



Decarbonization Solutions for Healthcare



COMPANY OVERVIEW

1973

Family Owned &
Operated

80+

Employees

45+

Industry-Leading
Manufacturers

10

Active in 10 Industry
Organizations

8

Professional Engineers
on Staff

3

Locations in Troy, Grand
Rapids, and Saginaw

MICHIGAN AIR
PRODUCTS

REPRESENTING QUALITY MANUFACTURERS SINCE 1973

Fluid Handling



Terminal Cooling/Heating



Air Handling & Energy Recovery



Air Distribution & Ventilation



Specialty



WHAT IS DECARBONIZATION?

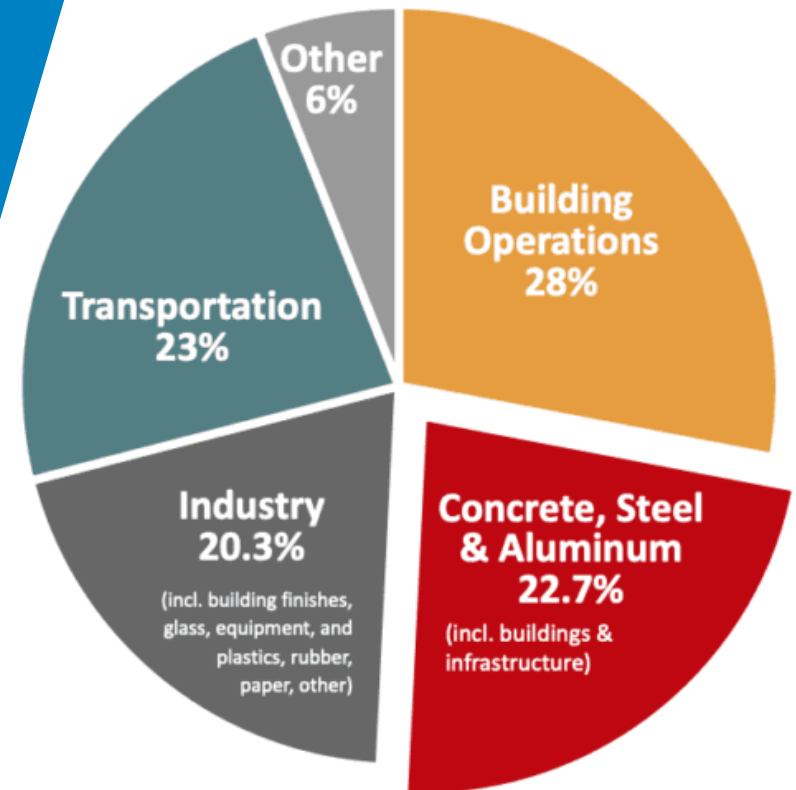
- The U.S. has a goal to meet net zero by 2050
 - This means that the amount of greenhouse gasses entering the atmosphere will be equal to the amount of greenhouse gasses being removed from the atmosphere.
- This can be done through electrification
 - Converting fossil fuel processes to electric



