

Università degli Studi di Napoli  
Federico II

Facoltà di Ingegneria



Corso di Studi in  
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Per l'Energia e l'Ambiente

(Classe delle Lauree Magistrali in Ingegneria Meccanica, Classe N. LM33)

Tesi di Laurea

## TECHNICAL AND ECONOMIC ANALYSIS OF A LOW ENTHALPY GEOTHERMAL PLANT

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### SOMMARIO DELLA TESI

The study deals with the design and construction of two low enthalpy geothermal plants (closed loop and open loop), each of 100 kW, for heating, cooling and domestic hot water production. The closed-loop system has vertical borehole heat exchangers, using ground heat, and a heat pump capable to transfer heat from a cold environment to a warm one and vice versa, and a heat storage tank for DHW. The open-loop plant presents two wells withdrawing and reintroducing water to an aquifer, a heat pump and a heat storage tank for DHW. Costs of both systems have been evaluated and compared with traditional heating systems (fed by Diesel fuel, LPG and Methane). About both open and closed-loop, it was noted that in the end is always convenient the geothermal plant compared to conventional systems for costs and efficiency. The main differences between the two geothermal plants are: in the closed loop, there are many losses of load between the pipes and the borehole and it presents a lower efficiency with respect to the open loop; load losses in the second type plant are negligible. When possible, open loop option is preferred due to the consistent heat source, and lower costs. The disadvantage of the open loop is the possible aquifer pollution which may cause damage to the heat pump. Then is often chosen the closed-loop. The (NPV) is much higher in the open-loop because the costs are lower than the closed loop ones. The customer can choose what type of geothermal system to use for his house according to the available budget and aquifer.



A low-enthalpy geothermal closed-loop system



A low-enthalpy geothermal open-loop system

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