Daikin MEGA-Q

The Heat Pump for Commercial Hot Water in Northern Climates
HVAC Manufacturer’s Representatives & Building Automation contractor

AHUs, ERVs, Chillers, ASHP & WSHP Chillers, Fans, Lab exhaust, Lab energy recovery, pre-fab plants, terminal equipment, humidification, IAQ
www.hts.com

Specialized in Daikin VRV/VRF, Daikin ASHPs, VRV driven ERVs and AHUs, VRV controls
www.dxseng.com
Largest Daikin VRV rep in North America!

Building automation, energy and emissions monitoring and reporting, fault detection systems
www.controltechinc.com
Speaker Bio

Jean-Samuel (JS) Rancourt
Managing Partner (HTS & DXS)

Mechanical Engineer, University of Waterloo (Ontario, Canada)
Areas of expertise: ASHPs, VRF and refrigerants

North American Manufacturer’s Representative Councils:
• Daikin Comfort Technologies
• Oxygen8 Solutions

Voting Council Member of MA’s Grid Modernization Advisory Council!
• Representing Building Electrification Sector
Part 1 - Challenges with ASHP DHW

• Compressor Lift

• Bringing water outdoors

• Peak load vs recirc loads

• Efficiency & Emissions
The Lift Challenge

- Conventional cold climate air source heat pumps (for space heating)
- Heat air from ~70°F to ~100°F using 0°F ambient air
- Compressor “Lift” = 100°F

Compressor “Lift” = 122°F
The Lift Challenge

- Domestic water heating needs storage (not instant)
- Stored domestic hot water needs to be ~140F, which requires heating beyond 140F
- Heat water from ~50F to ~150F using 0F ambient air
- Compressor “Lift” = 150F
- Technology required:
  - 2-stage
  - Small R-32 single stage
  - CO₂ *
Part 1 - Challenges with ASHP DHW

- Compressor Lift
- **Bringing water outdoors**
- Peak load vs recirc loads
- Efficiency & Emissions
Running water outdoors

- **Air source** heat pumps must extract heat from **outdoors**
  - Basement mounted HPWH? (large space vs hot water load)
  - Homes & old schools

- You must bring water to the heat pump, **outdoors**
  - Addition of propylene glycol & management?
  - Heat tracing?
  - Considerations for power outages?
  - Extreme weather events?

- What if there was a **split** commercial water heater, where **refrigerant** lines can deliver heat from outdoors to indoors?
Part 1 - Challenges with ASHP DHW

- Compressor Lift
- Bringing water outdoors
- Peak load vs recirc loads
- Efficiency & Emissions
Peak & Recirc Loads

- **Peak hours** (2-3 morning hours and 2-3 early evening hours for multi-residential)
  - As domestic water gets used, new 50F city water needs to be added to the tank, and heated to 150F
  - **Large lift** (2 stage inverter driven, or CO₂)

- **Off-peak** (mid day, late evening and night-time)
  - Domestic hot water still gets circulated in most large commercial centralized domestic hot water system
  - Return water could be in the 130F range
  - Needs to be re-heated to 150F
  - **Low lift** (2 stage inverter driven)

- ASHPs that cannot handle low lift rely on electric resistance heating elements in the recirculation tank, running 18-20 hours / day
  - *ie. CO₂ systems*
Part 1 - Challenges with ASHP DHW

- Compressor Lift
- Bringing water outdoors
- Peak load vs recirc loads
- Efficiency & Emissions
The importance of efficiency

- ASHP efficiency for hot water is a bit more challenging
  - Larger lift, peak & recirc loads, Winter & Summer

- ASHP efficiency for hot water is key
  - To support Electric Sector Modernization Plans (ESMPs)
  - To manage grid peak loads
  - To manage building electrical feeds
  - To manage operational costs
  - To reduce emissions
Life Cycle Climate Performance Comparison

- Building LCCP Study using 3rd party energy model
- 8 Story multi-rez building (Boston)
- All-Electric HVAC systems
  - VRF vs ASHP Chiller
  - **ASHP DHW**
  - VRF driven ERVs
- Deep analysis of grid emissions
  - Correlations to time-of-day & year
  - Correlations to weather
  - Overlaid onto TMY3
  - Multiple Grid phasedown scenarios
- Multiple refrigerant leak rates and emission scenarios

30-year emissions, constant grid emissions (2021-2022) net-zero grid in 30 years, linear
All Electric HP Hot Water Solutions

Madhav Kashinath,
Director of VRV Product Marketing
Speaker Bio

Madhav Kashinath – Director, VRV Product Marketing

- 16+ Years HVAC Experience
- 10th Year with Daikin
- Actively Engaged with ASHRAE
All Electrical Solutions with Daikin

A Unique proposition w/Daikin

...addressing 4 Pillars in a building

...Fully Integrated Solutions

... Simplify design in Key Commercial Applications
Now Introducing

Cool/Heat

Controls

Hot Water

Service

Vent./IAQ

DOAS Kit W/ HGRH

VRV EMERION

VRV AURORA

VRV T Series

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Introducing a Daikin All-Electric
Heat Pump Hot Water Generation system

Mega-Q
The Basics – Mega-Q for DHW

1. High efficiency Inverter Air cooled HP
2. Cascade Unit - Refrigerant to water
   - R410A Refrigerant
   - Built-in variable capacity water pump
3. Tank control kit
   - Connect up to 6 MEGA Q systems to 1 water loop.
Typical layout

- **Cascade**
- **Heat pump**

Water Supply

3-way valve (Field supplied, optional) → Leaking Hot Water pipe

140 – 194°F (60-90°C)

Note: Braze plate heat exchanger / indirect tank needed to make water potable

To building hot water system

Tank Controller

Field Supplied

Circulation pipe

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Installation Flexibility

3 installation patterns

1. The H/P unit & cascade unit installed outside side by side

2. The cascade unit can be installed up to 65ft away. This includes the cascade unit being moved indoors

3. Both the H/P unit & cascade unit installed inside. Note that the H/P unit would need to be ducted to the outside
Split System design

Tank - Indoors

Cascade - Indoors

HP Source - Outdoor

Refrigerant piping

Hydronic Piping
DHW Control & Tank Sensor Kit

- Tank Sensor Kit attached on-site
- 3 temperature sensors control the HP unit operation
MEGA Q

- Mega Q is a tried and tested Daikin solution used in overseas market for several years
- Now adapted for the North American region and combined it with HP units assembled in USA (Texas)