WHY DECARBONIZE? – THE IDEAL

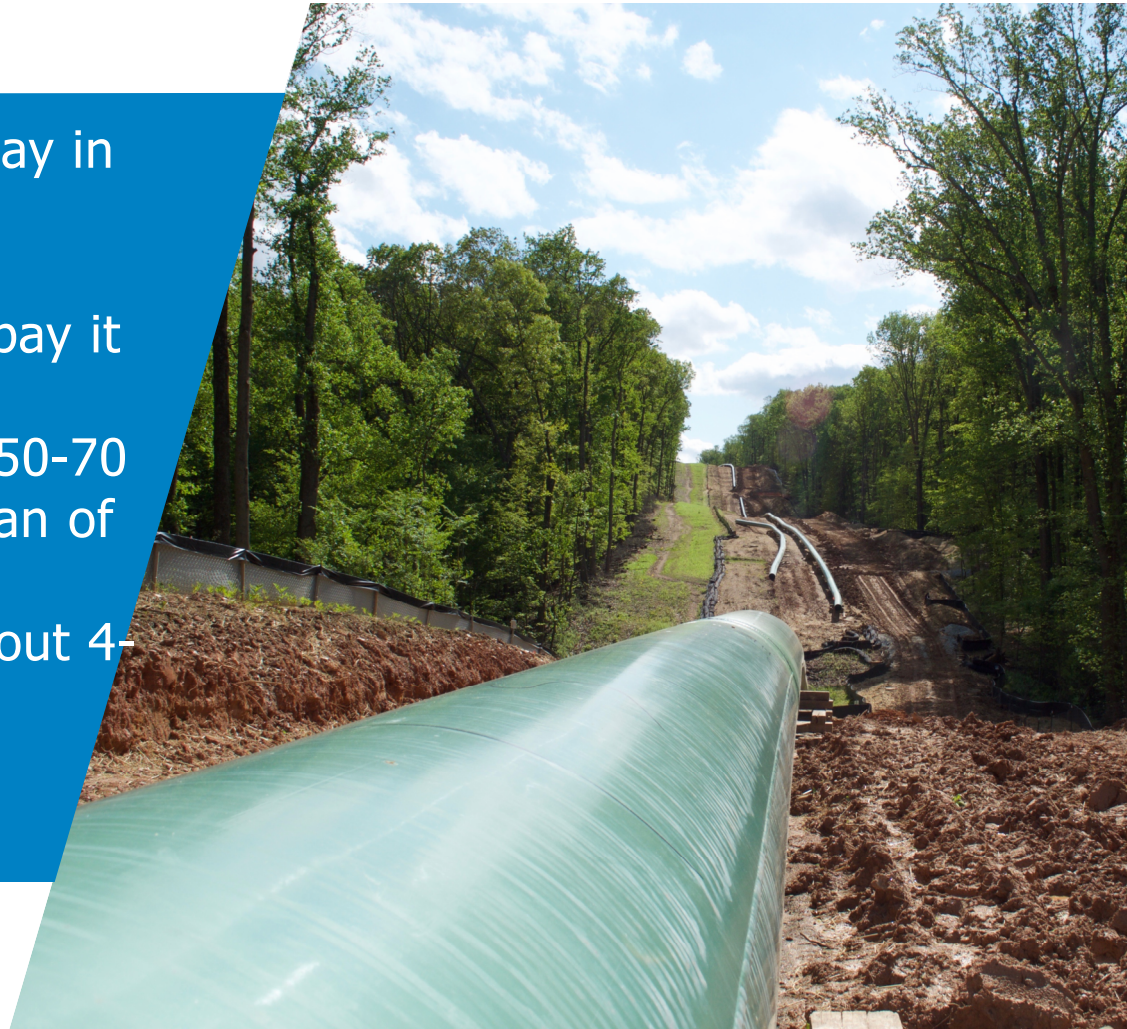
Global CO₂ Emissions by Sector

- Buildings account for over a quarter of carbon production worldwide
- Owners, Developers, and Engineers are increasingly preferring decarbonized buildings
 - Tax credits and government rebates
 - Climate change
 - Decreased utility cost
 - Tenant preference
 - Municipal/federal code



