

## Deliverable D5.5

### Performance evaluation in real demonstration site No 2: Angel's Gate, Ferrara (Italy)

#### WP5

Grant Agreement number	792355
Project acronym	GEO4CIVHIC
Project full title	Most Easy, Efficient and Low Cost <b>Geothermal</b> Systems <b>for</b> Retrofitting <b>Civil</b> and <b>Historical</b> Buildings
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#### **Dissemination Level**

PU	Public	
CO	Confidential, only for members of the consortium (including the Commission Services)	X
CI	Classified, as referred to in Commission Decision 2001/844/EC	

## Publishable summary

Deliverable D5.5 is a confidential document delivered in the context of WP5, task 5.3 and subtask 5.3.2: “Real case No.2 Historical Building in Ferrara (ITALY)” developed as part of the GEO4CIVHIC project.

The deliverable describes the GEO4CIVHIC project solutions as implemented at the premises of the historic site Angel’s Gate in the World Heritage property of Ferrara, City of the Renaissance, and its Po Delta (Italy) located in the geographical purview of the UNESCO Regional Bureau for Science and Culture in Europe.

The demonstration site, Angel’s Gate, was equipped with an old and inadequate heating system using a gas boiler and without any active cooling. A new geothermal heating and cooling system replaces this plant. This system is composed of four co-axial geothermal heat exchangers drilled at about 100 m depth, a geothermal hybrid dual source high temperature heat pump (heating capacity of 35 kW<sub>th</sub> and CO<sub>2</sub> as refrigerant), a technical room hosting the heat pump and the monitoring system. All geothermal heat exchangers are installed with a traditional drilling method with water, using a double rotating head as requested by the Italian ARPAE authorities. The monitoring system measures thermal and electrical energy to assess the performance of the plant. Six new fan coils with enlarged surface area replace the four existing ones.

The project involved a range of stakeholders that helped to overcome conservational constraints and barriers to geothermal power application in historical buildings through an inclusive working scheme involving conservational and management authorities of the site along with local and international technical experts.

The project faced several delays and setbacks. First, the COVID pandemic delayed the installation and start-up until the summer of 2022. Then, a cloudburst on August 18<sup>th</sup>, 2022 flooded the technical room destroying the electronics of the circulating pumps. The material supply shortages following the economic uptake after the pandemic caused further delays to the repair. Finally, the system did restart in heating mode in February 2023.

Nevertheless, when operational, the system demonstrated the feasibility of heating and cooling a classified historic building with a high temperature heat pump using respectively the ground and the air as energy sources in heating mode and as energy sink in cooling mode.