Abstract:

Rapid industrial and population growth has increased demand for energy in Palestine in recent years. Air conditioning systems are among the most energy consuming systems, as most of them operate on non-renewable energy sources that are harmful to the environment, such as fossil fuels. Therefore, it is necessary to exploit renewable energy sources available in Palestine, such as geothermal energy.

In project (1), the system was planned to connect a geothermal heat exchanger with a VRF system to cool the wedding hall, but as the cooling load was too large due to large heat gain due to ventilation requirements, our approach got changed. To achieve a more efficient and sustainable solution. By implementing a heat recovery system that incorporates an Air Handling Unit (AHU), a heat exchanger, a chiller, and a geothermal horizontal loop. This decision was driven by the need to manage the substantial cooling demands more effectively while maximizing energy efficiency.

The heat recovery system functions by capturing and reusing waste heat from the indoor air, thereby reducing the workload on the chiller. The AHU circulates and conditions the air within the hall, ensuring a comfortable and consistent indoor environment. By integrating a heat exchanger, the warmer outdoor air can be leveraged to precondition the incoming air, significantly cutting down on energy consumption.

The chiller, which is vital for maintaining the desired indoor temperature, is efficiently cooled by the geothermal system. This setup not only enhances overall system performance but also aligns with the sustainability goals by reducing reliance on conventional energy sources.

The main idea of the project is to replace the non-effective energy source used in the regular air conditioning system in a wedding hall in the city of Jenin with an area of 900 square meters in a renewable, environmentally friendly energy source and an effective air conditioning system. This is by implementing the combination of heat recovery and geothermal cooling which is better equipped to handle large cooling loads compared to the VRF system, while also providing long-term cost savings and environmental benefits.

A comparison between the system with water-cooled chiller without heat recovery and a system with air-cooled chiller without heat recovery was implemented resulting that the water-cooled chiller is a better option. Therefore, another comparison between a system water-cooled chiller and heat recovery and with a system with water-cooled chiller and heat recovery was implemented showing that the system with water-cooled chiller and heat recovery is a better system with higher COP which is 7.3, higher annual saving of $11,895, higher NPV which is $7319 and SIR of 1.20.