



# **MOST EASY AND LOW COST GEO THERMAL SYSTEMS FOR RETROFITTING CIVIL AND HISTORICAL BUILDINGS**

Web site: [geo4civhic.eu](http://geo4civhic.eu)

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# CONSORTIUM

## 19 partners

  
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## PROJECT INNOVATIONS (1/2)

- Rotary, vibration piling of steel co-axial GSHEs at depths between 50 – 80 m and up to 100 m
- Improve the Co-axial heat exchangers efficiencies (steel) and test plastic (GEOCOND)
- Dual source (air/water) heat pumps
- Two stage heat pump for high temperature terminals
- Low Global Warming Potential refrigerant heat pump working at low temperature

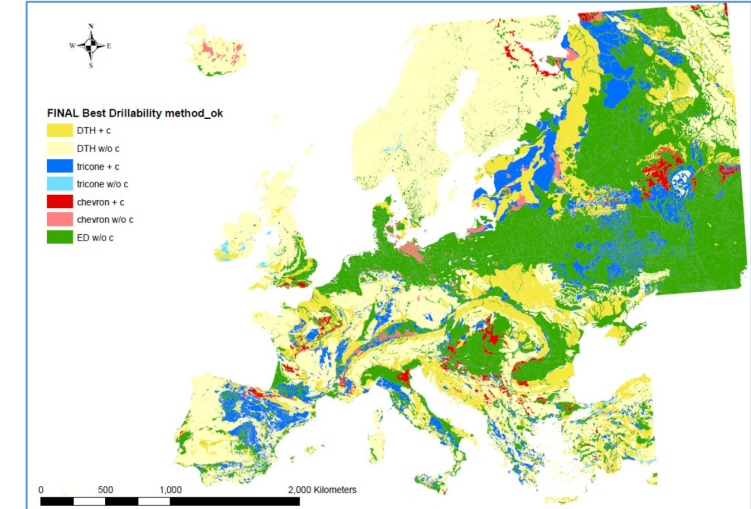


Vibration/rotation drilling head mounted on drilling rig



## PROJECT INNOVATIONS (2/2)

- European drilling maps
- Application (APP) for on-site drillability assessment



- Decision support system (DSS) for preliminary feasibility assessment and analysis of different solutions
- Building Energy Management (BEM) control optimization for RES synergies
- Application (APP) to guide user towards energy savings actions



# DEMONSTRATION CASES AND SCENARIO'S

- ❑ 2 field test sites to validate and improve the drilling methodology and machine components.
- ❑ 3 pilot case studies in existing infrastructure, to check and validate the adapted well point technology, to check and validate two types of innovative co-axial heat exchangers, two very shallow heat exchanger solutions, a new plug and play heat pump with optimized controls.

