TU Clausthal

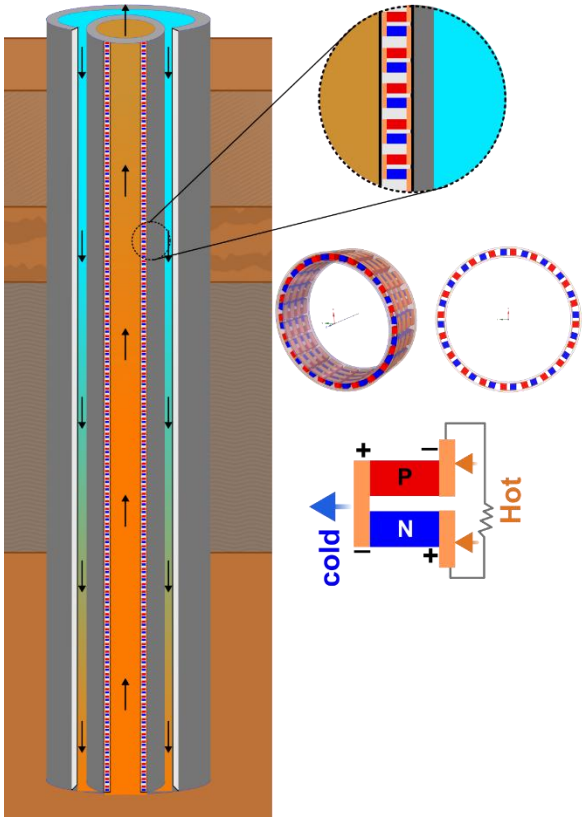
Institut für Technische Mechanik

Master's Thesis

Hybrid Energy Harvesting from Coaxial Borehole Heat Exchangers Using Thermoelectric Generators

Would you like to investigate how to harvest electricity from borehole heat exchangers while still producing thermal energy? Do you have hands-on experience with MATLAB and numerical simulations of heat transfer or fluid flow?

We offer a master's thesis on integrating thermoelectric generators (TEGs) into coaxial borehole heat exchangers (CBHEs). This master's thesis explores the hybrid use of CBHEs: embedding thermoelectric generators (TEGs) into the coaxial geometry to simultaneously harvest electrical power from the temperature gradient while delivering thermal energy. The research combines high-fidelity thermal modeling, thermoelectric performance calculations, and numerical simulation to evaluate technical feasibility, quantify additional electrical yield, and study design tradeoffs (TEG packing fraction, materials, geometry, flow conditions).



Your Tasks:

- Develop and implement a coupled thermal–electrical model for a CBHE + TEG system (MATLAB or Python).
- Run transient simulations and parametric studies (geometry, material properties, packing fraction, flow rate).
- Post-process and visualize results.
- Write a clear thesis and present study results.

We expect:

- Enrolled MSc student (mechanical / energy / applied physics / engineering).
- Very Good MATLAB programming skills
- Basic knowledge of heat transfer and thermoelectric principles.
- Comfortable with LaTeX is a plus.
- Independent work attitude; team spirit for collaboration with staff and students.

Supervision:	Prof. Dr.-Ing Gunter Brenner
Place of Work:	ITM/TU Clausthal
Commencement date:	as soon as possible
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