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Thermal Performance of an Air-Water Heat Exchanger (AWHE) Operating in Groundwater and Hot-Humid Climate

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Abstract : Low-depth geothermal energy can take advantage of the use of the subsoil as an air conditioning technique, being used as a passive system or coupled to an active cooling and/or heating system. This source of air conditioning is possible because at a depth less than 10 meters, the subsoil temperature is practically homogeneous and tends to be constant regardless of the climatic conditions on the surface. The effect of temperature fluctuations on the soil surface decreases as depth increases due to the thermal inertia of the soil, causing temperature stability; this effect presents several advantages in the context of sustainable energy use. In the present work, the thermal behavior of a horizontal Air-Water Heat Exchanger (AWHE) is evaluated, and the thermal effectiveness and temperature of the air at the outlet of the prototype immersed in groundwater is experimentally determined. The thermohydraulic aspects of the heat exchanger were evaluated using the Number of Transfer Units-Efficiency (NTU-ε) method under conditions of groundwater flow in a coastal region of sandy soil (southeastern Mexico) and air flow induced by a blower, the system was constructed of polyvinyl chloride (PVC) and sensors were placed in both the exchanger and the water to record temperature changes. The results of this study indicate that when the exchanger operates in groundwater, it shows high thermal gains allowing better heat transfer, therefore, it significantly reduces the air temperature at the outlet of the system, which increases the thermal effectiveness of the system in values > 80%, this passive technique is relevant for building cooling applications and could represent a significant development in terms of thermal comfort for hot locations in emerging economy countries.

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