

**GeoTHERM**  
expo & congress



# New solutions and facilities to exploit GSHPs in urban environments

Presenter:

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In cooperation with:

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# Introduction



In practice, HDPE-pipes dominate the market in Europe.

The main reasons are:

## Cost and corrosion

- Plastic pipes have superior corrosion resistance compared to plain metals in the same cost range
- Corrosion-resistant metals are much more expensive

## Handling

- BHE made of plastic pipes can be delivered to the drilling site in coils, factory-finished and for the full length
- Most metals would mean sections of rigid steel tubes to be connected during installation on site.
- Corrugated metal tubes with thin walls (stainless steel) could also be pre-fabricated and coiled, but at much higher cost

# New improved plastic coaxial BHE



## *Development of a new high conductivity plastic coaxial BHE*

*Outer pipe: external diameter: 63 mm// wall thickness: 5.8 mm// thermal conductivity: 1 W/mK  
Inner pipe: external diameter: 32 mm// wall thickness: 2.9 mm// thermal conductivity: 0.1 W/mK*

Inner pipe consist of a bilayer compound one with standard PE100 and the other with a PE 100 foam to ensure a very low thermal conductivity.

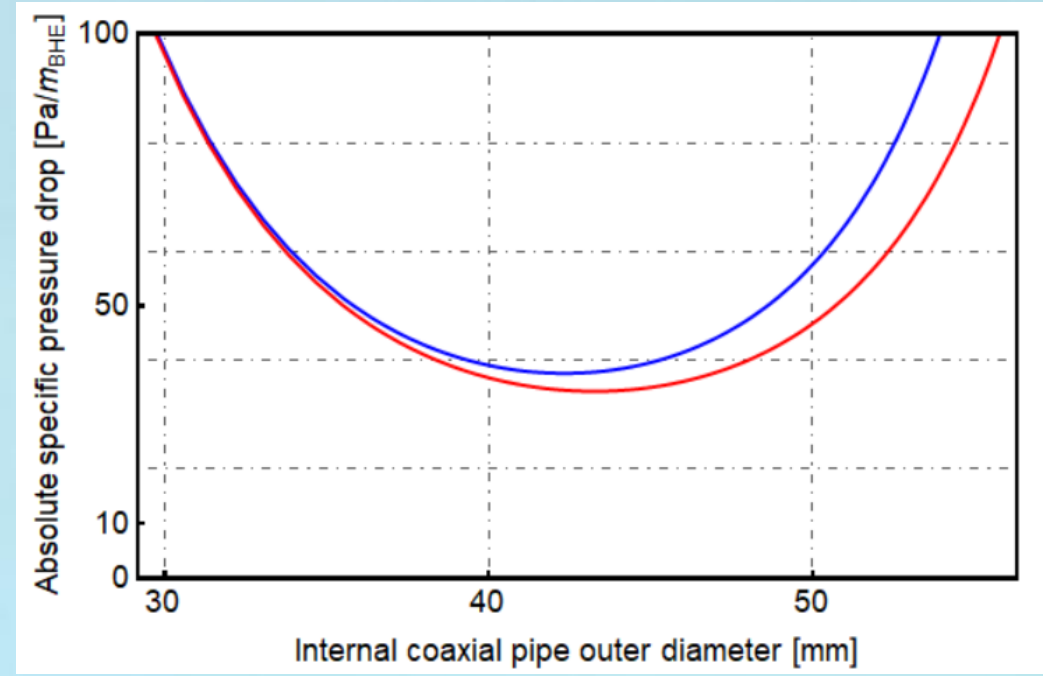
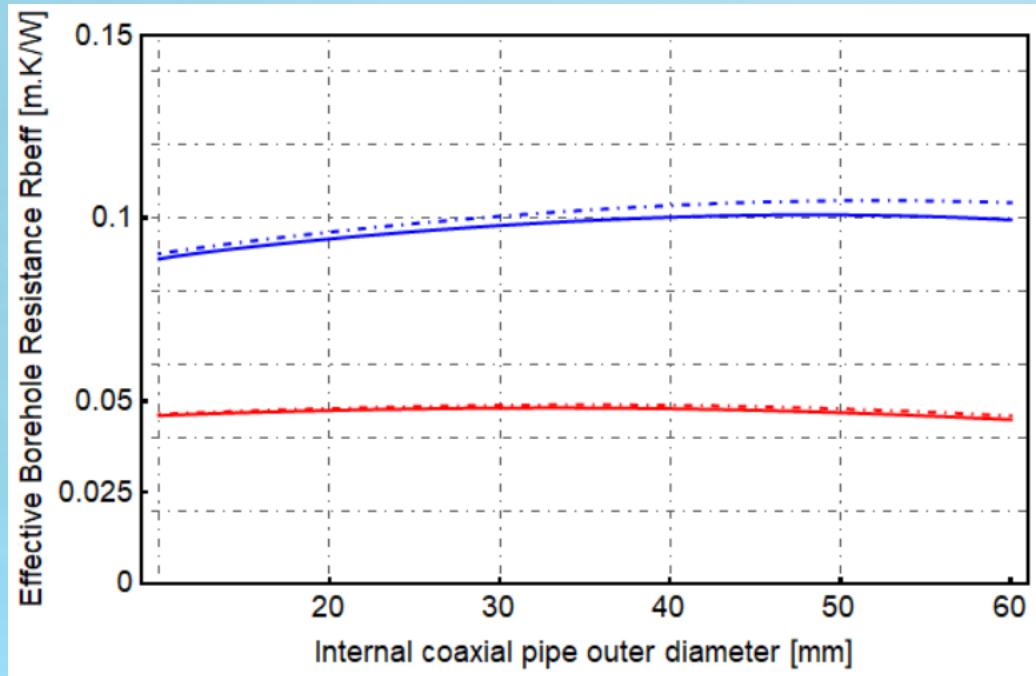
*The production of the CPHE has been done at the facilities of an Spanish company in collaboration with UPV. Two CPHE were performed:*

