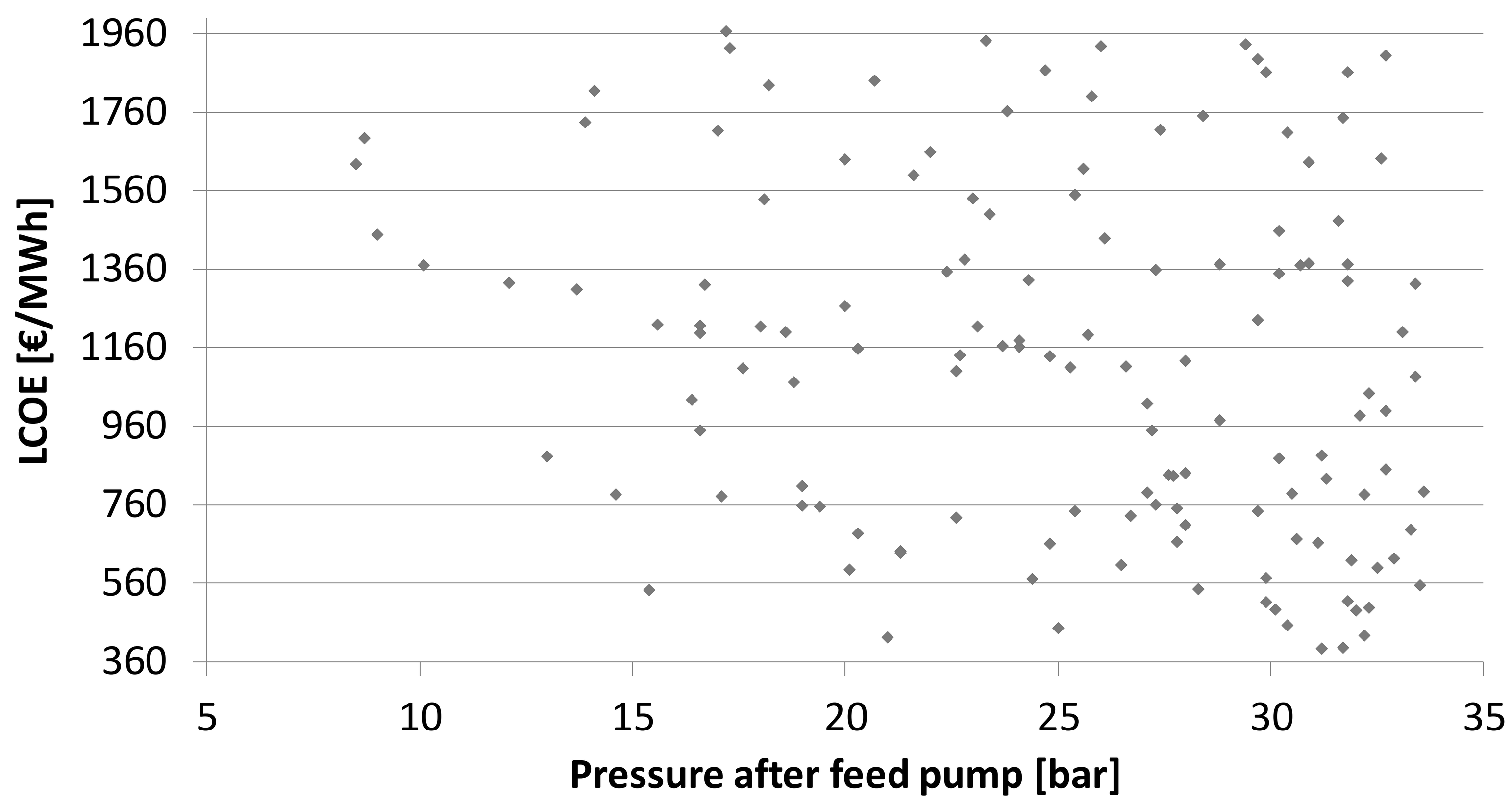
✓ *Temperature calculation-Ramey's approach*

