Daikin MEGA-Q

The Heat Pump for Commercial Hot Water in Northern Climates

BUILDINGENERGY
BOSTON

MARCH 19-20, 2024 • WESTIN BOSTON SEAPORT DISTRICT • NESEA.ORG/BE24

Conference + Trade Show of the Northeast Sustainable Energy Association (NESEA)

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
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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!

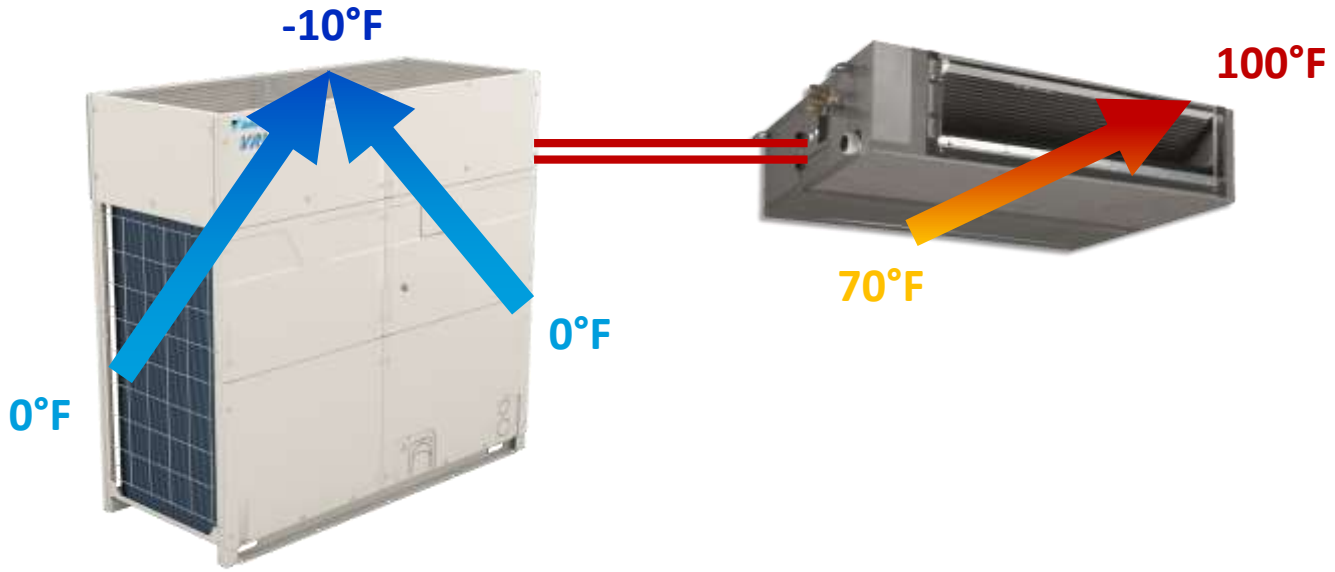
- *Representing Building Electrification Sector*