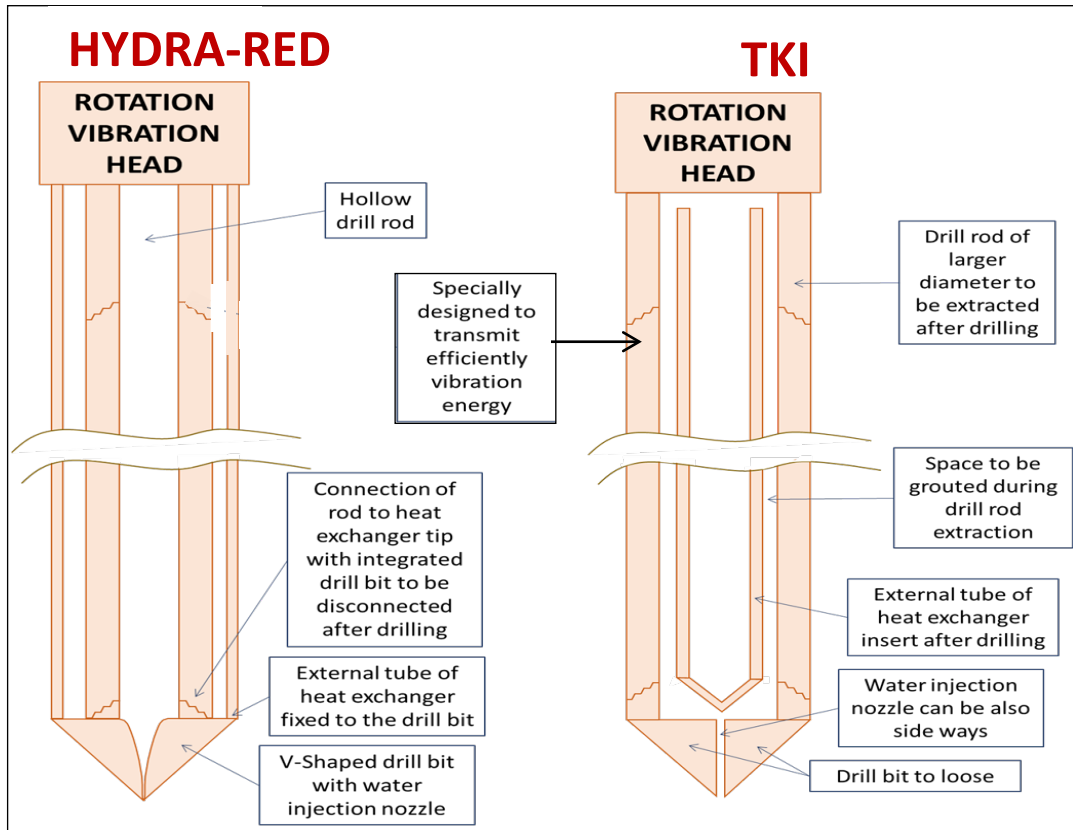


# DEMONSTRATION CASES AND SCENARIO'S

- 4 real demonstration case studies (1 civil and 3 historical) in different built environments, undergrounds and climatic conditions will be used to test the shallow geothermal system with the innovative drilling machine, the improved GSHE's and the novel heat pumps.



# FURTHER DEVELOPMENTS IN GEO4CIVVIC COAXIAL STEEL HEAT EXCHANGER AND COMPACT DRILLING MACHINE FOR BUILT ENVIRONMENT



	HYDRA-RED	TKI
<b>Method</b>	Piling	Piling
<b>Drill head</b>	Rotating, high speed	Vibrating, rotating, high power
<b>Fluid</b>	Water	Compressed air or water
<b>External diameter</b>	90 mm	60 mm
<b>Drill bit</b>	Rotating and connected to external tube	Universal drill bit to loose



# FURTHER DEVELOPMENTS IN GEO4CIVVIC COAXIAL STEEL HEAT EXCHANGER AND COMPACT DRILLING MACHINE FOR BUILT ENVIRONMENT

## Drilling machine features:


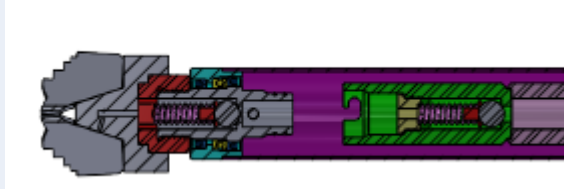
- Reduced size and weight
- Removable power pack
- Telescopic and rotating mast
- Magnetic clamps for shaft changes using an excavator



