Indirect expansion solar assisted heat pump system for hot water production with latent heat storage and applicable control strategy

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Research Motivation
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Day (24 Hours)

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• Design and built IDX-SAHP system for DHW.
• Create and implement system control strategy for efficient operation
• Study the effect of latent heat storage tank
• Investigate the reliability and stability of the proposed control strategy in different climate conditions
Test Rig schematic diagram

Test Rig – TB104, Brunel University
**Heat Pump Loop**

**Function:**
- Primary heating element for the system
Heat Source Loop

Function:
• Heating source to the HP via:
  1. Solar Collector
  2. AWHX
  3. PCM HX
Heat Sink Loop

Function:
• Transfers the heat from the heat pump to the storage tank
Direct Solar Loop

Function:
• Works as traditional thermal solar system
Load Simulation Loop

Function:
• Simulates the DHW consumption for typical dwelling
Flow chart of the system control strategy
BMS Control

Wiring sheet – Niagara AX 3.7
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Experimental procedure

Variations of solar irradiance during four test days

Variations of load profiles during four test days
Variations of WST water temperatures during two sunny test days – Top, Mid and Bottom

Variations of WST water temperatures during two cloudy test days - Top, Mid and Bottom
Variations of system power consumptions during four test days

Variations of system COPs during four test days
Variations of compressor and AWHX fan control signals during two sunny test days

Variations of compressor and AWHX fan control signals during two cloudy test days
The system was designed, constructed, instrumented and experimented successfully.

The proposed control showed energy saving and reliable operation.

The PCM HX could increase the system COP by 6.1% and 14% during sunny and cloudy days respectively.

The PCM HX improved the control of AWHX during cloudy days operation.

Further economic study is required for the system compared with a conventional DHW system.

Further Modelling for the system is required to study the system performance in different location (hot climate)
Thank You

Any Questions?