Phase change energy storage heat pump

Figure 1 shows that two phase-change thermal energy storage devices can be employed to connect the air source heat pump on the low-temperature side with the water source heat pump on the high-temperature side, with paraffin acting as the phase-change material (PCM). Water at 15 °C is produced by the air source heat pump.

The multi-energy coupled heat storage solar heat pump is the future research direction of the application of phase change heat storage technology in the solar heat pump. It is pointed out that the future development trend is to improve the thermal conductivity of phase change materials, optimize the structure, and strengthen the heat transfer.

Simulation results for IECC Climate Zone 6A reveal that the combi heat pump with phase change thermal storage can reduce the design size for heat pumps by 40-60%, reduce maximum electric demand by 30-50%, reduce electricity use during 4-12-hour load shed periods by 50%, and avoid the need for auxiliary electric resistance for both space- and ...

With the development of the economy and society, energy problems have become a great concern. The heat pump-coupled thermal energy storage (TES) system is a potential form of building heating, which can improve the stability of the grid and promote the consumption of renewable energy. Phase change materials (PCMs) are widely used in the field ...

The heat pump COP changes slowly during the heat storage process, while the system"s COP increases with heat storage time due to the gradually rising power from the solar component. The average system COP in Kunming, Hangzhou, Lhasa, and Harbin is 10.23, 8.87, 8.49, and 7.70, respectively.

Small Commercial Space Heating/Cooling Heat Pump with Phase Change Material Thermal Energy Storage 2 Performing Organization(s): Lawrence Berkeley National Laboratory PI Name and Title: Spencer Dutton (PI), Energy Technology Researcher; Marco Pritoni (co -PI), Research Scientist PI Tel and/or Email: smdutton@lbl.gov, mpritoni@lbl.gov WBS: 3.4.6.55

Phase change material (PCM)-based thermal energy storage (TES) can provide energy and cost savings and peak demand reduction benefits for grid-interactive residential buildings. Researchers established that these benefits vary greatly depending on the PCM phase change temperature (PCT), total TES storage capacity, system configuration and location and ...

Energy-saving potential of compression heat pump using thermal energy storage of phase change materials for cooling and heating applications," Energy. 263, 126046 (2023). ... Simulation-based performance evaluation of large-scale thermal energy storage coupled with heat pump in district heating systems," J. Energy Storage.

61, 106721 (2023).

They simulated the operation of water thermal energy storage, with and without phase change material (PCM), acting to shift the electric consumption of the heat pump to off-peak periods. ... Solar thermal energy storage and heat pumps with phase change materials. Appl. Therm. Eng., 99 (2016), pp. 1212-1224. View PDF View article View in Scopus ...

Box-type phase change energy storage thermal reservoir phase change materials have high energy storage density; the amount of heat stored in the same volume can be 5-15 times that of water, and the volume can also be 3-10 times smaller than that of ordinary water in the same thermal energy storage case [28]. Compared to the building phase ...

"Hybrid thermal energy storage with phase change materials for solar domestic hot water applications: direct versus indirect heat exchange systems," ... Study on heat transfer performance of phase change thermal storage heat pump water heater with carbon nanotubes. IOP Conf Ser Earth Environ Sci, 555 (1) (2020), 10.1088/1755-1315/555/1 ...

Chen et al. [56] addressed the issue of insufficient heating in cold areas by proposing a phase-change energy storage heat pump system that uses heat from solar energy and air energy to provide a heat source for secondary heat pumps. Phase change energy storage technology is applied in the system to fully integrate the "low power" strategy ...

2. The heat supply system coupling a passive phase change energy storage sunlight room and an air source heat pump according to claim 1, wherein each phase change heat storage module (1) is made of stainless steel by welding, with a heat absorption coating on its outer surface, and phase change materials being filled therein; and the phase change materials are prepared from ...

Experimental investigation of the novel melting point modified Phase-Change material for heat pump latent heat thermal energy storage application. Author links open overlay panel Xin Jin b, Fengping Wu a, Tao Xu a, ... As shown in Fig. 1, a typical heat pump latent heat thermal energy storage (HPLHTES) system is composed of an HP as the ...

The International Energy Agency (IEA) includes the heat pumps for space heating and cooling and hot water as one of the technologies which has the greatest long-term potential for reducing CO 2 emissions. According to the proposed BLUE Map scenario (a scenario in which energy-related CO 2 emissions are reduced by 50% in 2050 from 2007 levels), it is ...

In order to improve the application of renewable energy in cold regions and overcome the drawback of the low performance of traditional air source heat pumps (ASHP) in a low temperature environment, a novel type of dual-source heat pump system is proposed, which includes a heat pump, photovoltaic-thermal (PVT) modules, an air heat exchanger, and phase ...

Phase change energy storage heat pump

To alleviate the serious energy waste and air pollution caused by heating of buildings in rural areas, a solar-assisted transcritical CO 2 heat pump system with phase change energy storage (STCHPS-PCES) suitable for rural houses is proposed. In addition to the environmental protection of refrigerants and the matching of heating characteristics with the ...

Latent heat TES (LHTES) systems, by contrast, are based on phase change materials (PCMs) and offer the advantages of a fairly constant working temperature and the enhanced energy density of their storage material, which allows the storing of 5-14 times more energy than SHTES in the same volume, therefore reducing the size of the storage ...

Innovative phase change energy storage equipment for heat pumps is introduced. ... A mathematical model for heat transfer is developed, and the equipment is integrated with the air source heat pump, utilizing identified phase change materials and control logic for various modes. Field experiments on a retrofitted office building air source heat ...

This paper studies the performance of a cold storage heat pump system integrated with phase change materials (PCMs) for space cooling. An air-cooled heat pump unit comprising of two constant rotation speed compressors is selected. The PCM is an organic material that is commercially available, and has a phase change temperature of 10-12 °C.

The study analysis the behavior of a new developed heat pump water heater technology which integrates a phase change materials storage with a standard heat pump water heater to maximize the performance parameters of the Unified Energy Factor (UEF) and First Hour Rating (FHR). A model-based control development co-simulation

Performance analysis and operation optimization of air-to-water CO 2 heat pump with phase change thermal storage. Energy and Buildings, Volume 209, 2020, Article 109738 ... Solar thermal energy storage and heat pumps with phase change materials. Applied Thermal Engineering, Volume 99, 2016, pp. 1212-1224. V. Kapsalis, D. Karamanis.

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