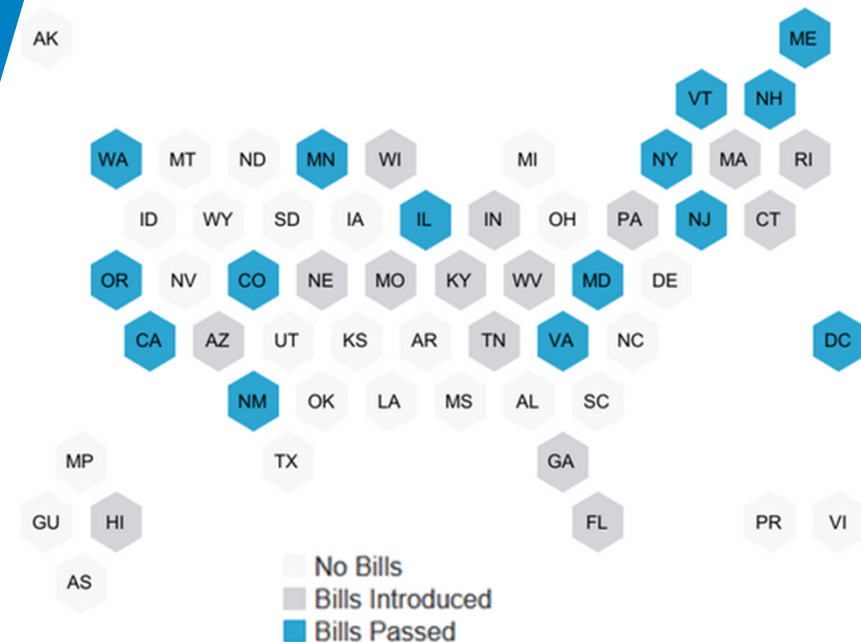
WHY DECARBONIZE? – THE LOGIC

- Gas utilities rely on expansion to stay in business
 - Take on loans to maintain rates
 - Expand their customer base to pay it off
- Much of the gas infrastructure is ~50-70 years old, which is about the lifespan of the equipment
 - Cost to replace & upgrade is about 4-5x what's available through the Inflation Reduction Act



WHY DECARBONIZE? – THE REALITY

- 25% of Americans currently live in a jurisdiction requiring Zero Emission buildings
- Clean Heat Standard
 - Gas Utility Providers need to continually reduce emissions from their supply.
 - This has been adopted by a handful of states.
- We are headed towards decarbonization nationally



DETROIT HEALTHCARE TRENDS

- Corewell Health
 - carbon neutral by 2040
- Henry Ford Health
 - Destination Grand is targeted to be net zero by 2050
- U of M Health
 - Completing LEED Platinum Kahn Health Care Pavilion in fall 2025
- Ascension
 - Net Zero by 2040



BE THE LEADER

Don't let regulation or
government mandates
drive the market.



WHAT NEEDS TO CHANGE?

- HEAT/COOL SOURCE
 - From: boilers and gas furnaces
 - To: heat pumps
- FLUID MOVEMENT
 - Variable speed pumps/compressors
 - Improved hydronic efficiency (automatic balancing valves, etc.)
- TERMINAL UNITS
 - Low temperature heating
 - Variable speed fans
 - Convection