Part 1 - Challenges with ASHP DHW

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

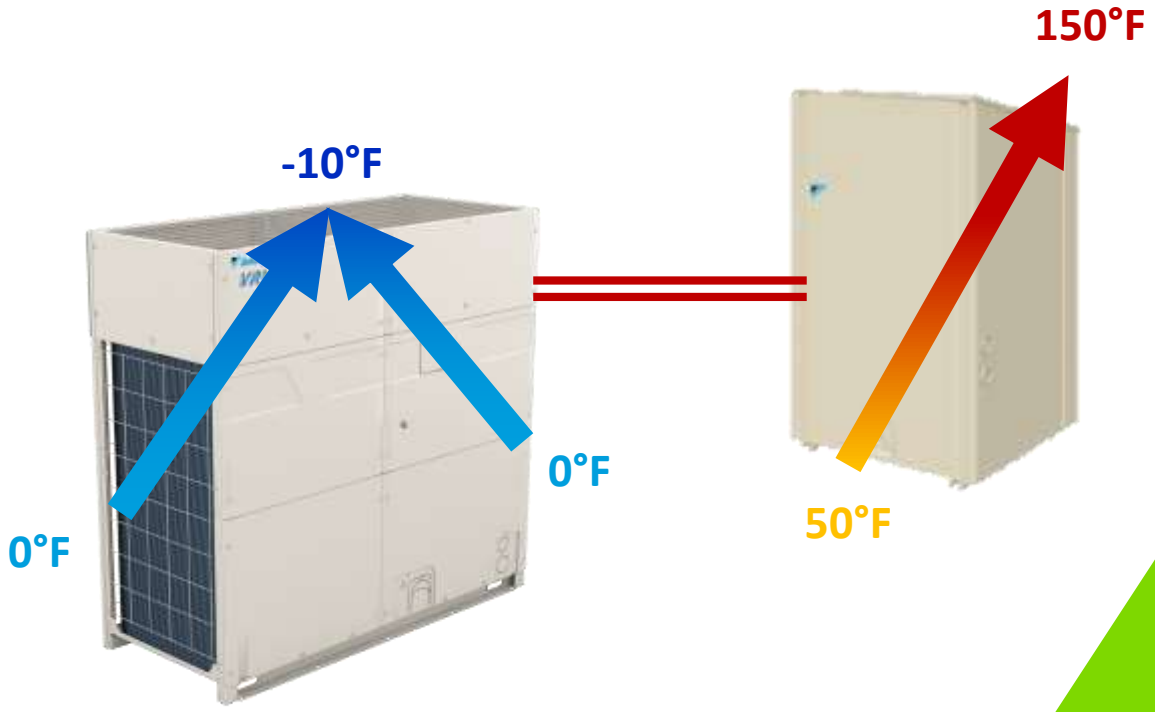
The Lift Challenge

- Conventional cold climate air source heat pumps (for space heating)
- Heat air from ~70F to ~100F using 0F ambient air -22F ambient air
- Compressor “Lift” = 100F Compressor “Lift” = 122F



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
  - CO_2 *



Part 1 - Challenges with ASHP DHW

- Compressor Lift
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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

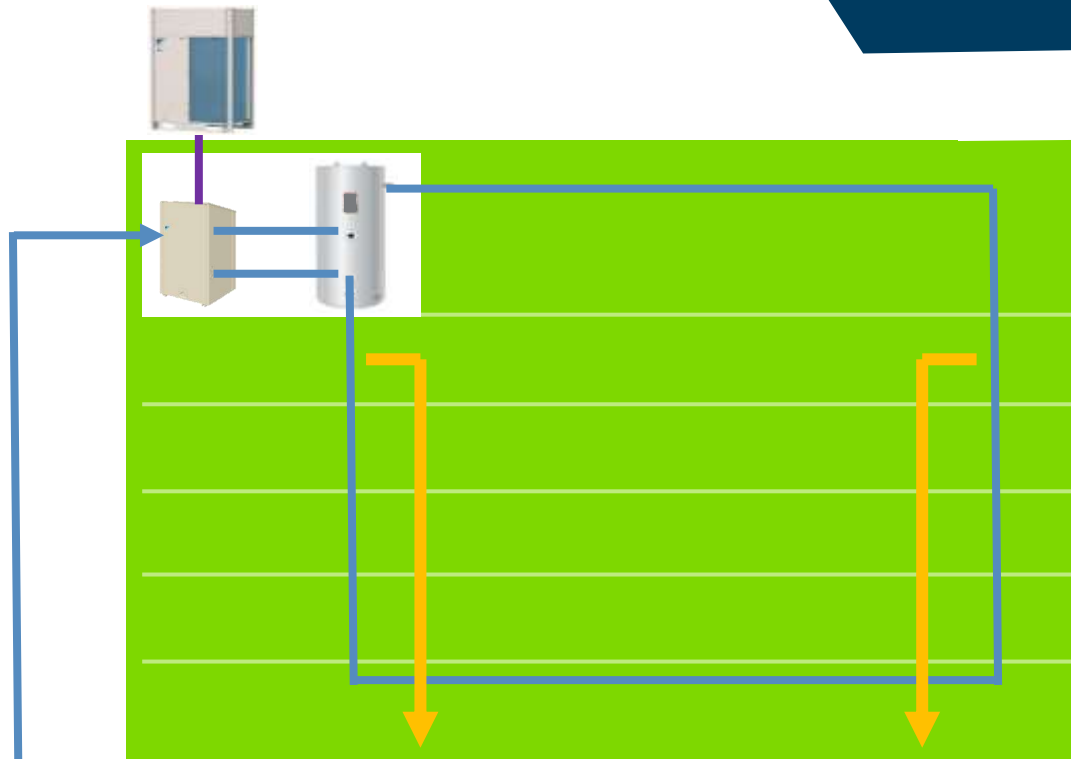
- Compressor Lift
- Bringing water outdoors
- **Peak load vs recirc loads**
- Efficiency & Emissions