✓ *Adapted pump technology – Line Shaft Pump (LSP)*

Application of the model to DESTRESS sites

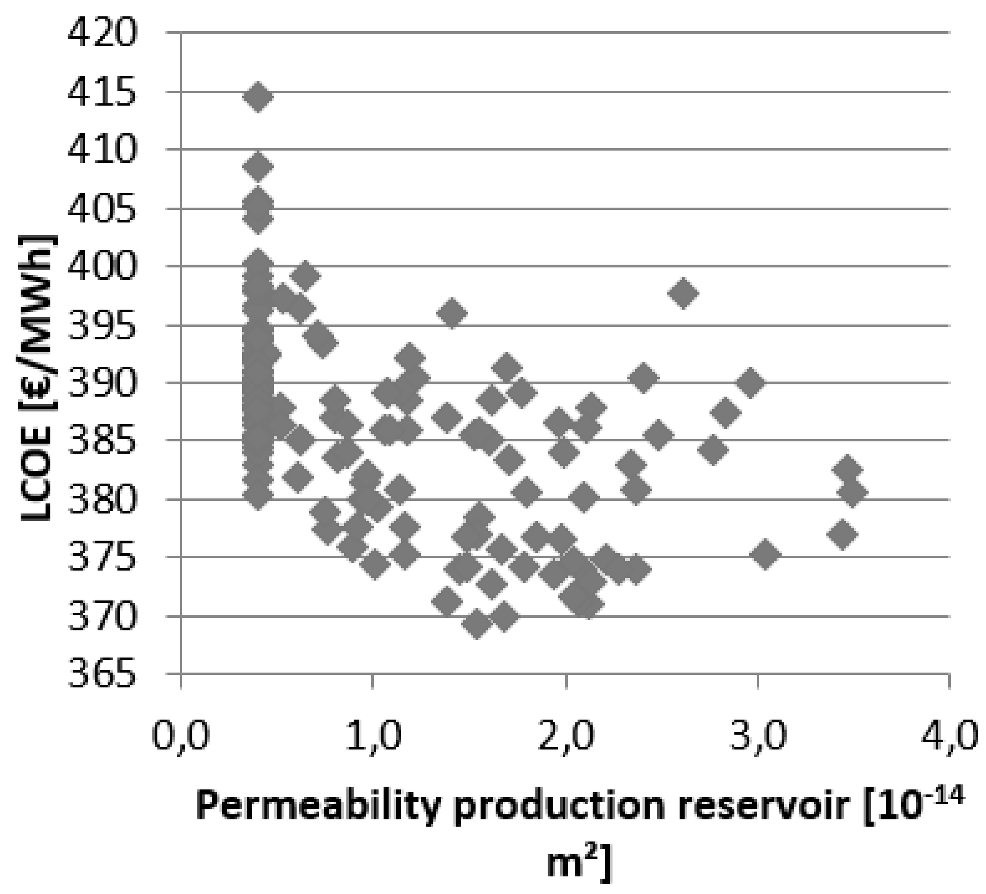
Soultz-sous-Forêts (France)

Power plant modelling: LCOE over pressure after feed-pump



Pure electricity; LSP; $\dot{m} = 33\ kg/s$; 150 Monte-Carlo iterations; 1000 power plant configurations; working medium isobutene; chemical stimulation; including risk factors; without risk mitigation measures

