



Logic and Apparatus for Cost-Effective Heat Comfort Control for Air-Source Single-Speed Unitary Heat Pump Systems

Smart heat pump control reducing peak power 40% while improving comfort in cold climates.

Heat pumps have become an increasingly popular method of home temperature control because of their energy-efficiency and low operational costs. However, a barrier to the use of heat pumps in cold climates is reduced thermal comfort caused by cold blows. Researchers at Purdue University have developed a Heat Comfort Control (HCC) system to optimize the energy use of the heating elements through modulation to balance between thermal comfort and energy efficiency. Simulation of the HCC system predicts a 41.47% reduction in peak electricity demand of the heat pump. Purdue's approach is easy to implement, requiring no major hardware modifications to conventional systems. This technology has applications with heat pump manufacturers seeking to improve air-source heat pumps for cold climates.

Advantages

- Improved thermal comfort
- Reduced peak electrical demand
- Improves viability of heat pumps in cold climates

Applications

- Residential HVAC
- Distributed energy resources
- Green Technology

Technology Validation:

Technology ID
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Category

Energy & Power Systems/Grid
Modernization & Smart Grids

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This technology has been validated through comparing the HCC system with a baseline heat pump control system using a Modelica simulation of a residential home. Results showed a reduction of 57.7% in cold draft time, a 41.47% reduction in peak power demand, and thermal comfort improvements of 40%.

TRL: 3

Intellectual Property:

Provisional-Patent, 2024-01-31, United States

Utility Patent, 2025-01-29, United States

Keywords: Cold climate heat pumps, Smart HVAC control, Energy-efficient heating, Thermal comfort optimization, Residential energy systems, Demand response technology, Green building solutions, Peak load reduction, Heat pump performance enhancement, Sustainable home heating, Intelligent climate control, Renewable HVAC systems, Home energy efficiency, Electrification of heating