- 12 m CPHE to be installed and tested in the geothermal laboratory of UPV*
- 50 m CPHE to be installed in coordination with HYDRA, RED and CNR in Italy*

# New improved plastic coaxial BHE: *Thermohydraulic assessment*

$R_{b,eff}$  a coaxial plastic arrangement for varying internal pipe dimensions and fixed external pipe diameter of 75 mm.

Absolute specific pressure drop of a coaxial plastic arrangement for varying internal pipe dimensions and fixed external pipe diameter of 75 mm.

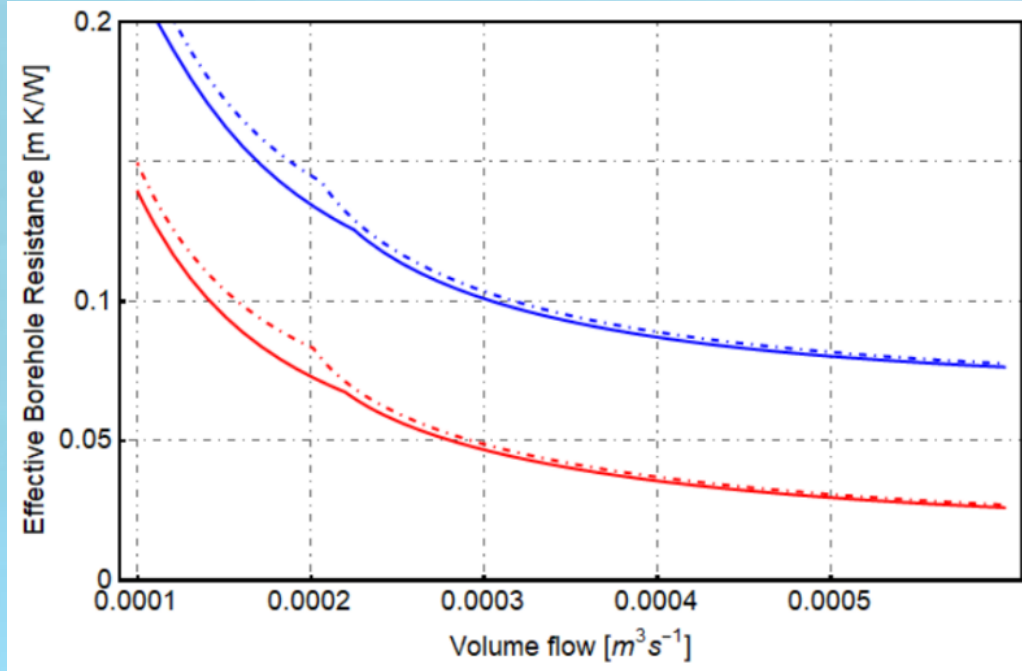


The blue curves correspond to standard PE-100, whilst the red curves correspond to highly conductive plastic external tube and the internal one is composed