Geothermal Energy In Quest Of Optimization

Located in eight places with a Mediterranean climate in common, the European Ground-med project aims to streamline the design and implementation of vertical geothermal energy connected to heat pumps.


The boreholes have been made in a limestone ground by the swiss company Augsburger.

With significant cooling and heating needs in both summer and winter, the Mediterranean coastline is a privileged area for the implementation of a reversible thermal system based on geothermal heat pumps. It could be true if we had equipment to guarantee a high level of efficiency throughout the year, both in heating and cooling. This quest for efficiency is precisely the purpose of Ground-Med (2009 2013), which is a European research program on geothermal vertical probes with a budget of 7,25 millions Euros distributed among 24 participants including CEA, Cetiat, CIAT and Greth (Group for research on heat exchangers).

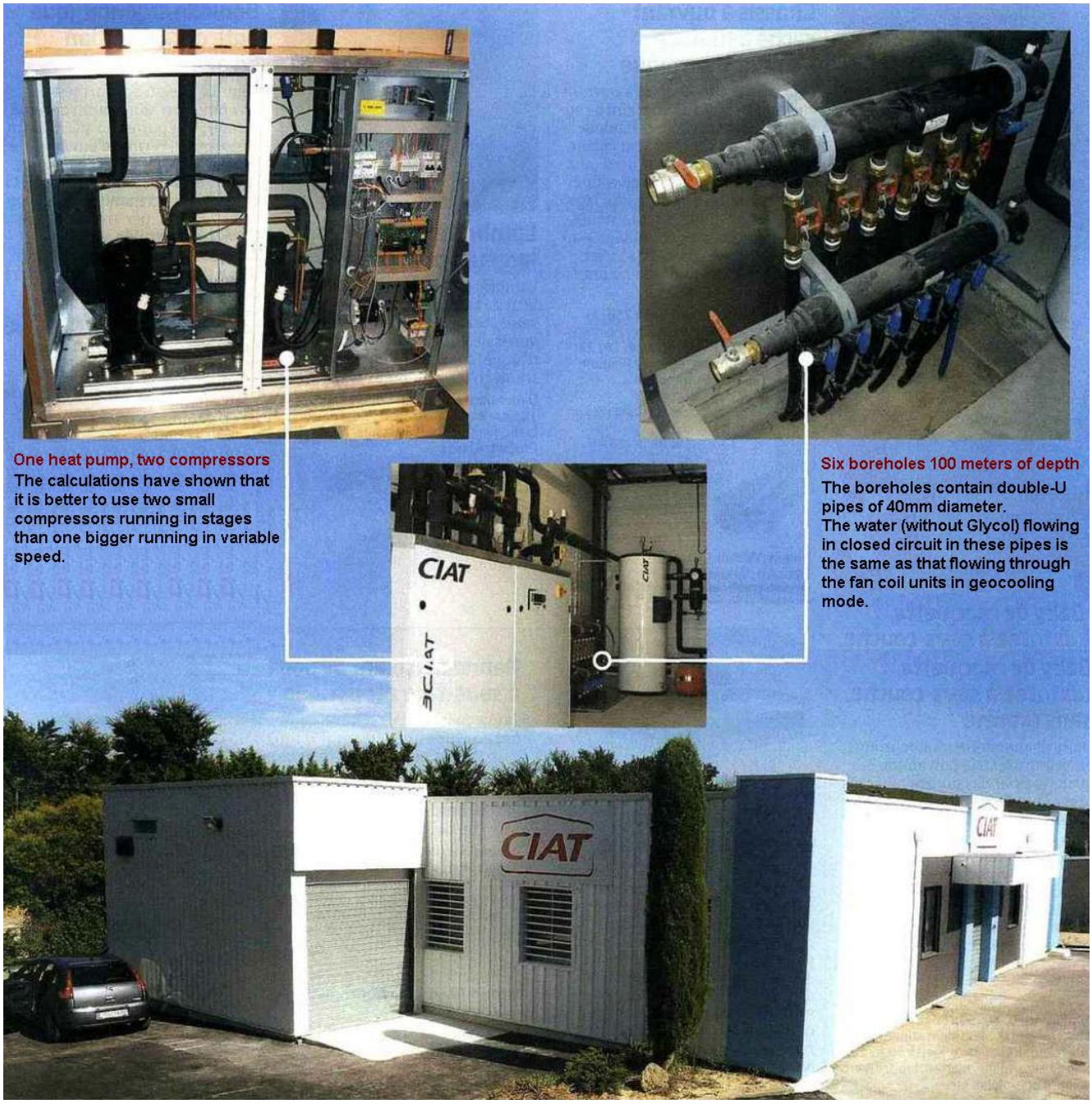
A seasonal performance factor greater than or equal to 5.

Among the eight European buildings (offices, university buildings, rehabilitated factories) used as laboratories in the project, only one is in France: the commercial agency CIAT Septèmes-les-Vallons (Bouches-du-Rhone). This lightweight building (metal frame) of 350 m² newly refurbished (2010) has, above all, been submitted to the rigorous analysis of the dynamic thermal simulation software Comfie-Pleiades. Results: 12 kW maximum for the cooling needs and 24 kW for the heating needs. "As part of Ground-Med, CIAT has developed two specific Heat Pumps: one of 25-kW for Septèmes-les-Vallons, and the other of 60 kW for the buildings of Barcelona (Spain) and Coimbra (Portugal)", explains Eric Auzenet in charge of research on thermodynamics systems. "In both cases, the goal is to reach a seasonal performance factor (SPF) greater than 5, which means that at least 5 kWh of thermal energy is produced on average for each kWh of electricity consumed".

An ambitious aim which demands a lot of pre-study. The fan coils units operate with a water temperature of 40/35°C in winter and 10/15°C in summer instead of the usual 45/40°C and 7/12°C.

CIAT has also chosen a tandem of two small compressors in parallel operating in stages rather than using a more powerful "inverter" compressor. "Our calculations show that the variable speed is not necessarily the most economical solution. Furthermore, it is locked by the Asian suppliers", says Eric Auzenet. Otherwise, the improvements on the heat exchanger, on the refrigerant expansion (R410A) and the feeding of the evaporator have

allowed to reach a seasonal performance factor of 6,2 in heating production and an energy efficiency ratio of 7,3 in cooling production for the heat pump specially developed for the project (a derivative of the Dynaciat range).



During the mild inter-season, it have been predicted to bypass the heat pump in order to cool the building (geocooling) without any energy cost that the electricity consumption of the hydraulic pumps (which are at variable speed and have high efficiency).

"One of the assets of geothermal is that we can recover in summer a part of cold injected in the ground in winter" comments Eric Auzenet. Furthermore, CIAT plans to install a preventive system of cold storage (about 25kWh) based on nodules filled of phase change material.

Operational since few weeks only, the installation collects its first results in view of a technical conference which will take place in Marseille in next October.

(Translation by Julien CANON (CIAT) from the original article published in Le Moniteur)