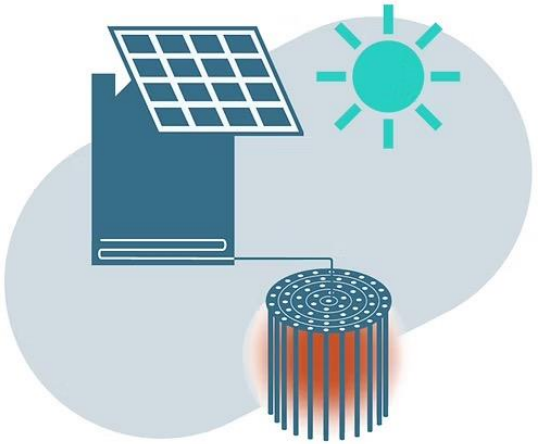
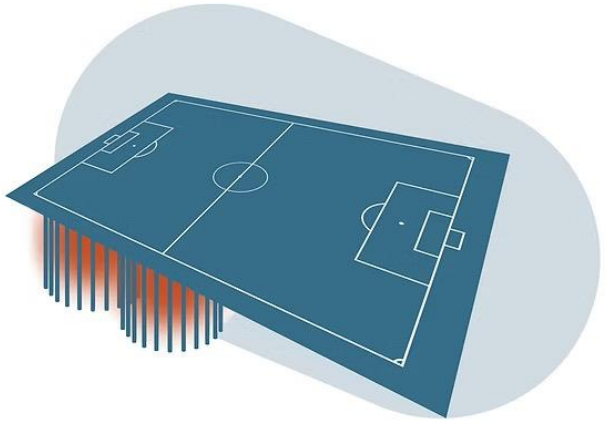
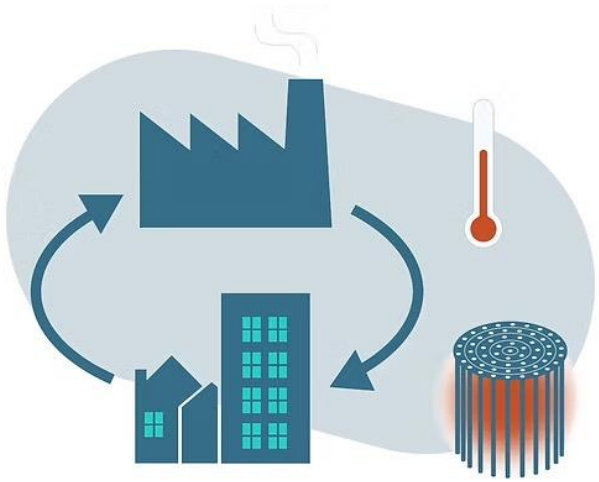
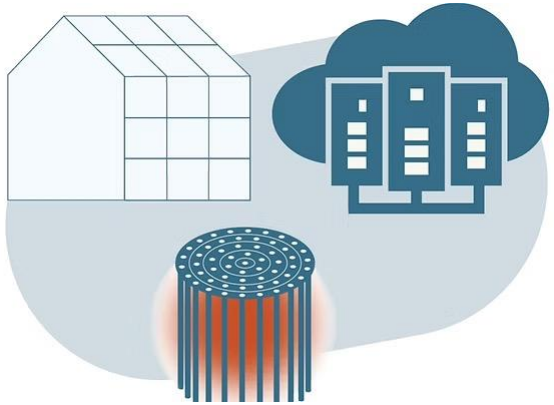