of a low conductivity plastic. Full curves show the 75/40 configurations, while dash-dotted curves show the results of the 75/50 configurations.

The blue curve corresponds to the 75/40 configuration with internal pipe thickness of 3.7 mm, while the red curve shows the results of the 75/50 configuration with thickness of 4.6 mm. The type of material does not substantially affect this result.

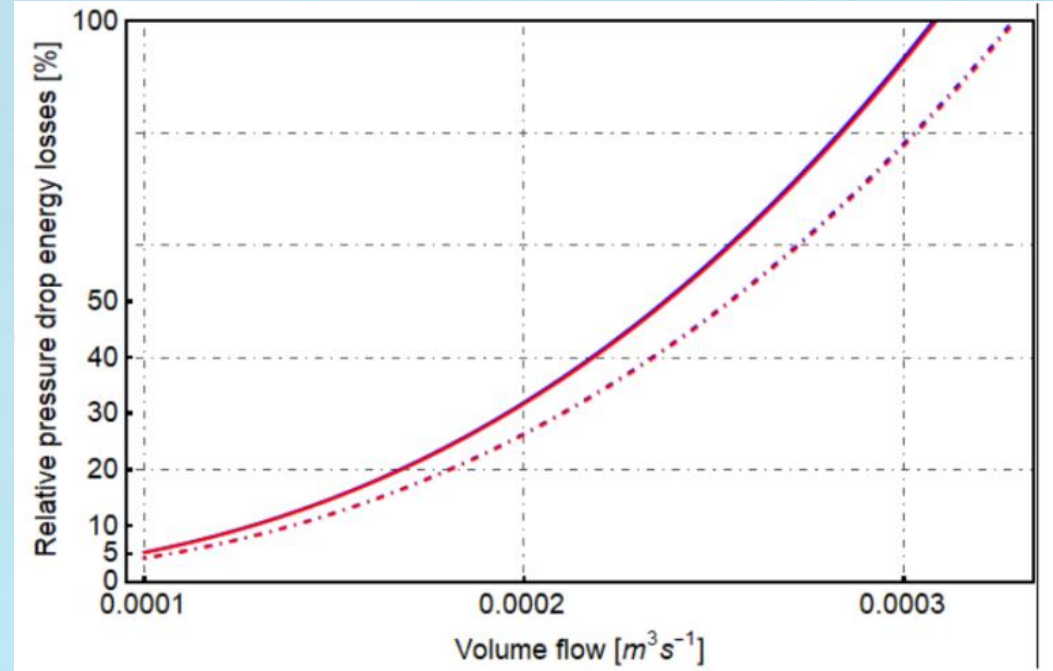
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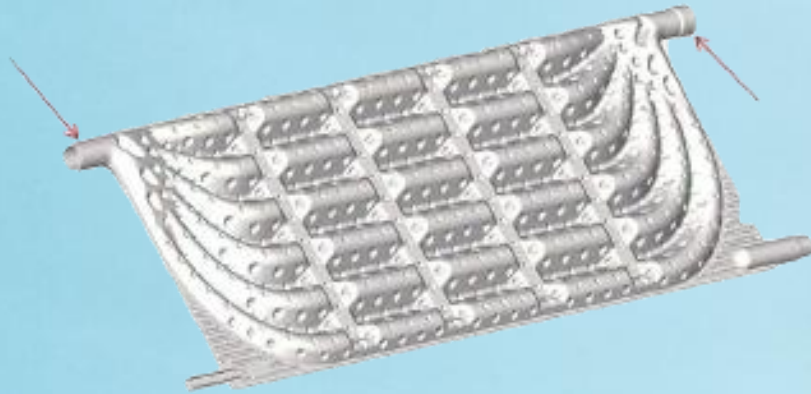
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Images of the Coaxial plastic heat exchanger with details of the bottom and head of the system



