Project 216: Lab Testing and Modeling of Advanced Variable Refrigerant Flow Systems

Project Start & End Date: 12/3/2010 – 9/30/2011

Total Project Budget: $595,680

BPA Budget: $297,840

Non-BPA Leveraged Budget: $297,840

Source of Leveraged Budget: EPRI & SCE

BPA Project Actuals:

BPA FTE Budget: 0.10

BPA FTE Actuals: 0.02

BPA PM: Mira Vowles

Principal Investigator: Ron Domitrovic, EPRI

Project Synopsis

This project will build a 5-chamber test facility to produce performance maps for variable refrigerant flow (VRF) heat pump systems with heat recovery capability (HR VRF)

- Planned Deliverables:
  - Design of Test Stand and experiment
  - Construction of Test Stand
  - Performance maps for HR VRF systems

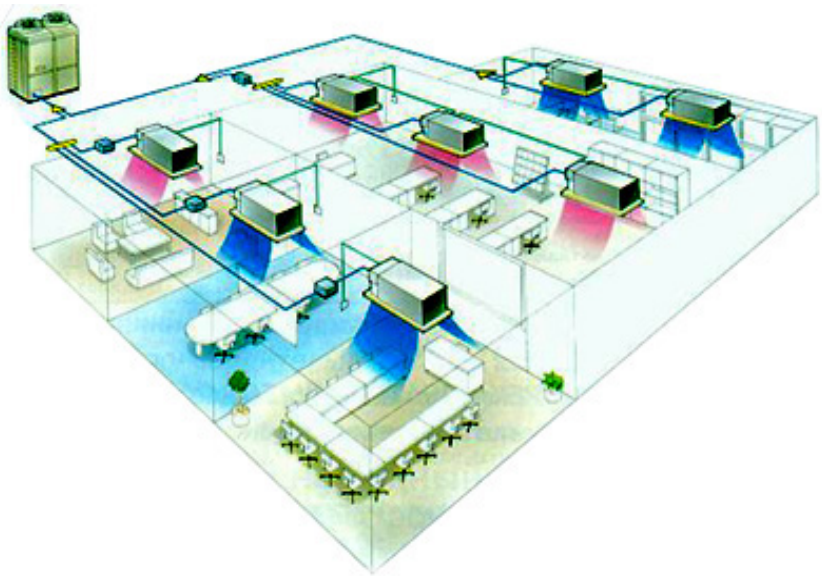
Project Synopsis (continued)

Performance maps will be used to assess energy savings and streamline EE incentives

- EE Technology Gaps Addressed:
  - **GP1** VRF energy savings and control optimization is not well understood
  - **GP11** Develop reliable VRF engineering and technical information
  - **GP69** Lack of waste heat recovery in commercial buildings

Heat Recovery VRF Systems

- Inverter driven compressors and fans
- Electronic expansion valves
- Sophisticated control algorithms and oil flow management



Heat Recovery VRF System Issues

- Hard to deem and verify system savings
  - Part load –TIP 216
  - Heat recovery –TIP 216
  - Ventilation –TIP 216
  - Economizer –TIP 216
- Incremental cost issues
- Specify cost effective applications –TIP 216