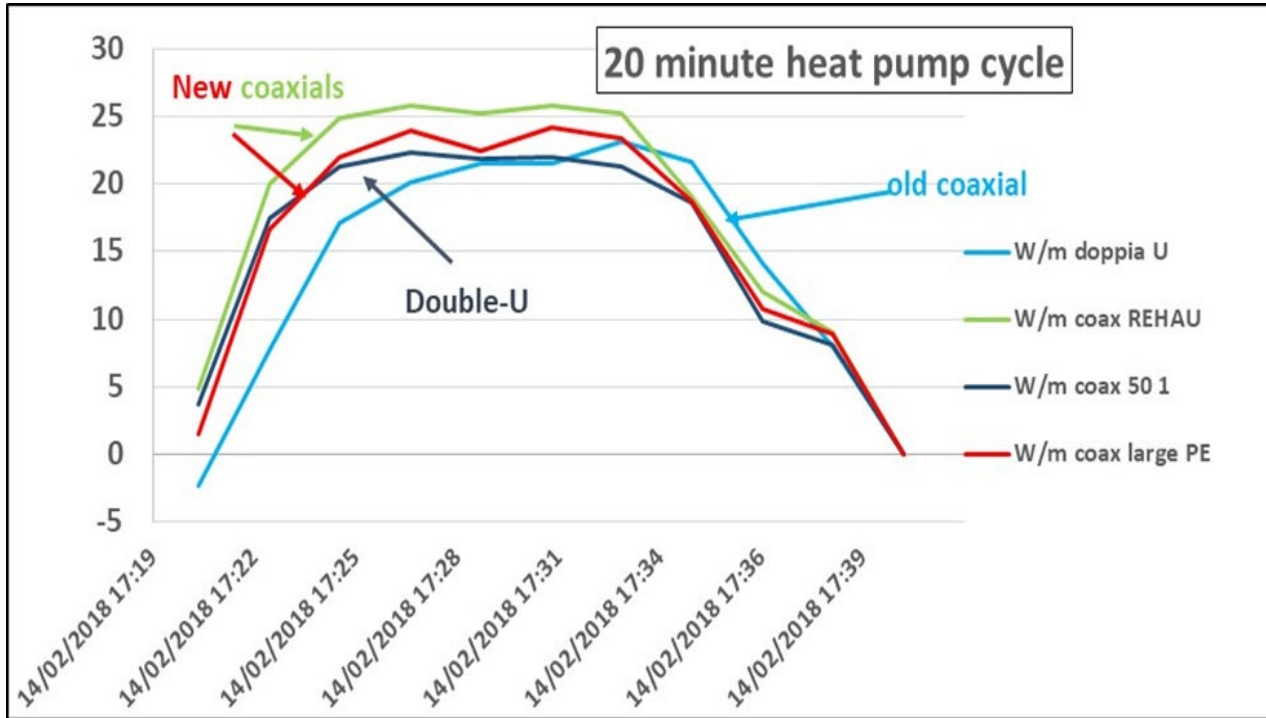
# COAXIAL STEEL HEAT EXCHANGERS AND COMPACT DRILLING MACHINES FOR BUILT ENVIRONMENT

## TKI

## HYDRA-RED

<p><b>Drill bit</b></p>		 <p>Tri-lame, tri-cone Only the drill bit rotates</p>
<p><b>Application</b></p>	<p>Soft and hard consolidated soils</p>	<p>Unconsolidated soils (clay, sand)</p>
<p><b>Drilling demo's done</b></p>	<p>Quarries in Italy and Germany R.O.P. 2-3 m/min Demo in Greystones (IR) Low air consumption, low bit wear</p>	<p>Pilots: Molinella (IT), Padova CNR (IT) Demo's in Mechelen (BE), Padova (IT), Ferrara (IT), Drilling</p>
<p><b>Drilling demo's to do</b></p>	<p>La Valletta (MALTA)</p>	

# HEAT EXCHANGER AND DRILLING METHOD INNOVATIONS



The energy extraction rate is at least 20 % higher than for double U's during heat pump cycles of 20 minutes

The thermal performance measured at the demonstration site in Putte (BE)

The TRT tests of the heat exchangers installed in Mechelen are confirming this higher yields

Probe mm	Conductivity W/mK	Resistivity K/(W/m)
63,5	2,17	0,089
88,9	2,48	0,028



## PROGRESS TO DATE

- ✓ The geometry and composition of the coaxial heat exchanger improve the thermal exchange yields in transitory conditions
- ✓ The reduction of installation times are in the order of 30 – 50 % in unconsolidated soil when support casing is needed unless an expensive double headed drill rig is used
- ✓ The cost reduction potential of 20 -30 % is the result of less meters to install (higher yields), the use of smaller machines and reduced installation times provided material costs are reduced further
- ✓ The compactness of the drilling machine make this technology particularly interesting for applications in built environment and for historical buildings.



# GEO4CIVHIC: INNOVATIVE GEOTHERMAL AND HYBRID HEAT PUMPS FOR BUILDING RETROFITS

In function of the emission systems of the buildings several heat pump solutions were developed

Type	Specifics	Applications	Demo
Geothermal, plug and play	Small, versatile, 5kW, H&C, HSW, solar	Renovated, single flats in multi-flat buildings	Padova (IT) with and without inverter
Geothermal, high temperature	Two stages of which one with CO2	(Historic) Buildings with radiators or high temperature terminals	Zagreb (HR), Greystones (IR)
Hybrid, high temperature	Dual source: air and geothermal, CO2 driven	Building with high temperature terminals	Ferrara (IT)
Hybrid, low temperature	Dual source: air and geothermal	Reduces length of geothermal heat exchangers	La Valletta (MALTA)
Geothermal, high and low temperature	CO2 driven, delta T of 30°C	Buildings with high and low temperature terminals	Mechelen (BE)





# Thanks for your attention



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