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 CO_2)

- 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. CO_2 systems



Part 1 - Challenges with ASHP DHW

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

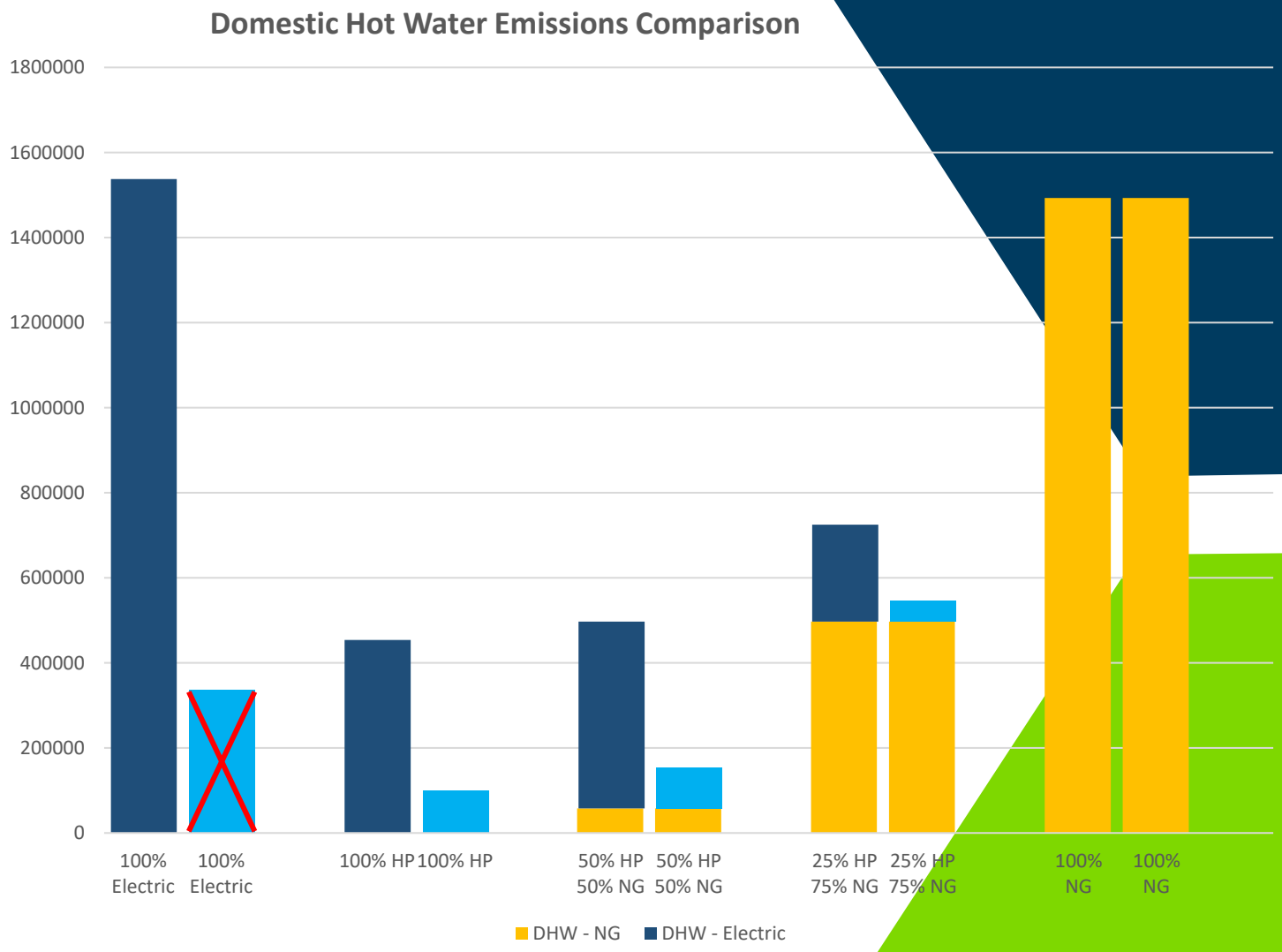
The importance of efficiency

- 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

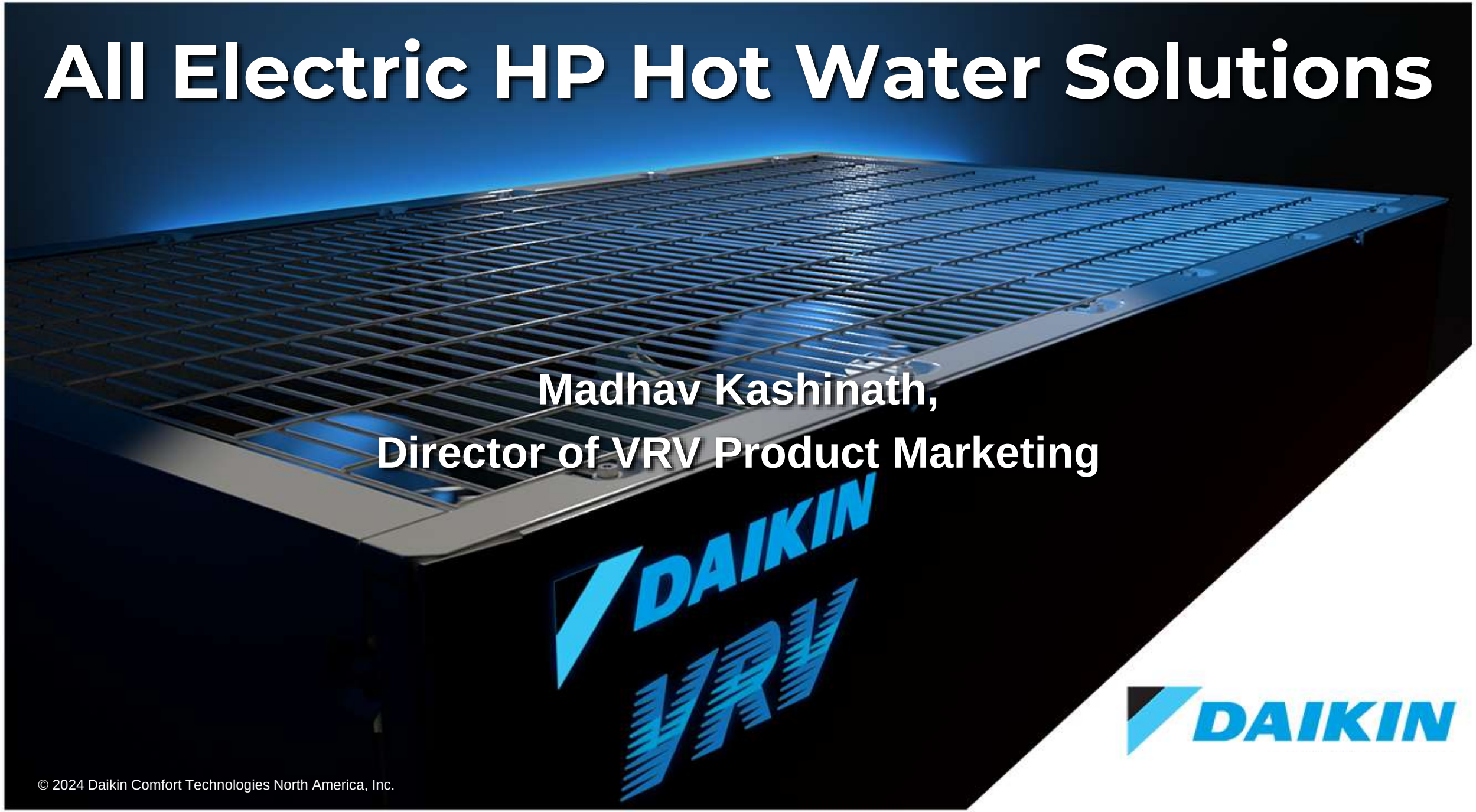
- Building LCCP Study using 3rd party energy model
- 8 Story multi-rez building (Boston)
- All-Electric HVAC systems
  - VRF vs ASHP Chiller
  - ASHP DHW
  - VRF driven ERVs
- Deep analysis of grid emissions
  - Correlations to time-of-day & year
  - Correlations to weather
  - Overlaid onto TMY3
  -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