BEST I JORDEN

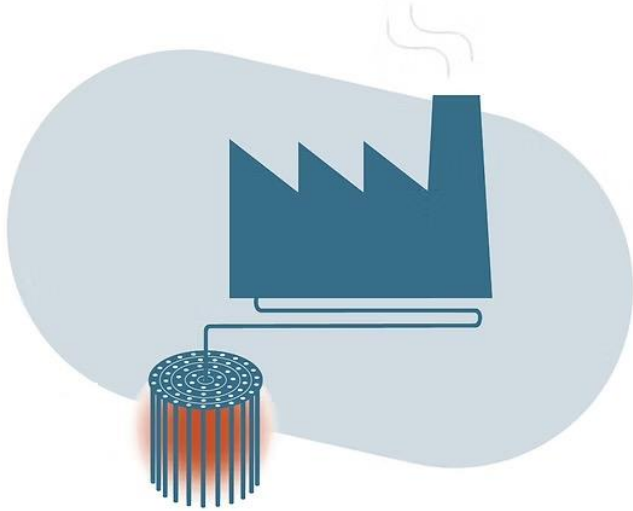
GeoTermos.no











MuoviXpert

- Turbokollektorer for temperaturer opp til 70 grader celsius
- Produseres i alle normale størrelser , enkel eller dobbel U
- Sveisbare rør med speil og elektromuffer
- Leveres også i preisolert utførelse for horisontale rør
- Samlekummer og fordelingsrør/samlestokker

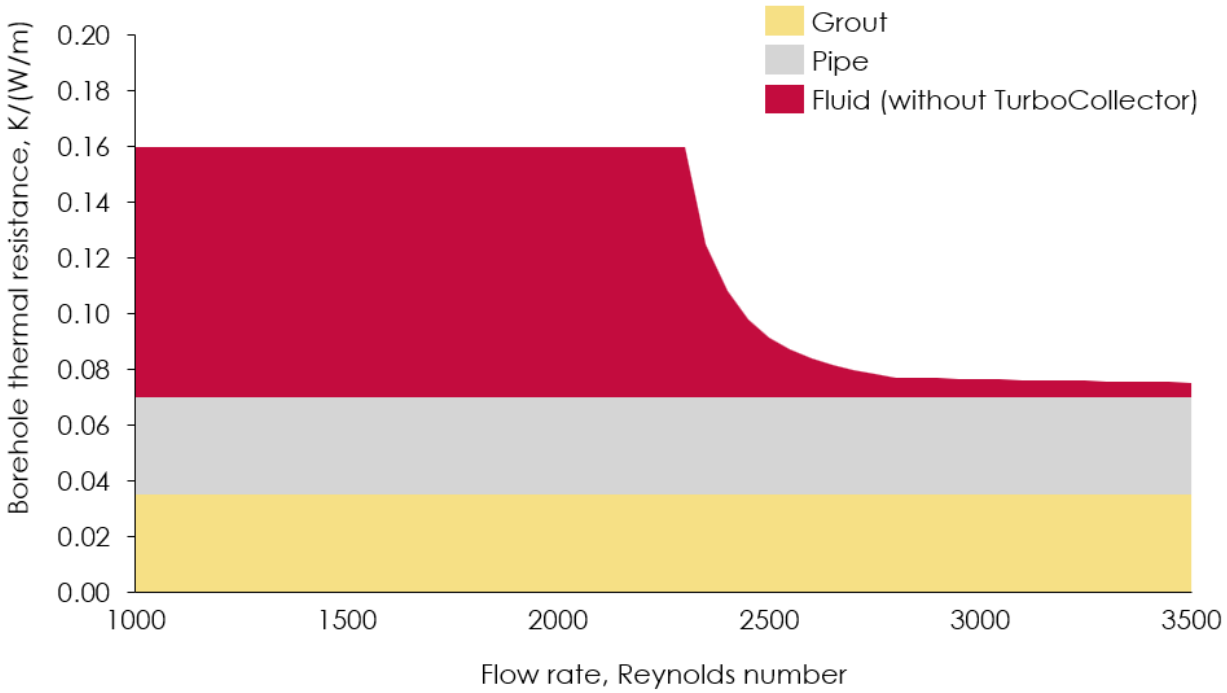
- Typiske anlegg som Fjell skole og Kolbotn IL

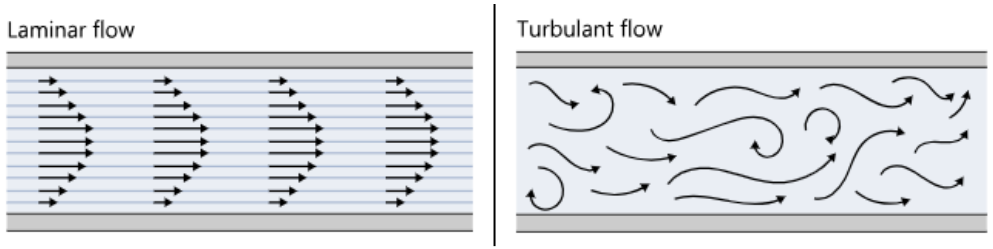
MuoviXtreme

- Kollektorer for temperaturer opp til 95 grader celsius
- Levetid opp til 50 år
- Produseres i ø32 , enkel eller dobbel U
- Ikke sveisbart , mekaniske koblinger

- Typiske anlegg som Nyhavna , hvor det idag er 3 borehull med denne type kollektor 4 x ø32 for langtids test.