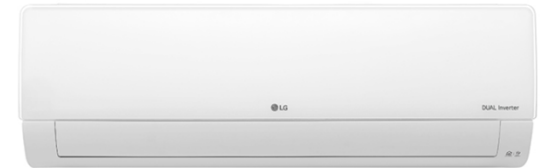
THE BASELINE

ELECTRIC HEAT



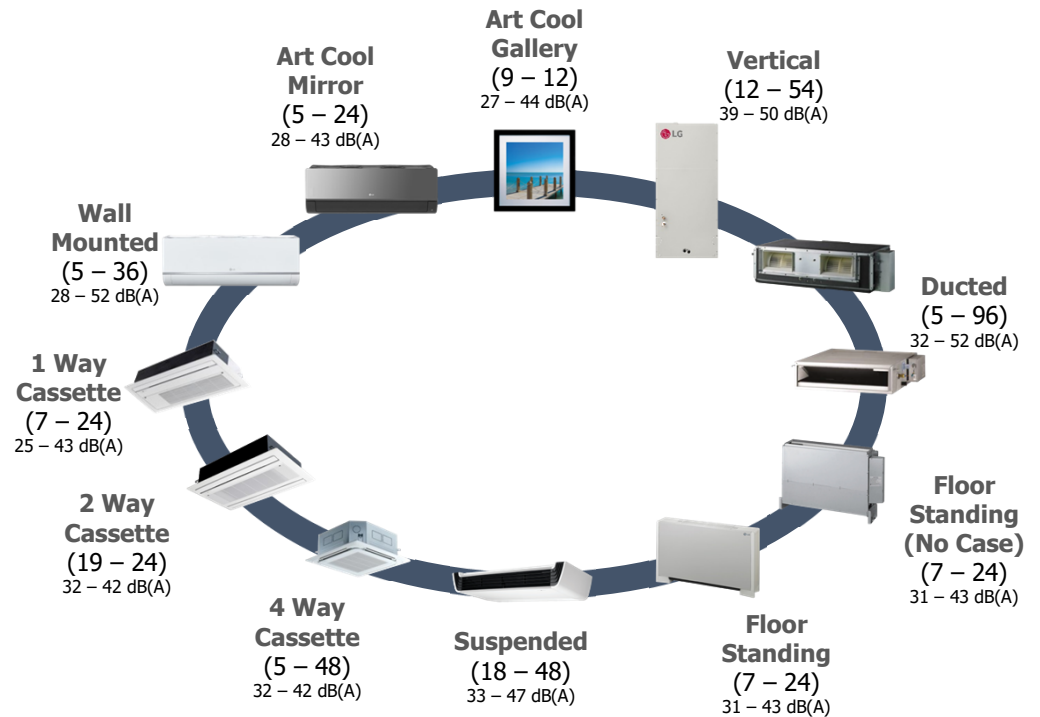
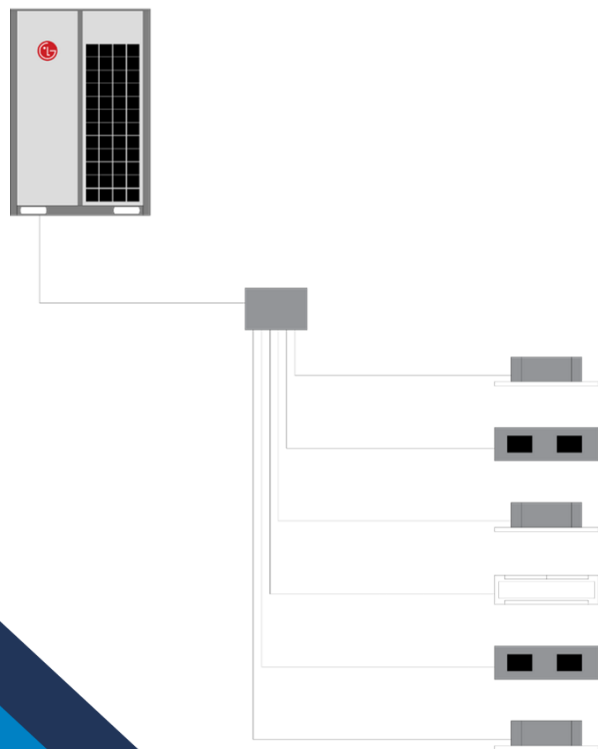
UNITARY EQUIPMENT

SPLIT SYSTEMS



COMMERICAL SYSTEM

VARIABLE REFRIGERANT FLOW



IS THIS OUR ONLY OPTION?

- While very efficient, refrigeration systems are not a great fit for healthcare
- Strict building code for healthcare severely limits system capacities
- VRF and unitary is only a good fit for office space



DETROIT ZOO

Hydronic Decarbonization

- Hot water/chilled water heat and cool is commonplace in healthcare.
 - No additional maintenance training required
 - Easy code compliance
- Some design considerations:
 - Low heating hot water temperature
 - Low ambient derate

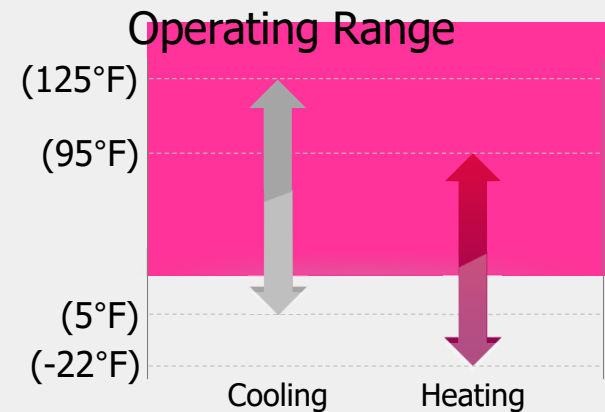
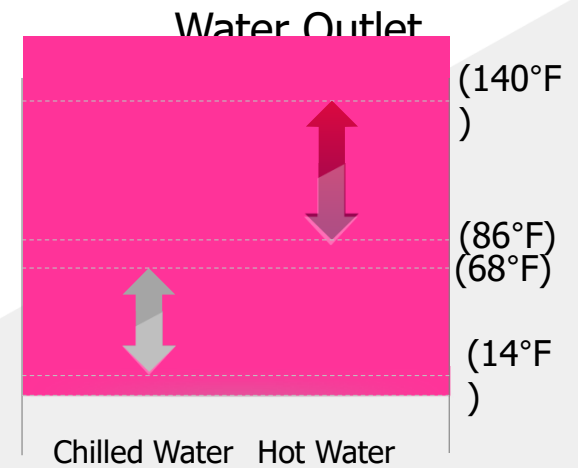


