

Projects on deep geothermal horizontal closed loop technology

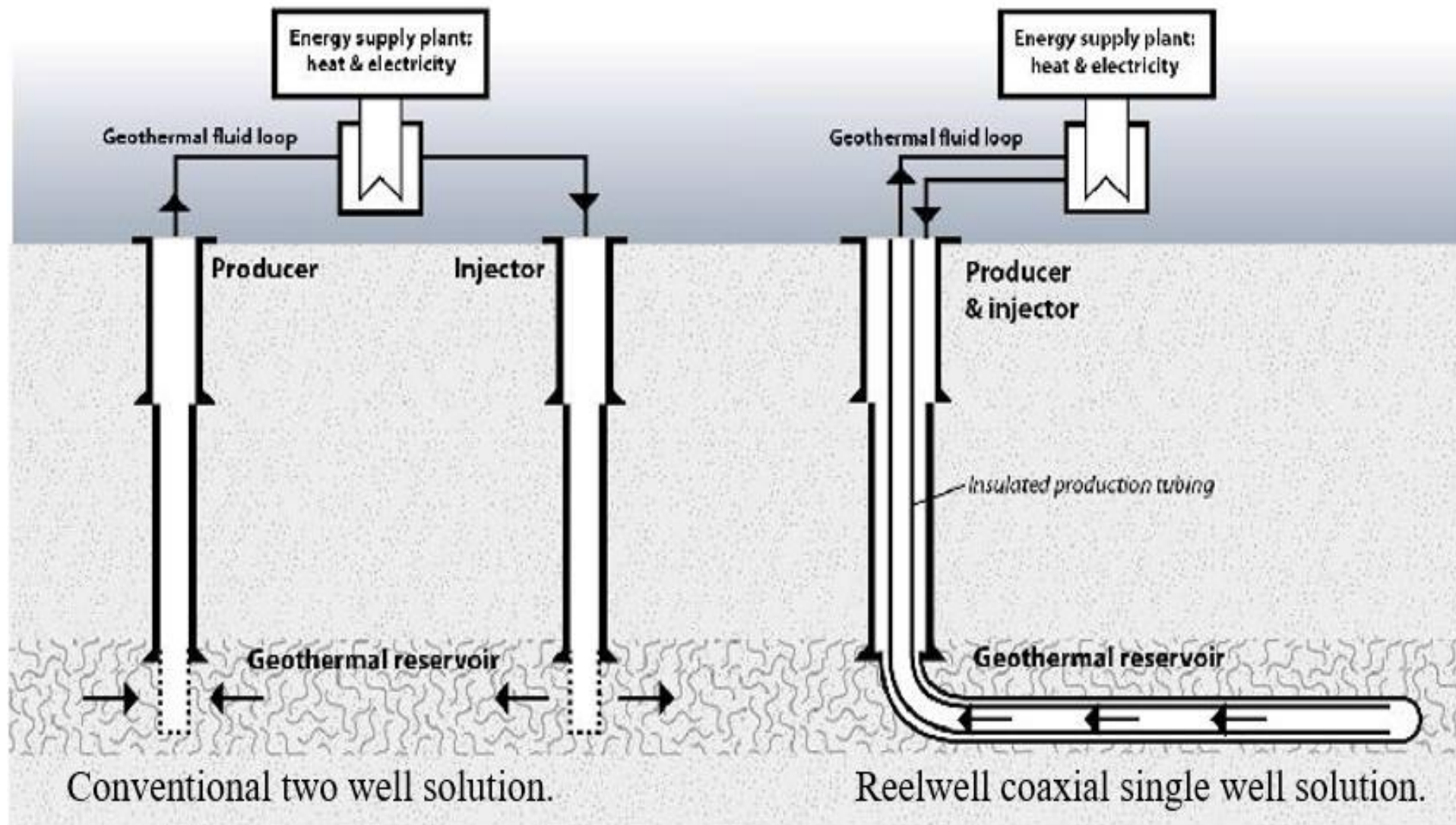
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GEOHERMAL PROJECTS ON REELWELL CLOSED LOOP TECHNOLOGY

- 1. HOCLOOP – Horizontal Closed Loop**
Funded by the Horizon Europe Programme:
Co-ordinated by IFE, partners are institutes in Belgium, Finland, France, Germany, Italy, Norway and Poland.
- 2. Geothermal Joint Industry Project**
Funded by The Research Council of Norway, OMV and the partners are Halliburton, SNSK, IFE and Reelwell.

