Development and Testing of the Next-Generation Residential Space Conditioner for California

AWARDED CEC EPIC PROJECT

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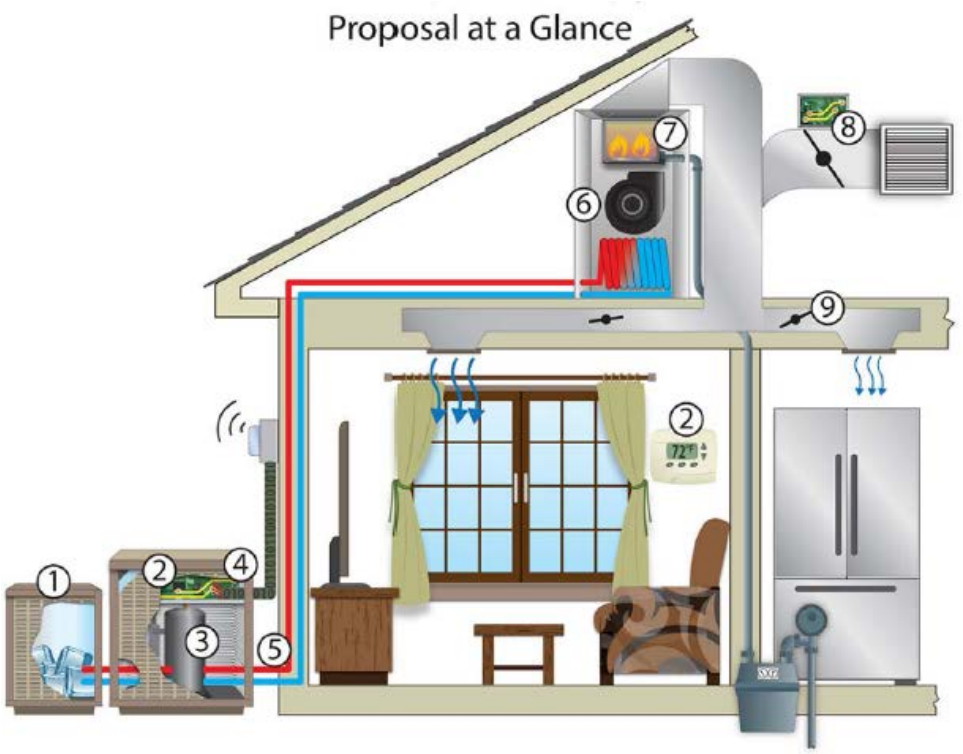
Project at a Glance:

Features of Next-Gen HP:

- Variable speed compressor (3)
- Variable speed ID fan (6)
- Auto Demand Response (2)
- Fault Detection & Diagnostics (4)
- Dual fuel (7)
- Alternative refrigerant (5)
- Integrated ventilation control (8)
- Zonal control (9)
- Thermal & Energy Storage (1)



Project Details:

- Lab tests:
  - EPRI (Knoxville), WCEC (Davis), PG&E (San Ramon)
- Field Tests:
  - Bay Area, LA Area, San Diego Area
- Technology Transfer

- Funding Sources:
  - $3 million from CEC
  - $323k from EPRI/Utilities
- Project Start: July 2015
- Project End: Oct 2018
- Partner: Daikin/Goodman

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Why Variable Capacity and Smart HVAC?

- Heating and cooling energy consumption in California Residential buildings is 31% of total household energy use compared to 47% in the US (2009 EIA)*
- HVAC plays significant part in California peak demand in summer


EPRI Thermal Testing Chamber

Diakin Outdoor HVAC Unit

- Use smart space conditioner with variable capacity (speed) as strategy to reduce energy consumption, demand and CO_2 emissions
  - Target year-round energy savings and peak power reduction for residential HVAC
  - Integrate *advanced energy-efficient* and *intelligent technologies* into *single* next-gen HVAC model, optimized for CA climates