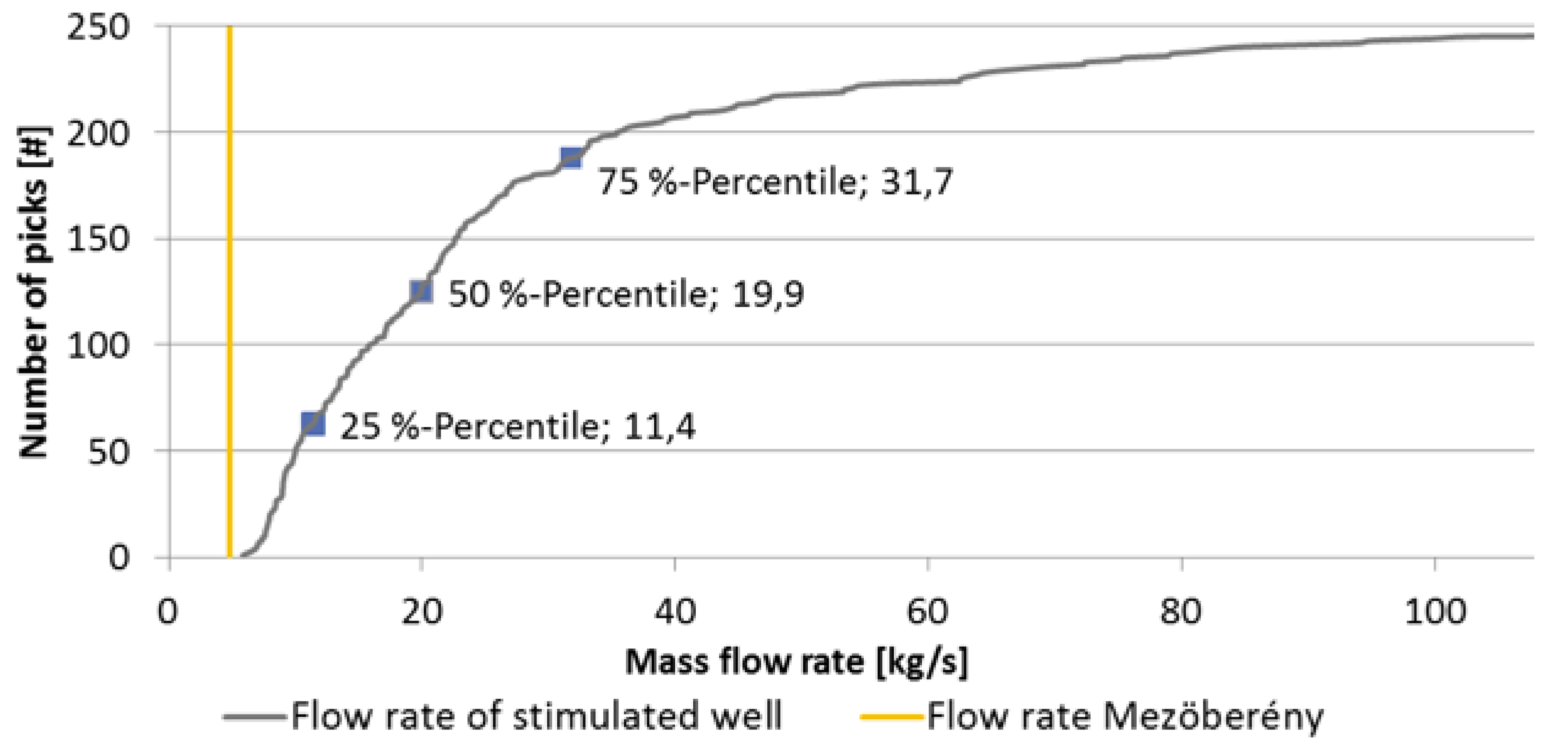
Effect of a changing permeability on the LCOE



Pure electricity; LSP; $\dot{m} = 33\ kg/s$; 150 Monte-Carlo iterations; power plant configuration 9; working medium isobutene; chemical stimulation; including risk factors; without risk mitigation measures)

Mezöberény

Effect of stimulation for the Mezöberény site



250 Monte-Carlo iterations; chemical stimulation; including risk factors; without risk mitigation measures

Conclusions

- Power plant optimization with the Monte-Carlo approach allows a further optimization of power plant configurations based on techno-economic results & investigations on the robustness of power plant configurations.
- The possibility to simulate heat, CHP and pure power provision in one model-consistent evaluation of different business models.
- New approaches in cost engineering give the community a sound database for early stage evaluation of geothermal power projects.

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 691728