The challenge: Minimizing thermal resistance

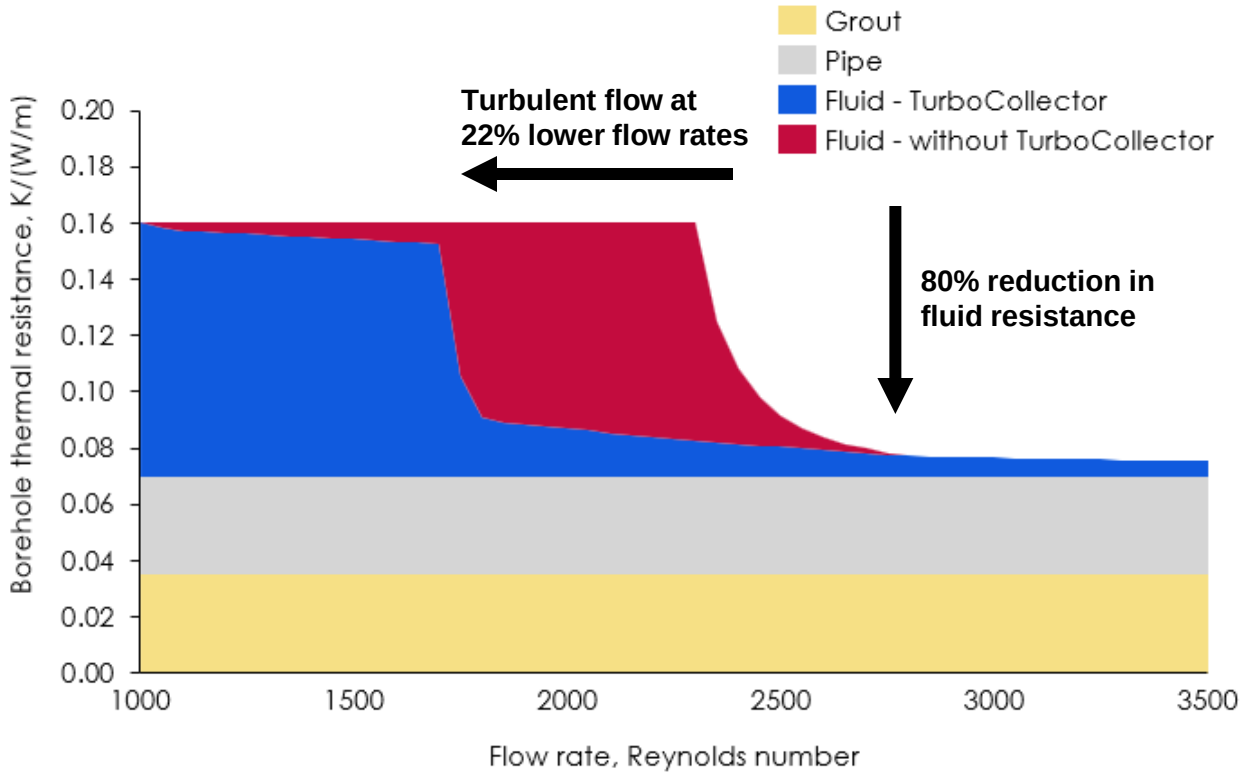




- At flow rates corresponding to Reynolds numbers below 2,300, the flow is laminar which creates significant thermal resistance in the fluid
- In the region with more developed turbulence (2800+ Reynolds) the resistance in the fluid is minimal
- In most systems today, the brine fluid flow rate varies across the season. This means a significant part of the running hours is in the laminar state (<2,300 Reynolds)

How it works

- **Turbulent flow at 22% lower flow rates gives…**
- **80% reduced fluid resistance, which gives…**