DETROIT ZOO

INVERTER CHILLERS

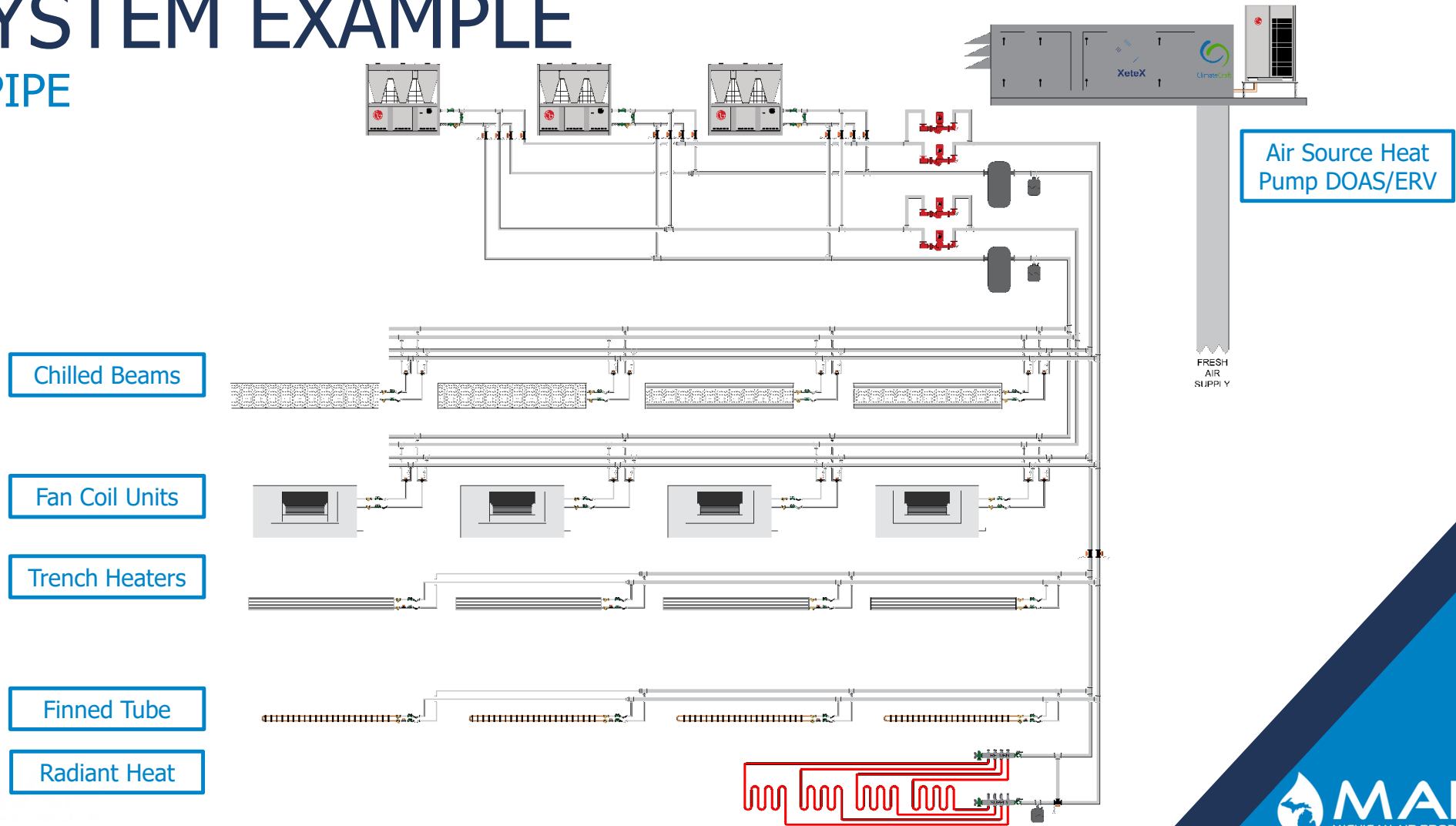
AKA: HEAT PUMP CHILLERS

- Excellent decarbonization/electrification solution
- Exceeds constant speed scroll efficiencies
- Produces chilled and hot water
- Extremely quiet
- Modular
- Low water temperatures



