2019 AHR Expo Findings & Commercial HVAC Research
Goals for Attending AHR

• Identify key trends in commercial HVAC from the manufacturer perspective
  • Where is the market changing?
  • What is driving market change?
  • Where are momentum savings opportunities?

• Identify best opportunities to segment market for BPA momentum savings modeling purposes
Methodology

7 Manufacturer Interviews

3 Targeted Booth Visits

Partnership with Energy350

BSRIA Market Trends Session
Important Reminder

- Findings are based on statements from manufacturers interviewed at the AHR Expo
- Any numbers and percentages presented are anecdotal, unless otherwise cited.
Key Findings
Four Key Finding Areas

- Commercial HVAC market isn’t changing much
- Energy savings require a system level view
- VRF still most promising EE technology
- Components/controls offer efficiency opportunities
A (Mostly) Stagnant Market

Commercial HVAC market isn’t changing

Energy savings require a system level view

VRF still most promising EE technology

Components/controls offer efficiency opportunities
Limited Market Change

What people are buying

What manufacturers are producing
Unitary Isn’t Going Away

• Dominating existing and NC markets
  • 35% in existing buildings (CBSA)
  • ~30–35% in new construction sales
• Gas/electric (~80%); HPs (~20%)
Really Two Separate Markets

Existing Buildings

New Construction
Existing Market is Stagnant

- The existing buildings market makes up 60–70% of the total market
- Manufacturers reported that from 40% up to 85% of replacements are like-for-like

“Manufacturers are mostly focused on designing drop-in replacements for each others’ units”
Why Isn’t it Changing?

Duct/system redesign expense

Inertia

Split incentives
New Construction Market
Better… But Not Changing

Design around efficiency
Codes drive building improvements

Trend towards bigger buildings could offset trends in efficiency
Where is There Energy Savings Potential?

- Commercial HVAC market isn’t changing
- Energy savings require a system level view
- VRF still most promising EE technology
- Components/controls offer efficiency opportunities
Drivers of Energy Consumption

Not an exhaustive list
Look First at HVAC Efficiency

HVAC Efficiency
- Heating Efficiency
- Cooling Efficiency
- Equipment Shell
- Losses

Operation/Management
- Installation
- Controls

HVAC Load
- Occupancy
- Building Size
- Ventilation
- Building Shell

Not an exhaustive list
Two Ways to Consider Efficiency

<table>
<thead>
<tr>
<th>Floor</th>
<th>Ceiling</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Driven by: Federal efficiency standard</td>
<td>• Driven by: Competition</td>
</tr>
<tr>
<td>• Motivation: Minimizing cost of system redesign</td>
<td>• Motivation: Improving brand reputation, appearing innovative/high end</td>
</tr>
<tr>
<td>• Market share: ~60+%</td>
<td>• Market share: ~5%</td>
</tr>
</tbody>
</table>

⭐ Potential opportunity to push existing stock towards high-end
Most Equipment Sales are Low-End

- Low-End: ~60+% “Good”
- Top-Line: ~5% “Best”
- Middle: ~35% “Better” – huge variability
Standards Drive Low-End
Competition Drives High-End, but Uptake is Limited
Manufacturers See Limited Efficiency Opportunities

• Manufacturers believe they are reaching the ceiling on equipment efficiency
  • Consistent with findings from the 2018 AHR Expo

• Future improvements will come from:
  - Operation
  - System Design
  - Controls
  - Components
Now, Let’s Consider Operation

Not an exhaustive list
Operation is Still a Problem

- “Most commercial HVAC equipment is not operating as intended”
- Or, installed incorrectly and has never operated as intended
Moving Toward Better Installation

- Newer technologies = higher standards

- No training requirements
- Installer trainings
- Selection software

- Service contracts
- User trainings

Potential opportunity for operational improvement
Finally, Let’s Look at HVAC Load
Several Ventilation Options, Different Efficiency Outcomes

**Constant Volume**
- Manual dampers cause over ventilation, wasted fan energy

**VAV**
- Vary air volume based on building needs

**DOAS**
- Decoupled air streams to deal to address ventilation separately

Good > Better > Best
What is DOAS?