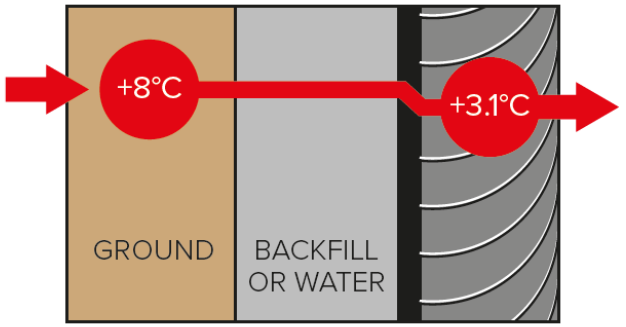


How it works

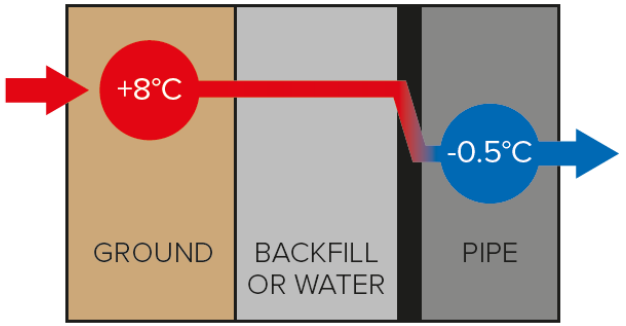
- **Turbulent flow at 22% lower flow rates gives…**
- **80% reduced fluid resistance, which gives…**
- **Up to 3.6C increase in brine temperature, which gives…**
- **Up to 11% COP improvement**

Example comparison

TurboCollector 40mm SDR17
Borehole resistance: 0.09 W/(K/m)



Smooth pipe 40mm SDR17
Borehole resistance: 0.16 W/(K/m)