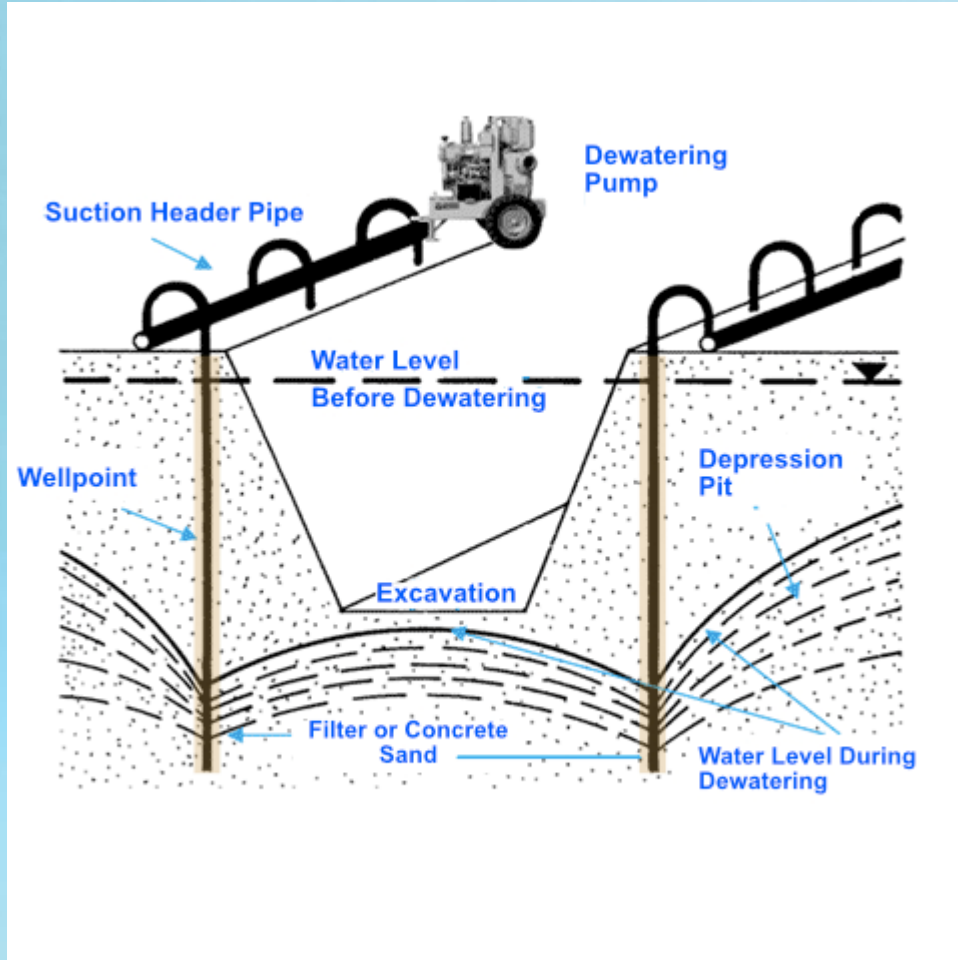
# Flat horizontal BHE with improved grout (PCM)



- ❑ Flat radiator horizontal BHE
- ❑ Use of thermally enhanced grouting (PCM)



# Adaptation of wellpoints:



- ❑ A wellpoint consists of a small diameter water abstraction drill
- ❑ Assessment of using techniques, materials and geometries which are used in traditional well point technologies as closed loop BHE
- ❑ Cheap installations and use of smaller drilling machines
- ❑ The depth of these probes will be limited (down to about 15 m)

# Thermal performance tests:

UPV testsite. Team: B. Badenes, M.A. Mateo and J. F. Urchueguía



Both systems are currently being thermally evaluated at the UPV's geothermal laboratory.