- **System**: Provides decoupled ventilation from space heating and cooling

- **Equipment**: RTU that can do 100% outside air and, potentially, humidification
Efficiency Opportunities

- VRF and system redesign
- Components driving efficiency
- Controls as a growth opportunity
VRF is the Next Big Thing… Still

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VRF Isn’t a Niche Market

• Double digit growth year over year, but in small market segment

• Starting to see mid-market pricing competition

• But, applications are limited

~75% of VRF sales in PNW are in new construction

~50% of new office buildings in PNW installed VRF
VRF Requires System Design

DIAMOND SYSTEM BUILDER
VRF DESIGN IS NOW QUICKER AND EASIER

Diamond System Builder is a layout and system selection tool for efficient and easy design of all Mitsubishi Electric systems.
VRF versus DHP

- VRF:
  - New construction
  - Sophisticated, but expensive

- DHP:
  - Retrofit
  - Simple and cheap, but limited

~30% of jobs that could go VRF end up going DHP
Efficiency Opportunity Through Components and Controls

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Components Driving Energy Efficiency

Economizers

HRV/ERV

Other: variable speed fans/compressors
Controls: Promising but Limited

• Every manufacturer offers an integrated controls solution

• But, ~75% of buildings <50K don’t have controls
  • ~70% of commercial buildings are this size
Lack of Owner Training

• Mis-managed/mis-operated/mis-installed
  • Losing out on energy savings
  • Happening across all systems at all efficiency levels

“It’s no one’s job to train owners on controls”
Market Inertia is Stifling Growth

Engineers want to install what they know

Manufacturers want to look competitive by offering controls
Weak Use Cases for Controls

Two conflicting scenarios, neither mainstream:

- Increased interest in data availability and visualizing system performance
  Responsibility with the end user

- Trend towards “servitization” and outsourced maintenance
  Responsibility with service contract holder
What’s Next for BPA Momentum Savings

Preview of upcoming project
Task 1. Pilot Data Collection

• Determine if there is enough evidence of above-code, energy-saving commercial HVAC equipment installations in a sample of permit data such that it is worth continuing a full-scale permit data collection project.

⭐ Go/No-Go Decision

• Develop a process for full-scale permit data collection based on lessons learned from the pilot.
Task 2. Confirm Program Activity

• Confirm that regional VRF and DHP projects are not entirely driven by programs and/or building energy code.

• Understand how programs are estimating savings from such projects to inform methodology development.

⭐ Go/No-Go Decision
Task 3. Develop High-Level Methodology

Use the information and knowledge gained in Tasks 1 and 2 to develop a high-level method for quantifying momentum savings from above-code VRF and DHP (and potentially other) systems.
Timeline

• Begin work: June 2019
• Completion: Fall 2019
CONTACT

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Appendix: Momentum Savings Modeling Market Segmentation
Understanding the Market… Where to Begin?

- Commercial HVAC is big → ~35% of commercial building energy use (EIA)
- It is diverse → high number of equipment types, component options, design options, and configurations
- So, developed a segmentation framework to narrow in on parts of the market that might be quantifiable for BPA modeling efforts
Commercial HVAC Market

Project Types
- Renovation
- Retrofit
- Replacement
- New Construction

Equipment Types
- Better
- Best
- Good

Building Types
- Single Story
- Multi Story
- <5,000 sqft
- 5,000-50,000 sqft
- 50,000-100,000 sqft
- 100,000+ sqft

Customer Types
- Energy Efficiency
- Operating Cost (TOC)
- Lowest first cost

Retro-commissioning

Size
- Functionality
- Efficiency
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Functionality

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Equipment Types

- Multi Story
- Single Story
Layer Factors to Understand Market Drivers

- **Retrofit**
  - Single Story
  - 5,000–50,000 sqft
  - "Good"
- **New Construction**
  - Multi-Story
  - 50,000–100,000 sqft
  - "Better"

Use equipment type sales to understand customer drivers:
- **First Cost**
- **Cost of Operation**

Could be persuaded to purchase more efficient technology, represents savings opportunity.