Deep Geothermal Energy System



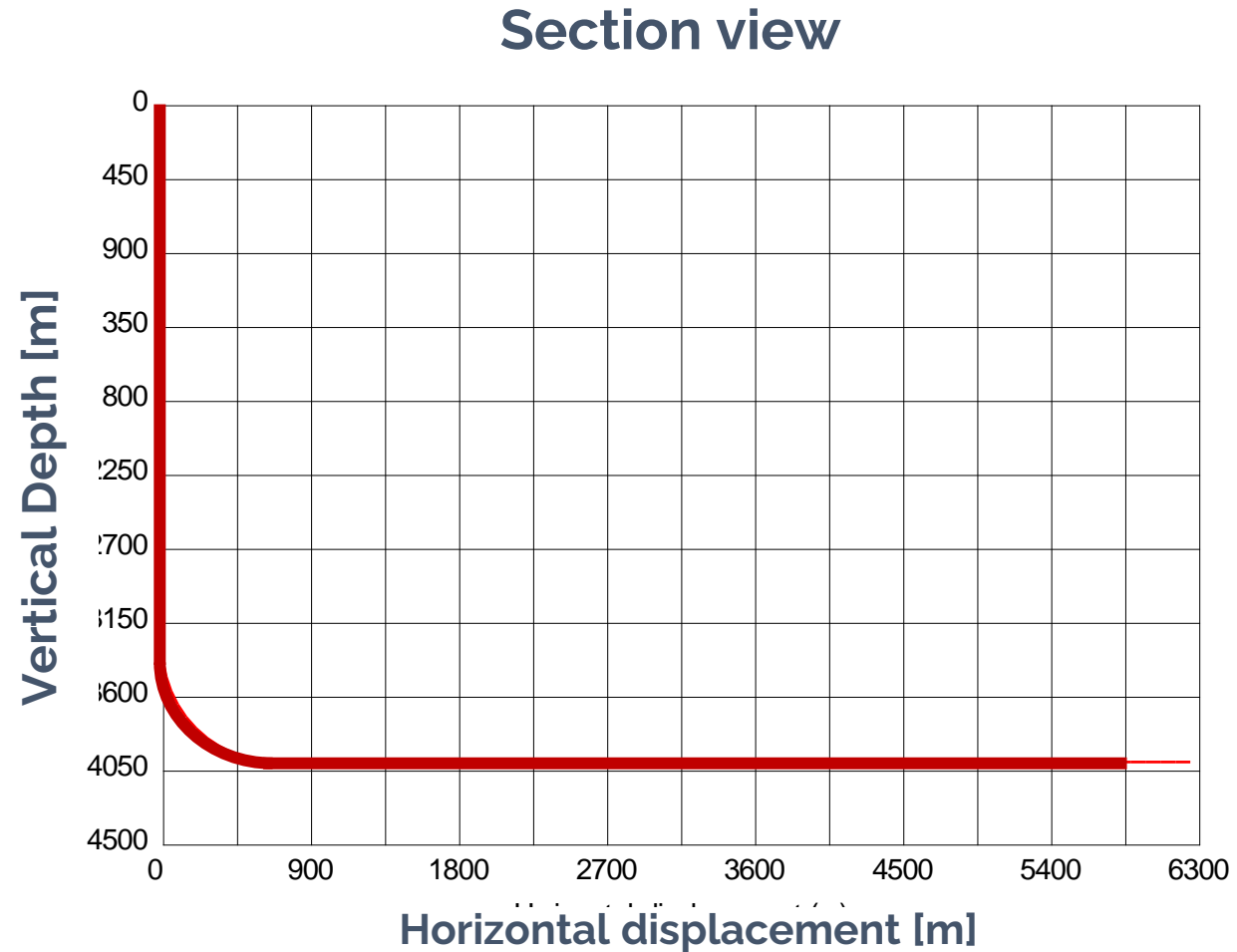
COMPARISON

| Conventional geothermal solution | Horizontal closed loop solution |
|---|--|
| <ul style="list-style-type: none"> -Minimum 2 wells -High permeability & connectivity of the reservoir -Require use of brine with adequate chemistry | <ul style="list-style-type: none"> -One well -Closed-loop system – permeability is not required -Can use alternative fluids for improved performance |
| <p><u>Common issues</u></p> <ul style="list-style-type: none"> -Low permeability & connectivity of the reservoir -Rapid decrease of injectivity -Scaling/precipitation in surface installations -Risk for unproductive wells/ non targeted aquifers | <p><u>Solved issues</u></p> <ul style="list-style-type: none"> -Suited for low permeability tight reservoirs -No scaling, precipitation, or corrosion issues -Avoid rock/fluid interactions -Avoid risk for unproductive wells |
| <p><u>Adverse Consequences</u></p> <ul style="list-style-type: none"> -Risk of induced seismicity -Loss of efficiency & performance -Project abandonment -Pollution of non-targeted aquifers -Low acceptance | <p><u>Expected benefits</u></p> <ul style="list-style-type: none"> -Minimize the risk of induced seismicity -Low maintenance costs -Increase outreach of geothermal energy -Minimal environmental impact -Improved acceptance |

