Development and testing of an innovative energy wall system in Torino (Italy)

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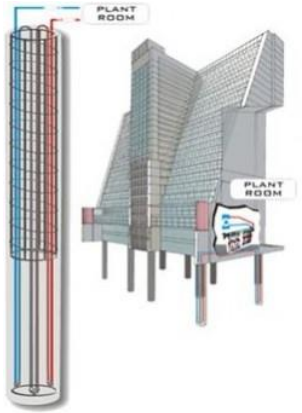
Introduction

Energy geostructures and energy walls

- Energy geostructures integrate in a single element a double structural and energy supply purpose

- *Linear* elements
  e.g. piles (most common), anchors



(gscltd.co.uk/closed-loop)

(scstn.it)

- *Surface* elements:
  e.g. tunnels, walls

(Barla et al., 2019)

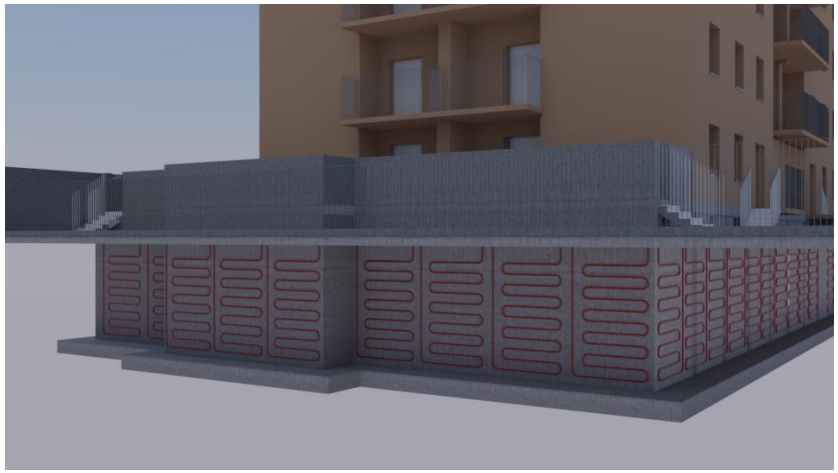
(CFMS, 2017)

- Application possible only in case of new buildings

System concept

Key characteristics

- **External application:** existing and new buildings, optimal exchange towards the ground side
- **Modularity**: Easy to install, flexible
- Low initial costs: cost-benefit analysis



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Prototype installation in Torino

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- **Energy Center building:** smart metering and high efficiency building in the PoliTO campus
- **3 Modules** installed with different deployment

- **Extensive monitoring system:**
  - 96 PT-100 temperature ground sensors
  - 3 tensiometers + 18 ground water volume sensors
  - 5 Pressure cells + 9 strain gauges on the wall surface

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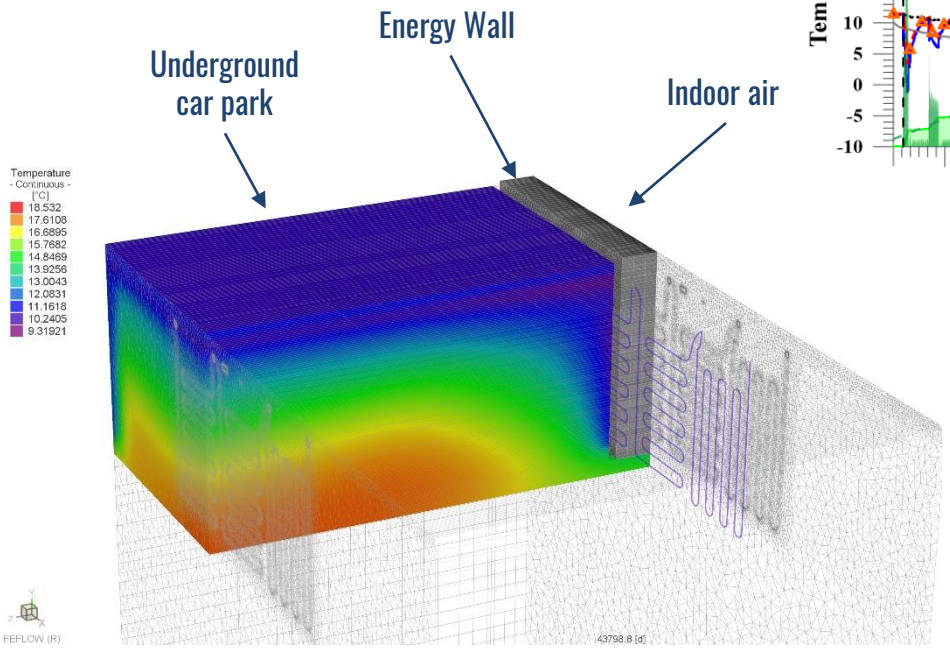
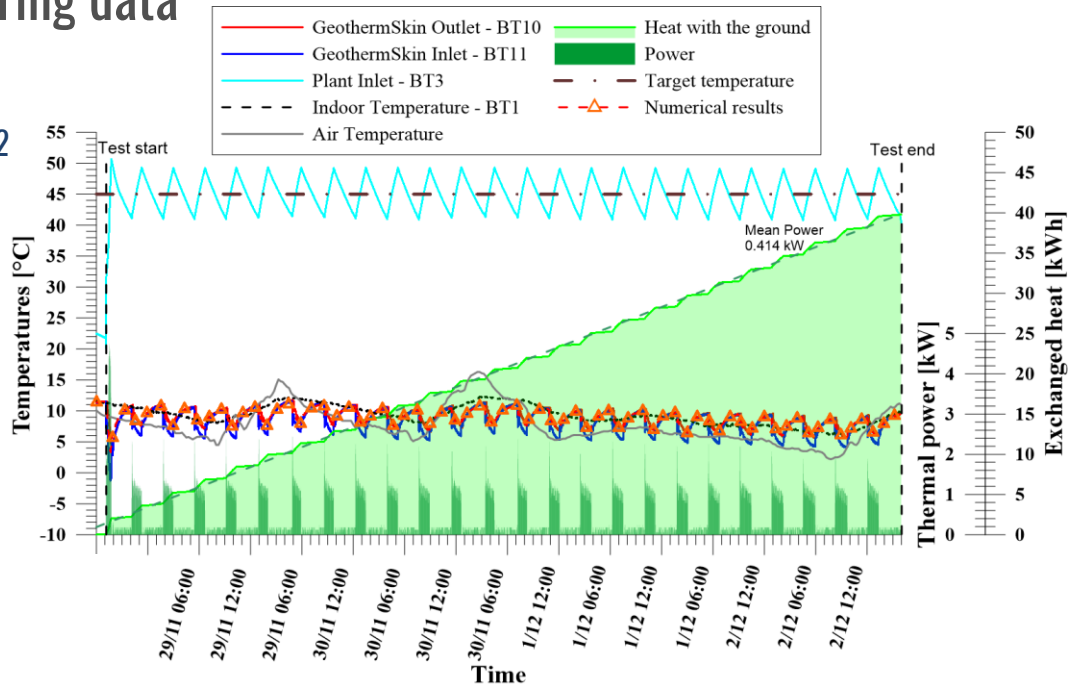
Thermal performance