SYSTEM EXAMPLE

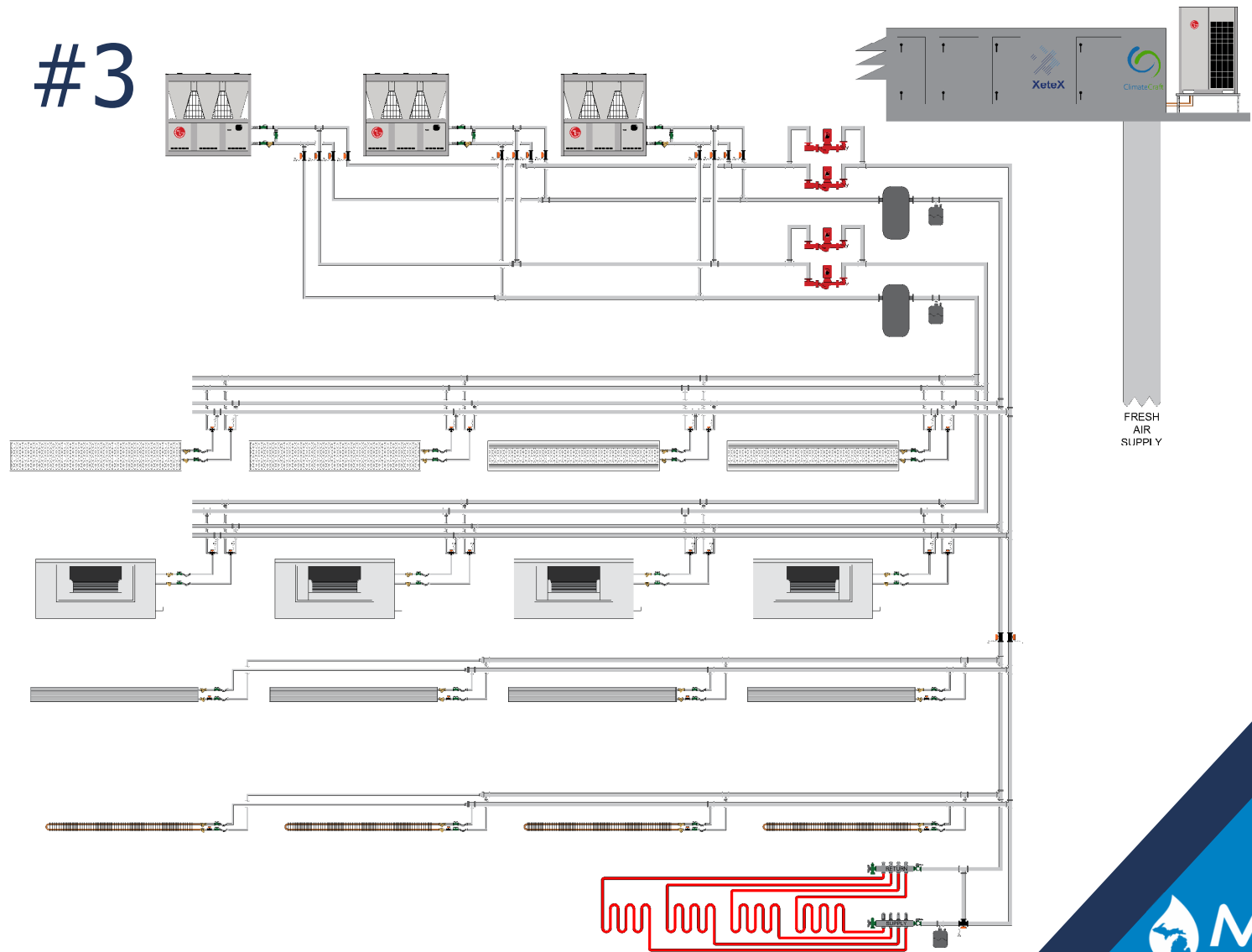
4-PIPE



SYSTEM #3

4-PIPE

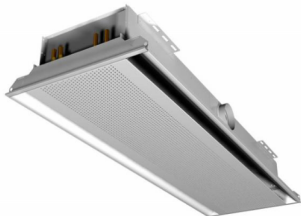
Chilled Beams



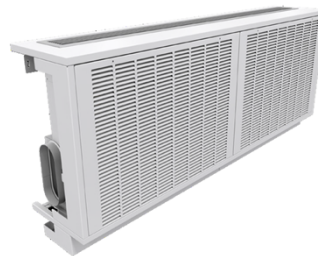
CHILLED BEAMS

- Chilled Beams are sensible only devices that use chilled or heated water supplied above the room dew point to heat or cool a space
