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Geothermal Heating and Cooling in the FVG Region: the Grado District Heating and the Pontebba Ice Rink Plants

DELLA VEDOVA Bruno^{1,2,3}

¹ Department of Engineering and Architecture, University of Trieste, Italy

² UGI - Italian Geothermal Union, Firenze, Italy

³ F.I.T. - Trieste International Foundation for the Progress and Freedom of Sciences, Trieste, Italy

Corresponding author's e-mail: dellavedova@units.it

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ABSTRACT

Two running applications of direct use of low temperature geothermal resources for heating and cooling of public buildings, recently realized in the Friuli Venezia Giulia (FVG) Region - Northeastern Italy - with public fundings, are presented.

The *Grado Geothermal Pilot Project* was an ambitious challenge, initiated in 2002 and completed in early 2015, aimed to demonstrate the feasibility and sustainability of a geothermal doublet on the Grado Island (GO), in the northern Adriatic coastal area, by: i) characterizing the geothermal carbonate reservoir of the Grado area, ii) estimating its heat potential, iii) drilling a geothermal doublet, with one production and one re-injection well, and iv) realizing the distribution network and connecting 6 public buildings. The project had a total cost of 5 million € and included two phases. The 1st phase, completed in 2008, confirmed the existence of a low temperature geothermal reservoir within the buried carbonate platform, assessed its geothermal potential and verified the feasibility of the district heating plant in Grado. Seismic and gravity surveys were completed to locate the first exploratory well. Grado - 1 borehole was drilled down to 1110 m, into a terrigenous cover and a Paleogene - Mesozoic carbonate basement high. The 2nd phase (2012 - 2015) included further geophysical prospecting to extend reservoir investigations and to locate the second borehole. Grado - 2 was drilled in 2014, at about one km distance to the East of Grado - 1, down to 1200 m. By December 2014, two km of district heating distribution network was deployed and the first two public buildings were connected. Some of the main results are: the identification of major fault systems and production areas, the comprehension of the hydraulic circulation systems, the assessment of the geochemical facies of waters and of their sustainable utilization. The Grado reservoir is a confined fractured aquifer hosting anoxic fossil seawaters with temperatures up to 49 °C in Grado - 2 (7 °C higher than Grado - 1), pressure of 250 kPa at wellhead and spontaneous artesian outflow of about 100 t/h. The initial functioning of the district heating plant, envisaging a geothermal heating of several connected public buildings during cold seasons (up to about 3 MW_(th) heating load), will allow a significant economical saving of the order of 80 000–100 000 €/yr.

The existing cooling system of the *ice rink of Pontebba* town (UD), located close to the Austrian border, was totally renovated in late summer 2012: a open loop heat pump system using groundwater thermal energy was realized and functions both for the ice production and maintenance, and for the heating and hot water needs of the ice stadium. Two ammonia heat pumps (350 kW each) were installed, supported by two production water wells (32 m deep) and one re-injection water well (30 m deep), drilled into the alluvial deposits of the Fella River. A total production rate of up to 200 t/h could be achieved from the shallow unconfined aquifer, with an average temperature of about 8.5 - 9.0 °C. Over the first two years of operation, cost reductions of the order of 45% have been achieved.