CHPB-18-2018: Optimal Design and Control of Residential Air-Conditioning Equipment with Integrated Thermal Storage

Objective

- To design residential A/C systems with increased efficiency, demand responsiveness, and low environmental impact through the **integration and management of thermal storage and natural refrigerants**

Motivation

- New utility rate structures for the residential sector are favorable to such systems

Expected Results / Impact:

- An optimized prototype system design of a residential A/C system with integrated storage
- Heuristic control logic specifically for residential utility rate structures inspired by optimal control strategies
- Model-based tools for system optimization and control

Approach

- Create parameterized models for dynamic analysis of different VCS equipment and working fluids, as well as different storage media
- Apply combined plant and control algorithms to iteratively optimize the system design and the real-time control policy to minimize payback period

Schedule

- Task 1: Optimize system control policy for baseline system
- Task 2: Evaluate the effect of alternative working fluids and storage media
- Task 3: Evaluate alternative system components
- Task 4: Optimize the design of a prototype system

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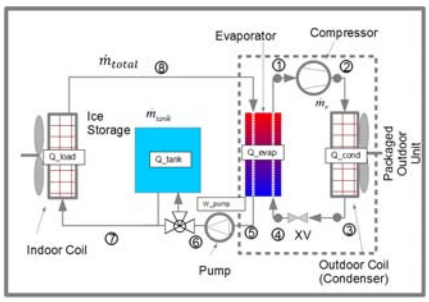
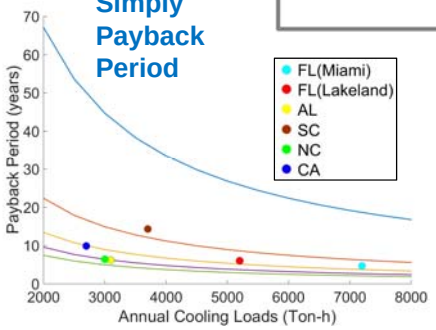
- **Integrated thermal storage**
  - enables faster and **more economical** response to dynamic loads given different types of utility rate structures
  - Allows for a packaged outdoor unit architecture that in turn enables **utilization of alternative technologies and natural refrigerants**
- **Now that economic viability has been established,** the objective of this project is to optimize both the design of the system and it's real-time control policy

Example Schematic of System



Estimated Simply Payback Period



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