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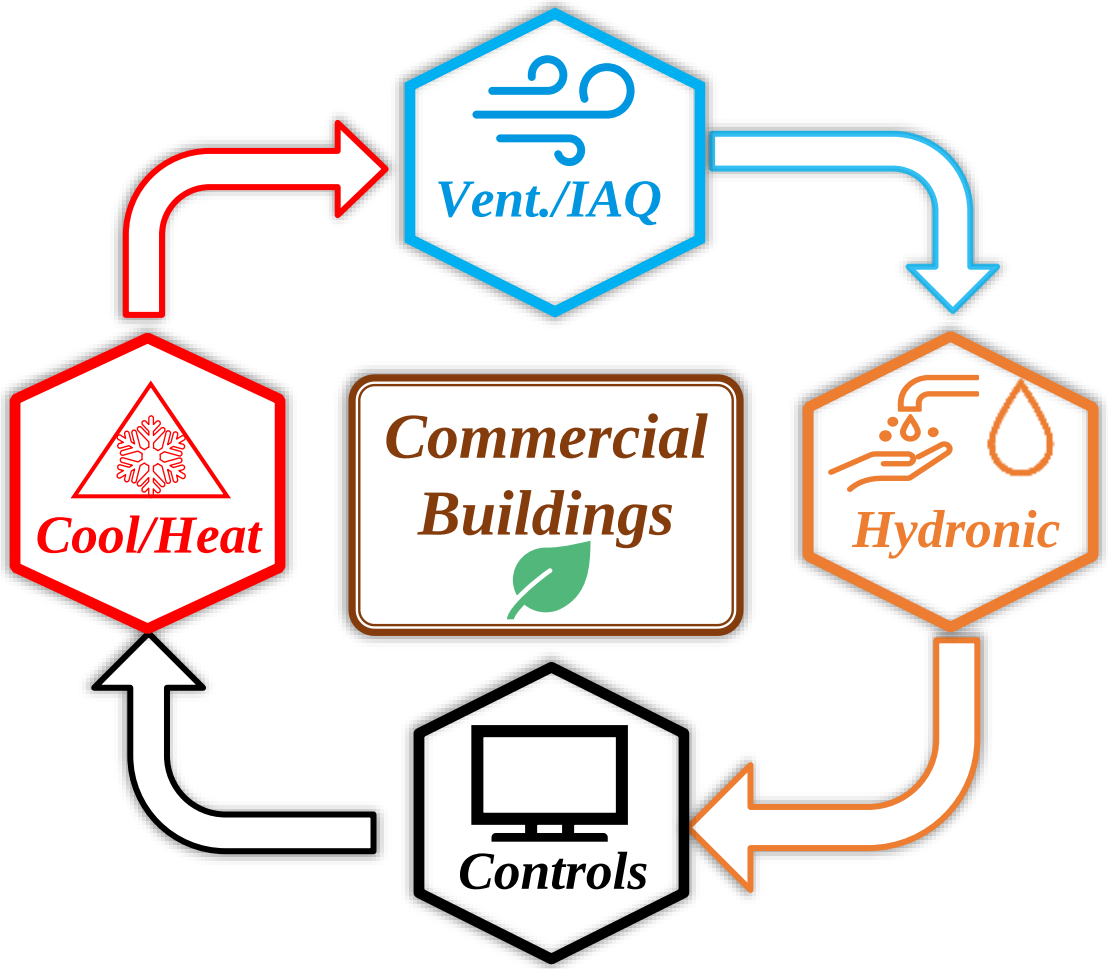
Speaker Bio

Madhav Kashinath – Director, VRV Product Marketing

- 16+ Years HVAC Experience
- 10th Year with Daikin
- Actively Engaged with ASHRAE
- Lead author on Guideline 41 – Design Installation & Commissioning of VRF Systems.