Example - performance calculations

Assumed well trajectory

Horizontal well
at 4 km vertical depth

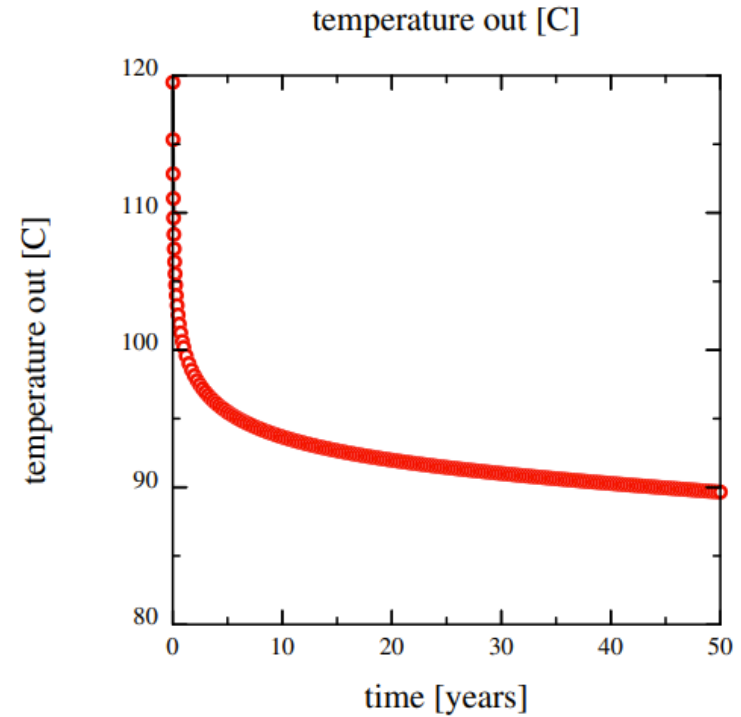
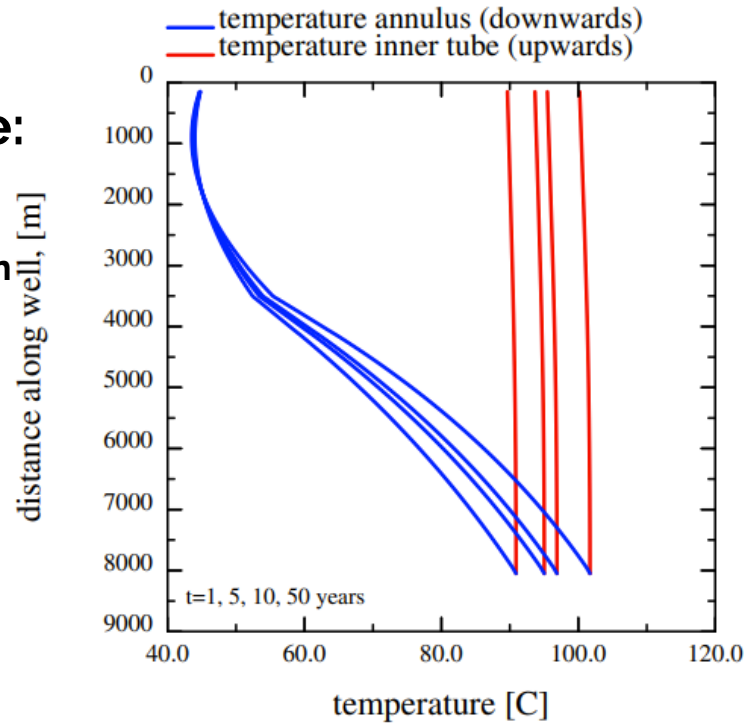


Well DK1: $V=3.7$ km, $H=4$ km, $Q=6$ kg/s

Example performance:

Assuming horizontal well section in typical formation.

Results from model by IFE.



1. PROJECT HOCLOOP:

Develop a new closed loop solution to reduce cost, improve performance to enable use of geothermal energy everywhere.

SCOPE OF WORK:

- Develop models and procedures for the closed loop system**
- Consider improvements by use of CO₂ and alternative fluids**
- Perform case studies on implementation and impact**
- Build and test the “Dual Heat String” (DHS)**
- Verify prototype DHS and procedures in a full-scale test well (Ullrigg)**
- Develop the technology to TRL 5**

2. GEOTHERMAL JIP

Scope:

- 1 Build model for the heat flow, - influx and transport.**
- 2 Design of the heat transport string.**
- 3 Pre-study and provisional plan for an example well at Svalbard.**
- 4 Evaluate production performance, cost and risk.**

REELWELL CLOSED LOOP SOLUTION FOR GEOTHERMAL ENERGY PRODUCTION

Improve access to the geothermal resources

- No need for hydrothermal reservoir or fracking
- Provide access to geothermal resources anywhere.

Improve energy production and performance

- Improve production by increasing the well reach.
- Improve the electric power production by use of CO₂ or alternative fluids.
- Minimize heat loss by the insulated DualPipe and provide low temperature on the wellhead.
- Improve social acceptance –avoid seismicity, toxic waste, small footprint etc.

Reduce costs

- Avoid NPT, risks and costs linked to conventional geothermal solutions.
- Reduce rig size and operation costs for well construction.