- Low maintenance requirement

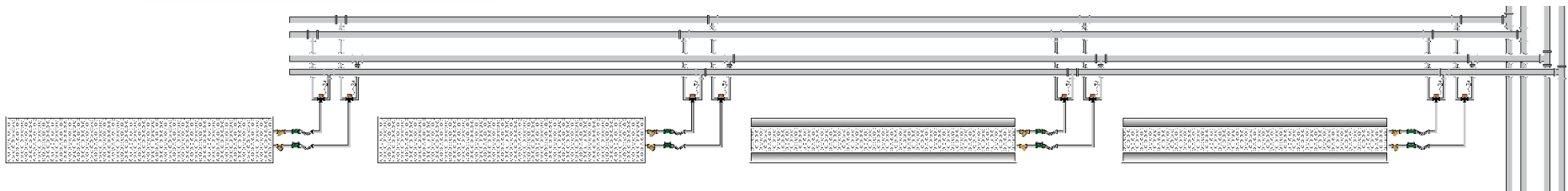
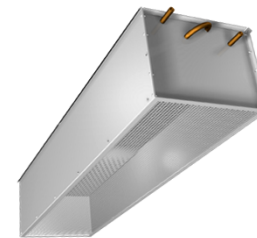
Active Chilled Beams



Floor Mounted Chilled Beams



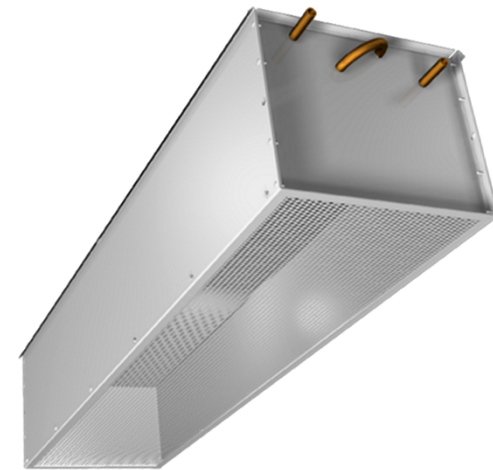
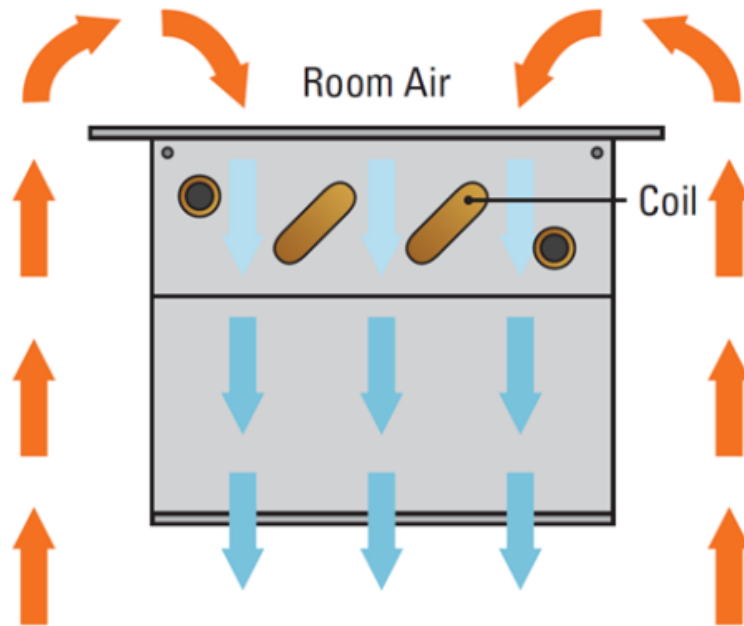
Passive Chilled Beams