All Electrical Solutions with Daikin



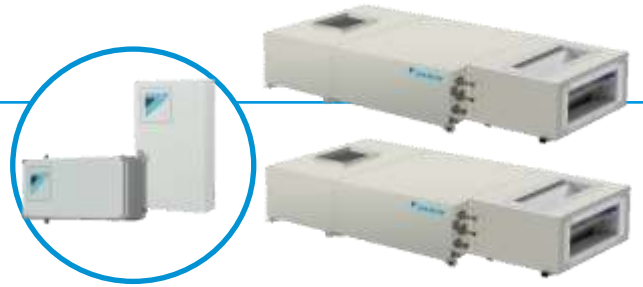
A Unique proposition w/Daikin

...addressing **4 Pillars** in a building

...Fully Integrated **Solutions**

... Simplify design in **Key Commercial Applications**

DOAS Kit
W/ HGRH



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

Mega-Q

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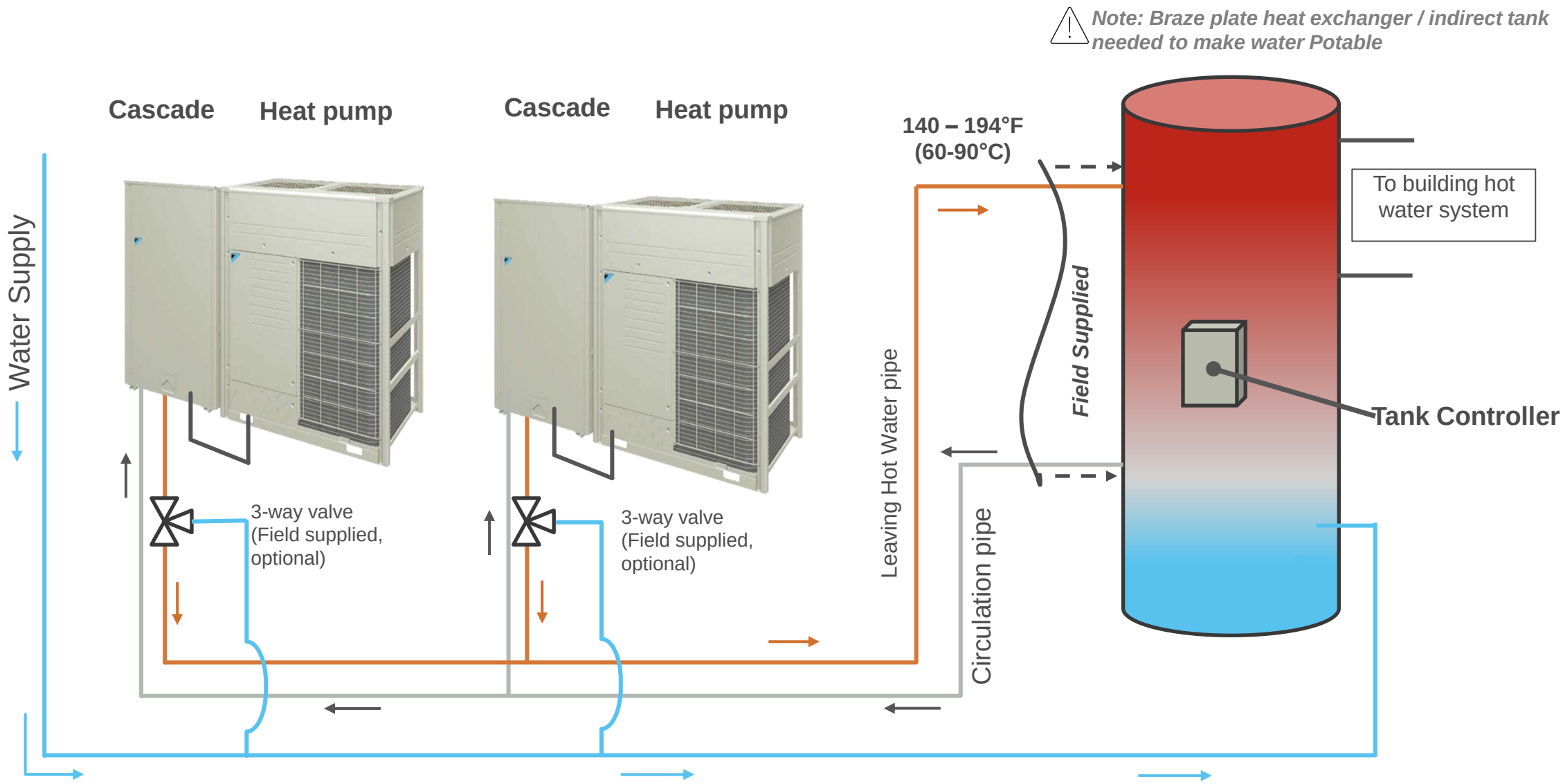
The Basics – Mega-Q for DHW