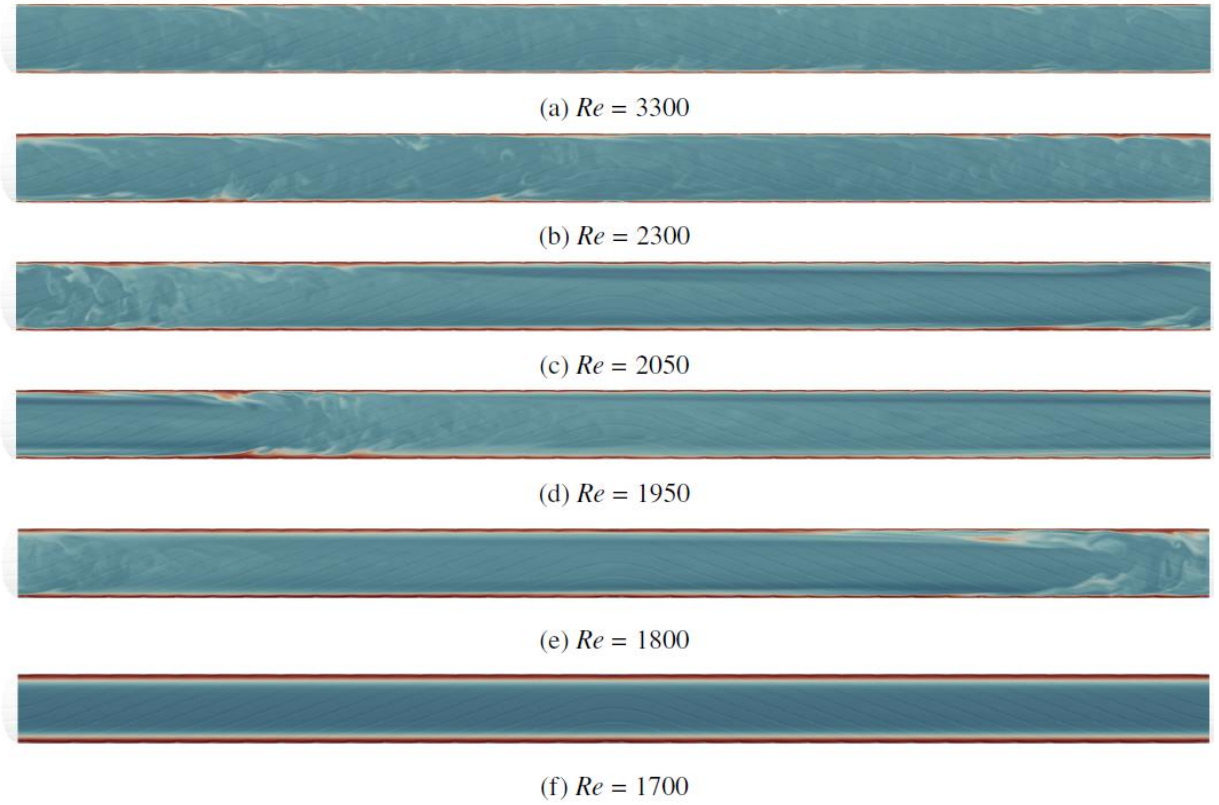


Example based on the following parameters:
Pipe dimension 40mm SDR 17
Flow rate of 0.4 l/s (Reynolds number 2000)
Heat transfer rate of 50 W/m.

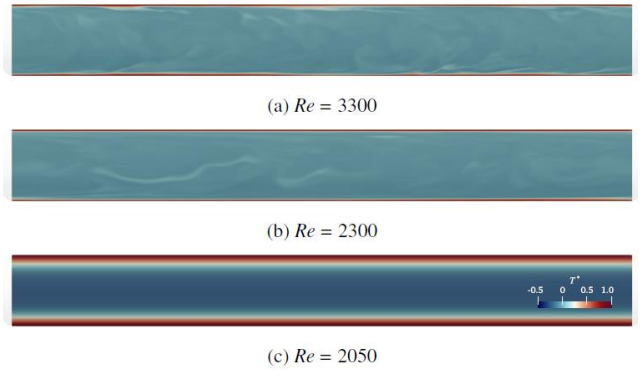
Scientific study using DNS (direct numerical simulation) shows transition to unsteady flow at 22% lower flow rates

Temperature visualization from numerical simulation

TurboCollector



Smooth probe



- Smooth pipe has been evaluated versus the TurboCollector
- Smooth pipe becomes laminar at Re < 2,300
- TurboCollector remains unsteady down to 22% lower flow rates (Re < 1,800)

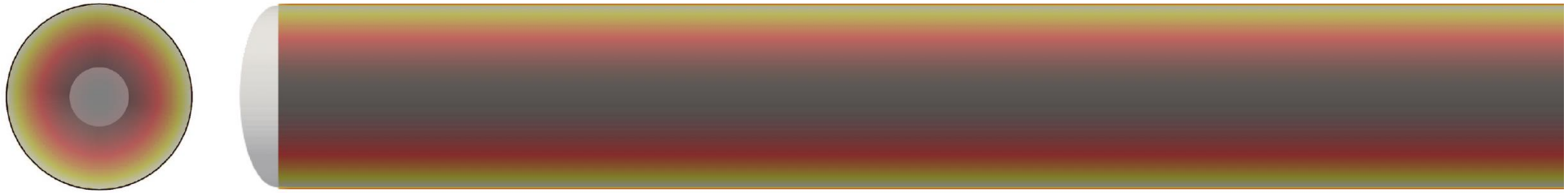
Scientific study using DNS (direct numerical simulation) shows transition to unsteady flow at 22% lower flow rates

Qualitative results TurboCollector vs smooth pipe

- Slices of the temperature field for (Re=2050, Pr=20) in modified and smooth pipe.

