

# Helical Downhole Heat Exchanger for Closed Loop Geothermal Systems

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American-Made  
Geothermal  
Manufacturing Prize

## Problem

Closed loop geothermal systems have tremendous potential: they have no carbon footprint and are readily available. However, unless efficiency of these systems are dramatically improved they cannot compete with other renewables and will not be able to scale globally.

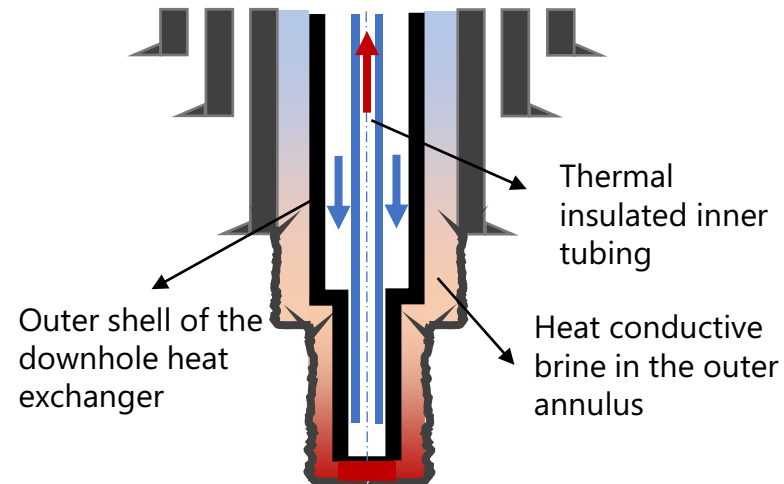
## Innovative Solution

We propose utilizing additive manufacturing technologies to make a highly efficient downhole heat exchanger. By forcing working fluid to flow in spiral-type pattern, we will reduce convective axial velocity and thereby increase effective heat harvesting time.

## Manufacturing Challenge

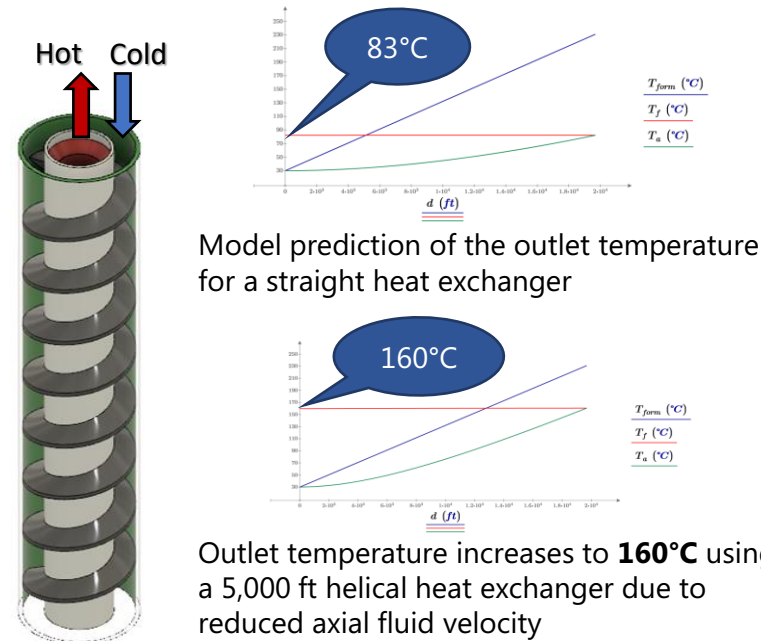
Manufacturing a helical-type heat exchanger using machining, welding, brazing, and swaging would be time-consuming and expensive. With Metal Additive Manufacturing becoming a regular production technology, helical-type heat exchangers could be easily produced.

## Closed Loop Geothermal Well

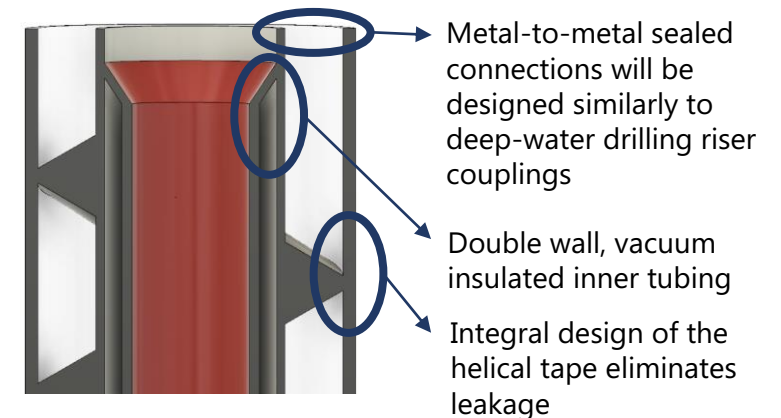


Closed loop well design solves challenges with CAPEX but creates technical challenges due to low thermal conductivity of the formation.

## Modeling Results



## Additive Manufacturing Solution



Modern industrial 3D metal printers can manufacture parts as long as 20 ft and with diameters more than 20 in. We can use and combine parts created through additive manufacturing to make helical downhole heat exchangers a cost-effective solution.