- High efficiency Inverter Air cooled HP
- R410A Refrigerant

- Cascade Unit - Refrigerant to water
- Built-in variable capacity water pump

- Tank control kit
- Connect up to 6 MEGA Q systems to 1 water loop.

Typical layout



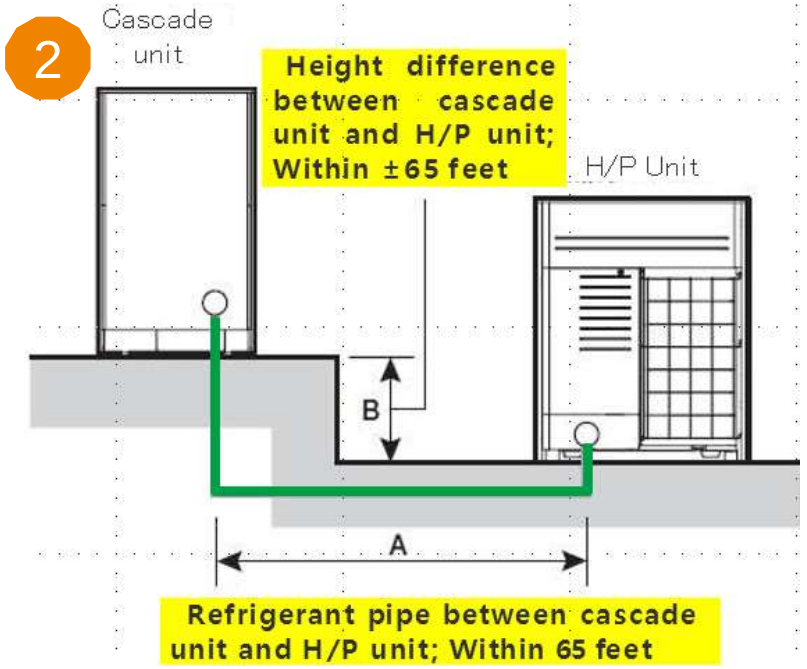
Installation Flexibility

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

1

2



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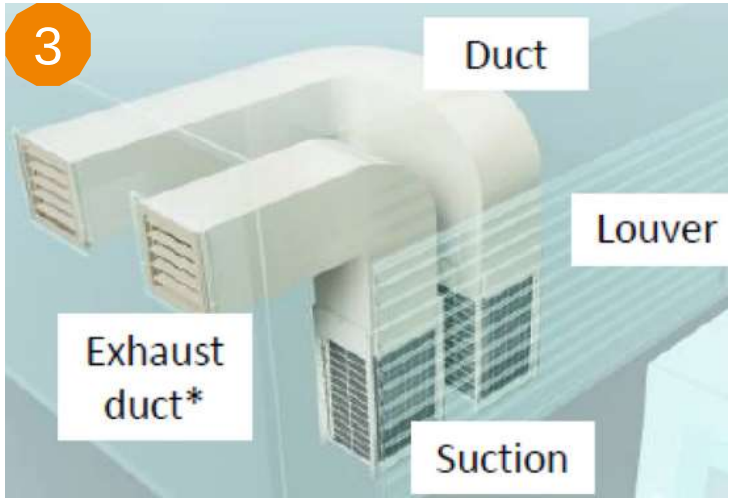