* www.eia.gov/consumption/residential/

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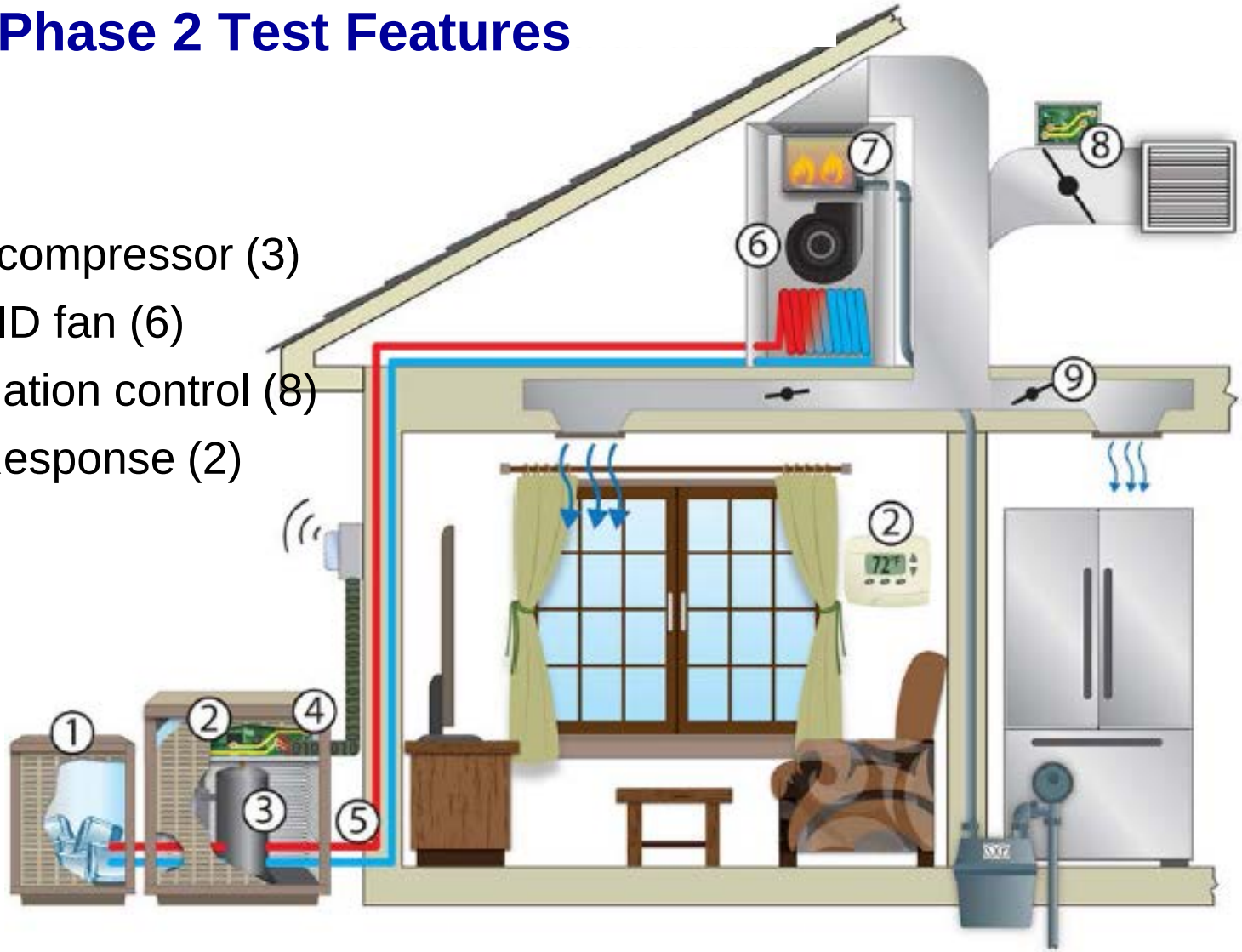
Phase 1 and Phase 2 Test Features

Phase 1:

- Variable speed compressor (3)
- Variable speed ID fan (6)
- Integrated ventilation control (8)
- Auto Demand Response (2)
- Dual fuel (7)



Phase 2:

- Fault Detection & Diagnostics (4)
- Zonal control (9)
- Alternative refrigerant (5)
- Thermal & Energy Storage (1)

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Fulfilling the Gap with EPIC

- ✓ Increase electricity reliability
- ✓ Lower electricity costs
- ✓ Increase electricity safety

By…..

- Matching residence loads with inverter technology for variable capacity and speed compressors and fans
- Intelligently switching between electricity and natural gas
- Demand-response compatible HVAC to conserve during peak loads
- Advanced Fault Detection and Diagnostics improve HVAC reliability & efficiency
- Lower Carbon footprint of Alterative Refrigerants improves climates for CA residents

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Recommendations for Future Research & Technology Needs

- From Variable Capacity & Smart HVAC for *Residential* to Advanced HVAC for *Commercial* Buildings
- Standardized Demand Response Connectivity across all *Residential* and *Commercial* Sectors

Commercial Rooftop Units

Commercial Chillers

- New refrigerants: lower GWP, ODP
- Energy Storage across *Residential*, *Commercial* and *Industrial* Sectors

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