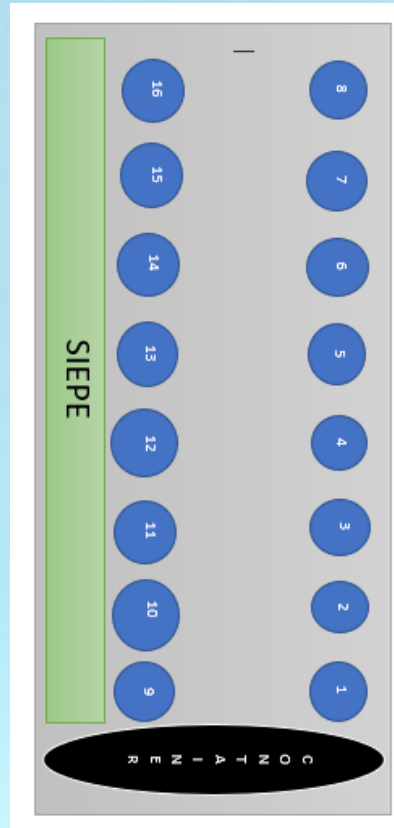
# Thermal performance tests:

Padova (CNR) testsite.

Team: A. Galgaro (UNIPD) and L. Pockele (RED)

Wellpoint 1-8 (acciaio al carbonio)  
Wellpoint 9-16 (acciaio inox)  
Tysen Krupp  
Geocond  
Nessuna (ex Hydra red)

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WellPoint	Materiale	Quota da p.c. [cm]	Altezza di scambio* [m]	Distanza da sonda successiva** [cm]
1	CATRAMINA	65	6.01	265
2	CATRAMINA	72	4.61	235
3	PRIMER (ZINCO99)	68	3.67	230
4	PRIMER (ZINCO99)	59	3.62	305
5	ANODO	56	4.93	285
6	NUDA	64	7.05	275
7	GALVANIZZATA	62	5.09	315
8	GALVANIZZATA	66	6.58	fine fila
9	AISI 304	51	4.85	255
10	AISI 304	52	5.10	230
11	AISI 304	87	5.91	260
12	AISI 316	95	4.31	280
13	AISI 304	107	4.96	285
14	AISI 304	53	5.98	295
15	AISI 304	118	4.51	315
16	AISI 304	75	4.02	fine fila