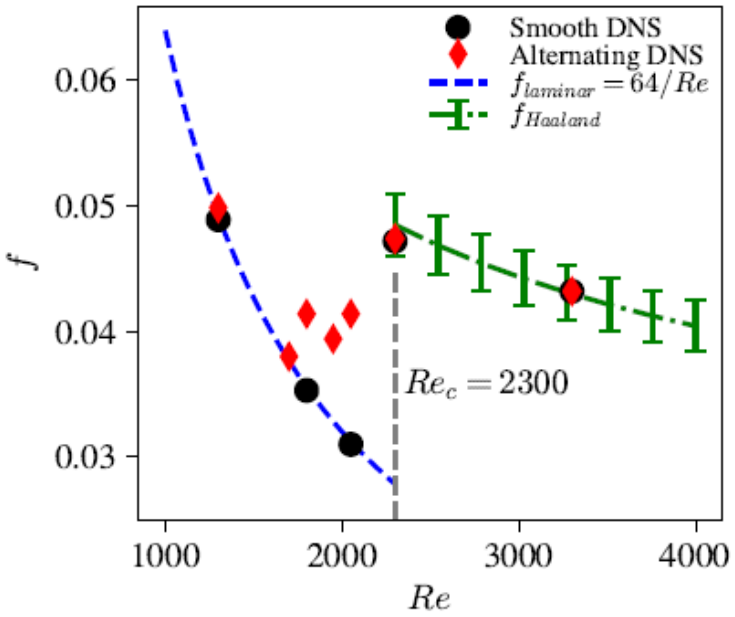
TurboCollector, unsteady flow

Smooth pipe, laminar flow

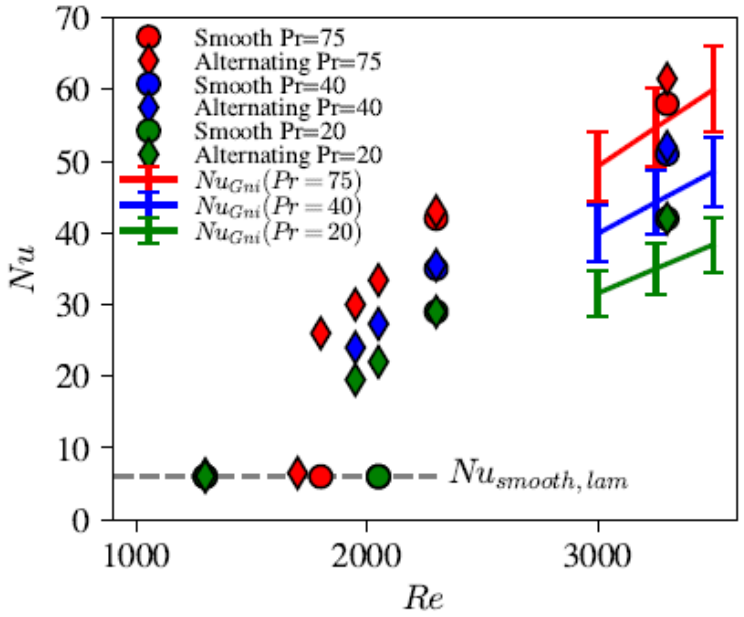


Scientific study shows up to 600% increase in thermal convective heat transfer

Friction factor (f) versus flow rate (Reynolds number)



Heat transfer rate (Nusselt number) versus flow rate (Reynolds number)



Explanations:
TurboCollector = “Alternating DNS”
Smooth collector = “Smooth DNS”
Pr = Prandtl number (= fluid type/characteristics)
Nu = Nusselt number = dimensionless convective heat transfer coefficient
f = friction factor = dimensionless pressure drop
Re = Reynolds number = dimensionless flow rate

Smooth pipe:

- Simulation results regarding pressure drop and heat transfer aligns very well with well-established correlations for the smooth pipe (blue, green and red curves)

TurboCollector:

- Study shows that between 1,700 – 2,300 Reynolds, the TurboCollector has a clear improvement in heat transfer (=“Nu”)

- The pressure drop in the TurboCollector increases only in the “window” of 1,700-2,300 Reynolds, where the significant heat transfer improvement happens

The scientific study shows that MuoviTech's patented fin design with alternating fin direction is the optimal solution

MUOVITECH TURBOCOLLECTOR
(Back-and-forth fin direction)

Significantly increased heat transfer for flow rates between 1800 – 2300 Reynolds

CONTINUOUS FINS
(No change in fin direction)

Insignificant heat transfer improvement

STRAIGHT FINS
(Fins parallel with flow direction)

No heat transfer improvement

Scientific study, done by Chalmers University of Technology, is available online

Thermohydraulic performance evaluation of internal fin designs for geothermal collector pipes

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1 Introduction

In this report we evaluate, using fully resolved Direct Numerical Simulations (DNS), the thermohydraulic performance of pipes with internal surface modifications (fins). The target application is collector pipes in geothermal systems but the results are applicable to other heat exchanger pipes with similar operating conditions. In typical geothermal collector pipes, a liquid (such as an ethanol-water mixture) with a temperature below the average ground temperature is circulated to extract geothermal heat from the borehole. The purpose of introducing internal fins to the collector pipe is to enhance the heat transfer rate from the borehole to the collector liquid. However, to determine a suitable fin design, several practical aspects needs consideration: