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Energy Efficient and Adaptive Cooling and Heating

Adaptive rooftop panel uses sun and sky inputs to supply heating or cooling water, cutting HVAC energy use and cost.

Researchers at Purdue University have developed a radiative cooling and heating rooftop panel that can be easily integrated into an HVAC system. HVAC systems receive, store, and disperse both cooling and heating energy. While effective, current systems still struggle with on-demand cooling energy storage, roof access beyond the solar panels, and overall complexity. There remains an unmet need for an energy-efficient cooling and heating rooftop panel. Purdue researchers developed one that uses the environment for its fuel and can maintain sub-ambient levels. The adaptive radiant material layer responds to input from the sun, sky and occupant feedback to generate hot water or chilled water as needed. The technology gathers heating energy from the solar panels during the day and then switches to storing cooling energy from the sky at night. This plus the hydronic system to store and dissipate the heat/cooling air as needed forms the solution at hand.

Technology Validation: Researchers tested the adaptive panel in different temperatures/climates and used a 3-way mixing valve to alternate between the two chilled and heated water loops to maintain thermal comfort.

Advantages:

-Nature-powered

-User-friendly

-Low-cost

Applications:

-Ventilation

TRL: 4

Technology ID
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Category
Energy & Power Systems/Energy Storage
Buildings, Infrastructure, & Construction/HVAC & Building Energy Efficiency
Buildings, Infrastructure, & Construction/Demand-Responsive Heating & Cooling Systems

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Utility Patent, 2021-12-23, United States

DIV-Patent, 2024-06-13, United States

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