Accomplishments

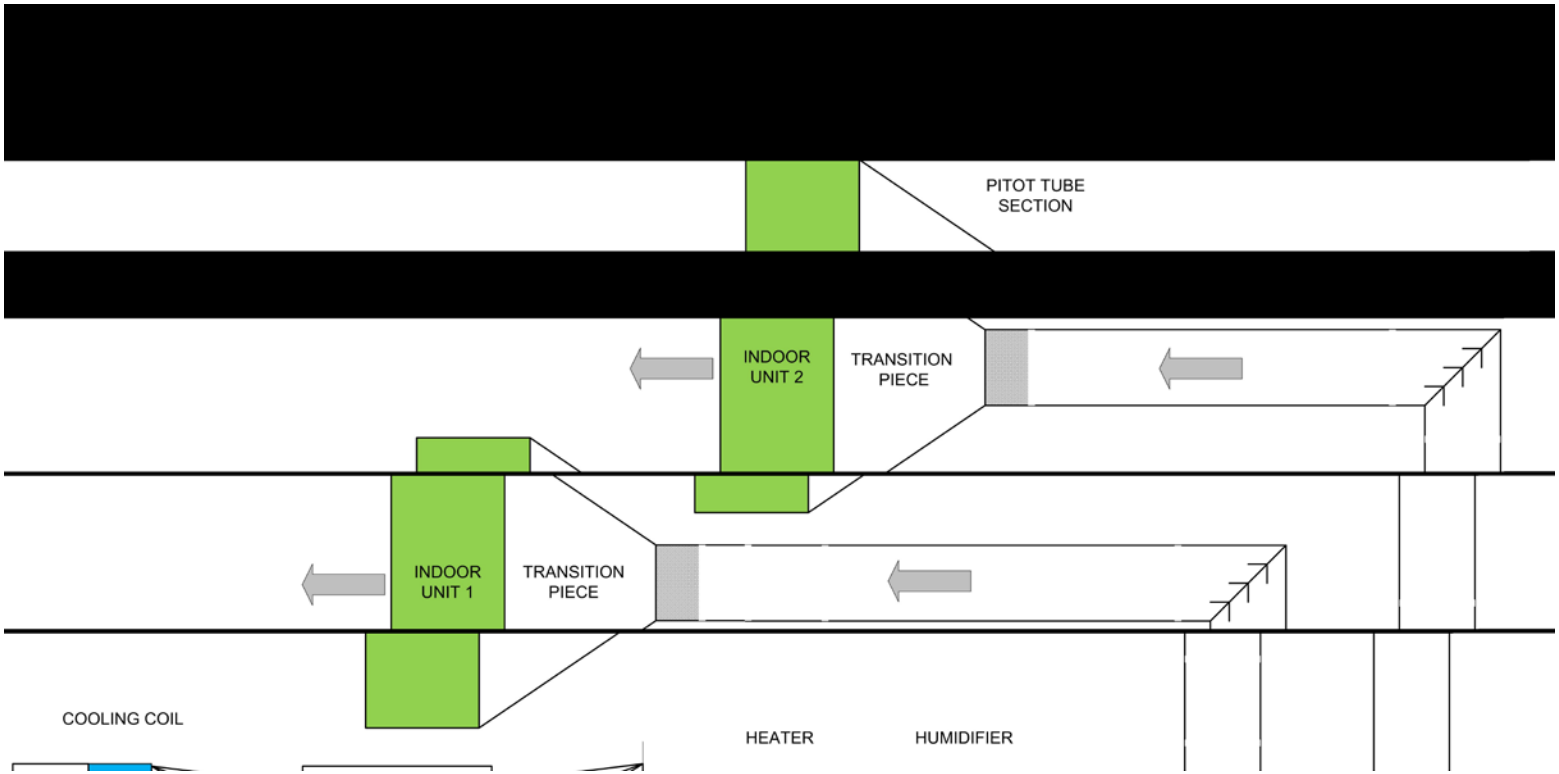
- Contract in Place
- Project Team Formed
- First stage gate complete
  - Design of Test Stand
  - Design of Experiment

Accomplishments

- VRF HR Outdoor Unit Climate Chamber

Accomplishments

- VRF HR Indoor Unit Test Stand Schematic



Expected Benefits

- Expected Value to BPA / Region:
  - offset load growth through acquisition of 3.3 aMW
- Estimated cost savings: $172 million
  - 3.3 aMW at $52M per aMW
- Other Benefits
  - Ancillary services
  - BPA is seen as a leader
  - Access to results from future use of test stand

Technology Transfer Plan

- Provide feedback to manufacturers
- Post results on BPA web-site
- Develop HR VRF modules for energy models
- Use field data to vet energy models
- Education and outreach
- Develop BPA EE offering
- Develop PNW best practices

Technology Transfer

Outreach is planned for:

- BPA Energy Efficiency staff
- Sub-Committee
- E3T HVAC TAG
- BPA Utilities
- Building Simulation Users Group
- RETAC, SCE, EPRI, EPRI members, etc.

Project Next Steps

Three stage gates:

1) Design of Test Stand -COMPLETE
2) Construction of Test Stand
3) Performance maps

- Expect to be within budget
- No direct role for BPA's Labs
- No intellectual property issues