Split System design

Cascade - Indoors

HP Source - Outdoor

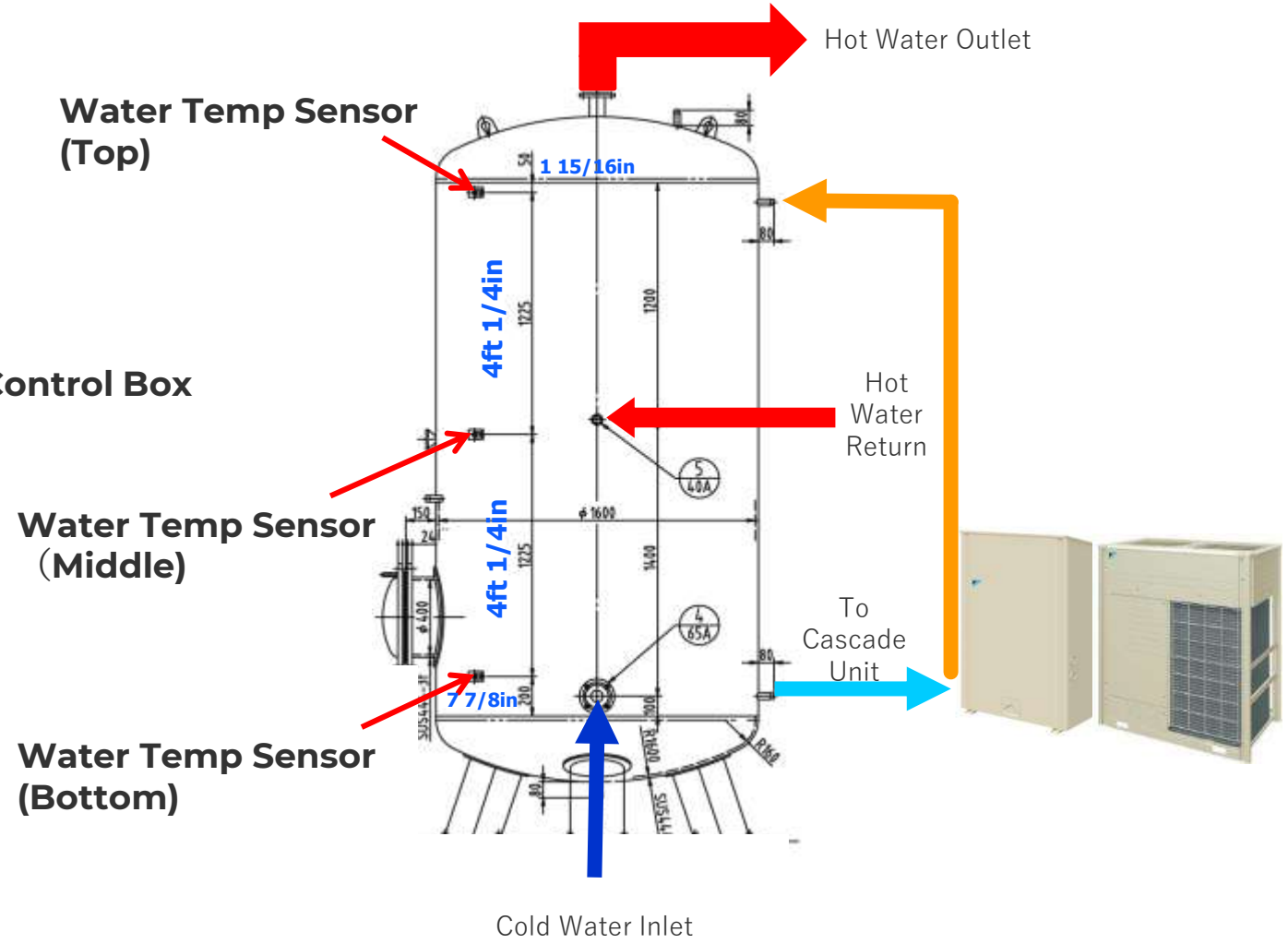
Tank - Indoors

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)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