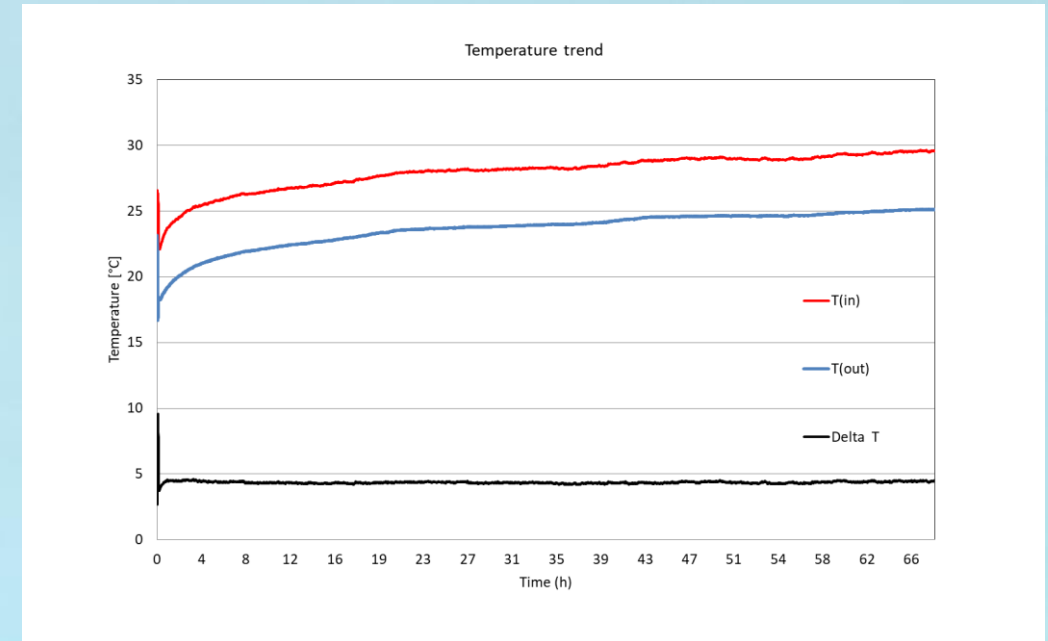
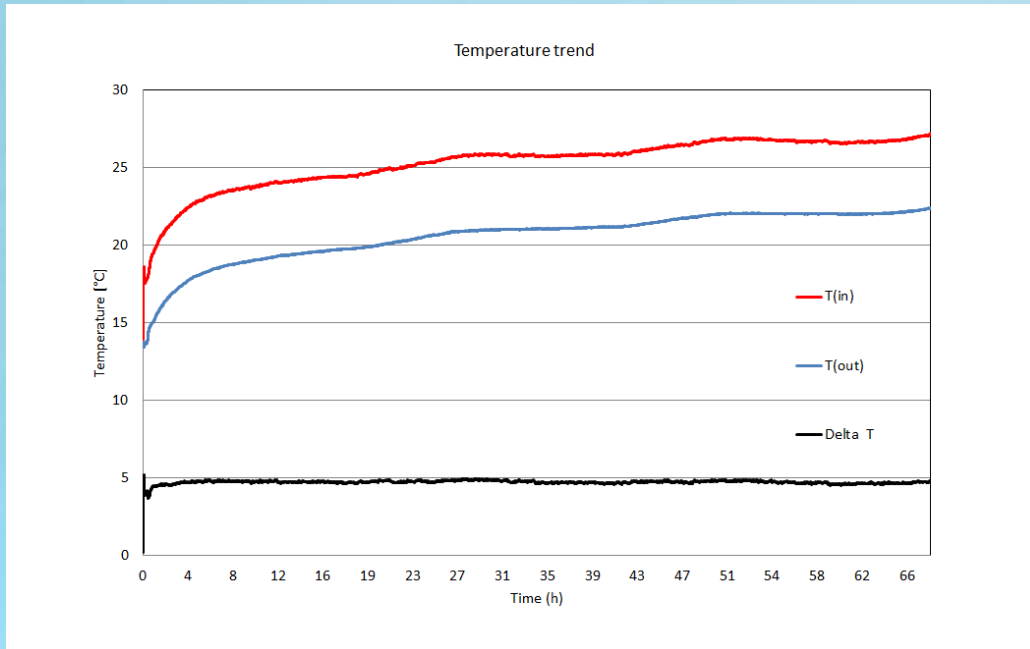
\*altezza utile della WP dopo la cementazione della punta

\*\* da 1 a 2 e così via sino a 8, poi da 9 a 10 sino a 16

# Thermal performance tests:

Padova (CNR) testsite:

Thermal tests are currently being evaluated



## TRT - carbon steel Wellpoint

Borehole number	8
Borehole total depth	39,64 m
Specific heat power	71,26 W/m

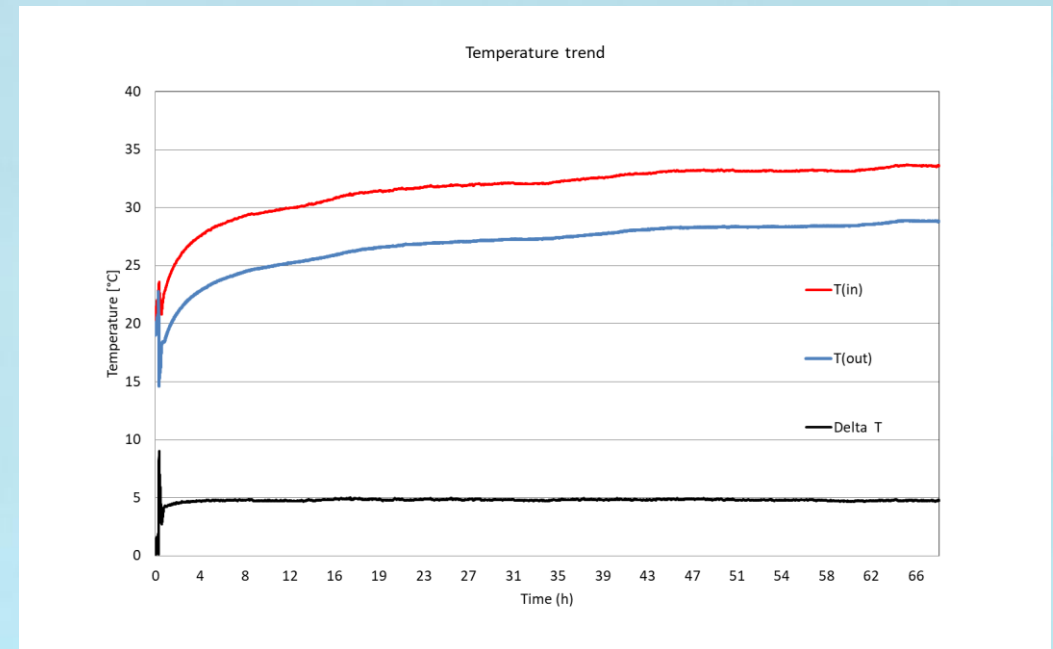
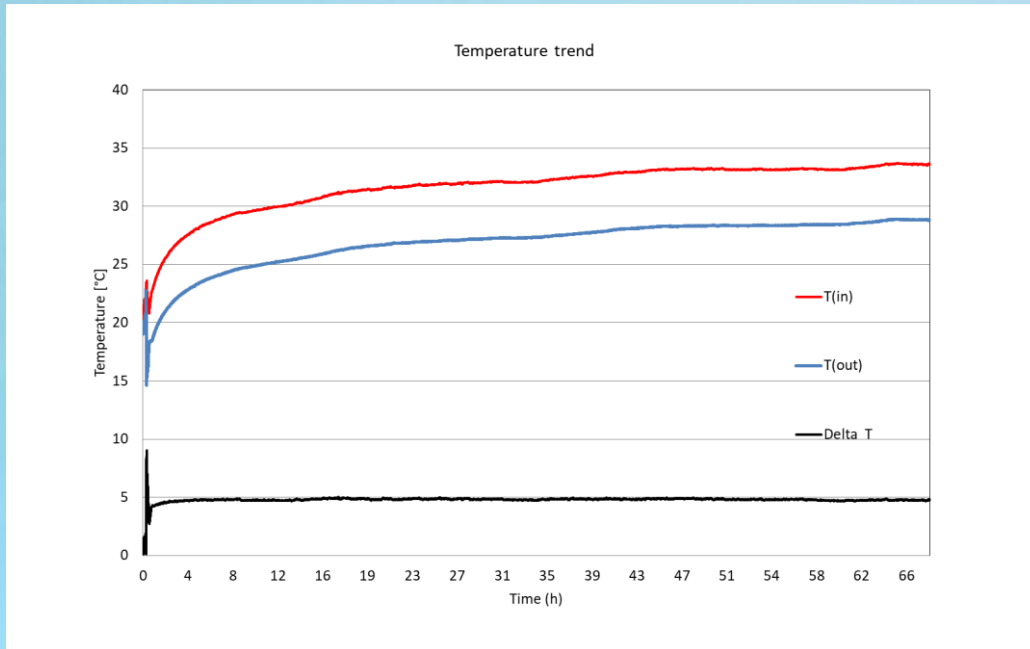
## TRT - overcoat treated Wellpoint

Borehole number	8
Borehole total depth	41,56m
Specific heat power	69,14 W/m

# Thermal performance tests:

Padova (CNR) testsite:

Thermal tests are currently being evaluated



## TRT – THYSSEN steel Borehole heat exchanger

Borehole number	1
Borehole total depth	92 m
Specific heat power	32 W/m

## TRT – ENHANCED PLASTIC GEOCOND Borehole heat exchanger

Borehole number	1
Borehole total depth	47 m
Specific heat power	61,21 W/m



THANKS  
for your  
ATTENTION