

Solar photovoltaic/thermal (PVT) technology collectors and free cooling in ground source heat pump systems

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Abstract

Ground source heat pump (GSHP) systems offer a low carbon heating and cooling solution for the decarbonization of buildings. As global temperatures rise, the cooling requirements of buildings will grow, even in regions where cooling systems have been historically uncommon due to their colder climate, such as Sweden. The combination of free cooling (FC) with GSHPs seems like a natural way to meet the increasing cooling needs, since the heat extracted from the building during the summer months can be injected into the ground to potentially regenerate the borehole field and enhance heat pump performance. However, a technology that is generally integrated with GSHP systems for borehole regeneration are photovoltaic/thermal collectors. This study investigates the performance of a ground source heat pump system with free cooling for a multi-family building in Stockholm, Sweden, and the interference on the free cooling capabilities of the system when photovoltaic/thermal collectors are present. The results demonstrate that the integration of PVT and FC not only maintains the cooling supply but also enhances heat pump performance, all the while reducing borehole length and land area requirements.

Keywords: Passive cooling, Solar hybrid, Solar PVT, Heat pumps, Low energy buildings

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