Conclusion from experimental monitoring data

- Mean thermal exchange rate: 18-26 W/m²
- No difference in efficiency among pipe deployment





			Peak		Average	
			Thermal power	Temperature change	Thermal power	Exchange rate
Circuits	Mode	Link	kW	°C	kW	W/m2
2-3	Cooling	Sequential	5,71	8,9	0,59	26,21
1-2-3	Heating	Sequential	3,8	5,1	0,615	17,83
1-2	Heating	Sequential	2,37	3,9	0,414	18,00
2-3	Heating	Sequential	1,94	3,3	0,411	17,87
1-2	Heating	Parallel	2,13	2,1	0,492	21,39

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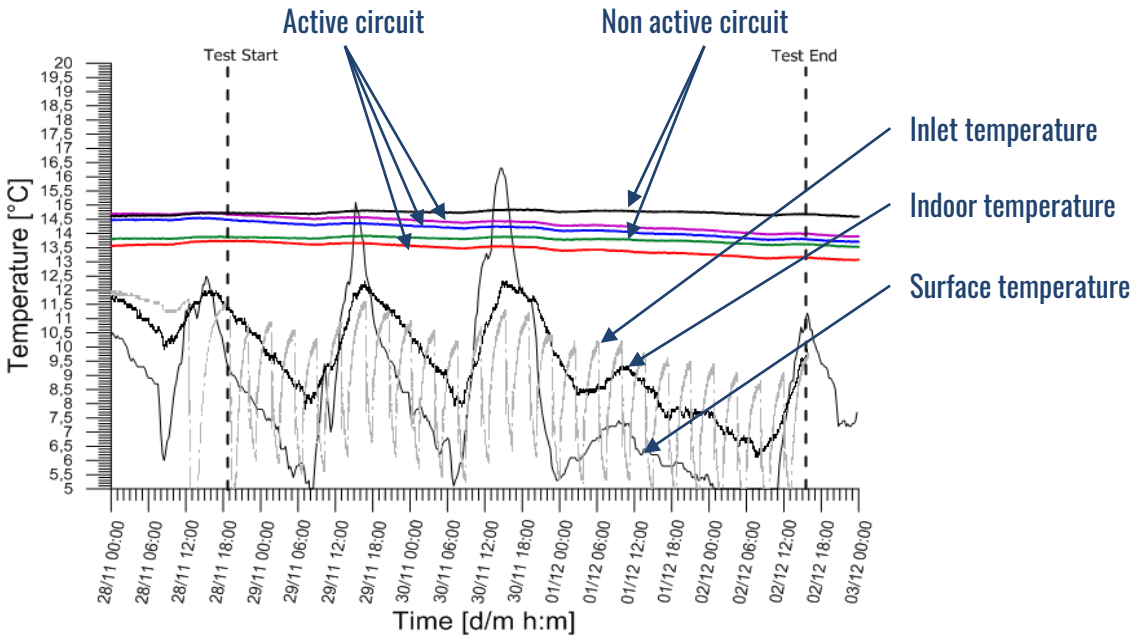
Impacts on ground and structures

Conclusion from experimental monitoring data

- Thermal affection in the ground: **limited to very narrow distances**
- External application: **no additional stresses** on the wall structure



Monitoring data at **30 cm** distance from the wall (**Depth=4,60 m**)

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