CHILLED BEAMS

PASSIVE

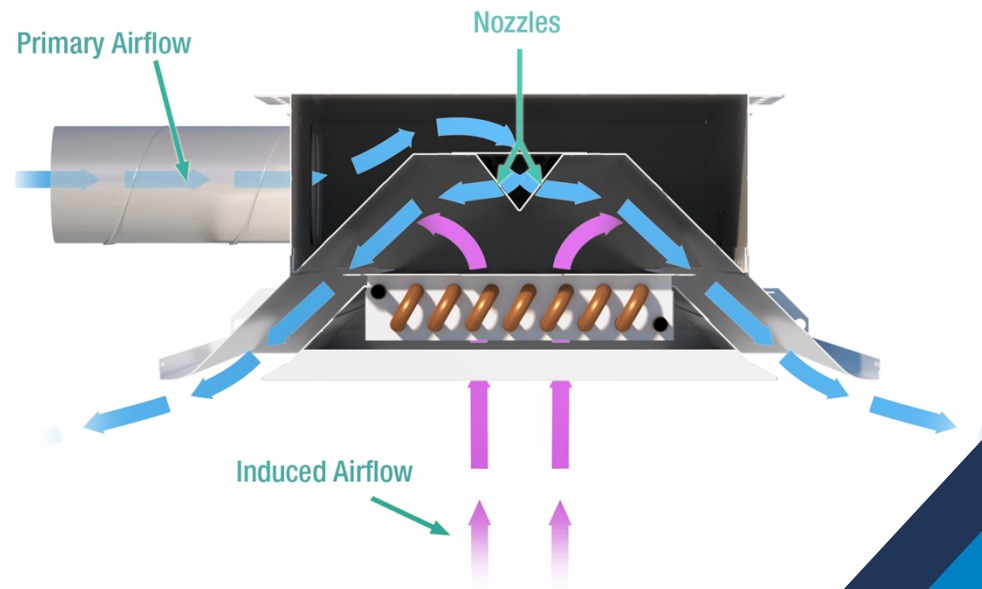
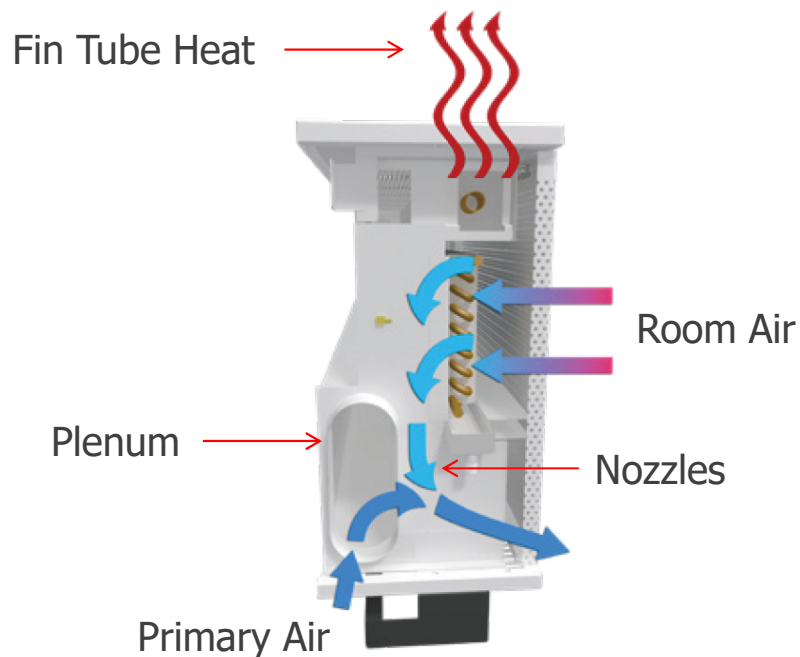
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CHILLED BEAMS

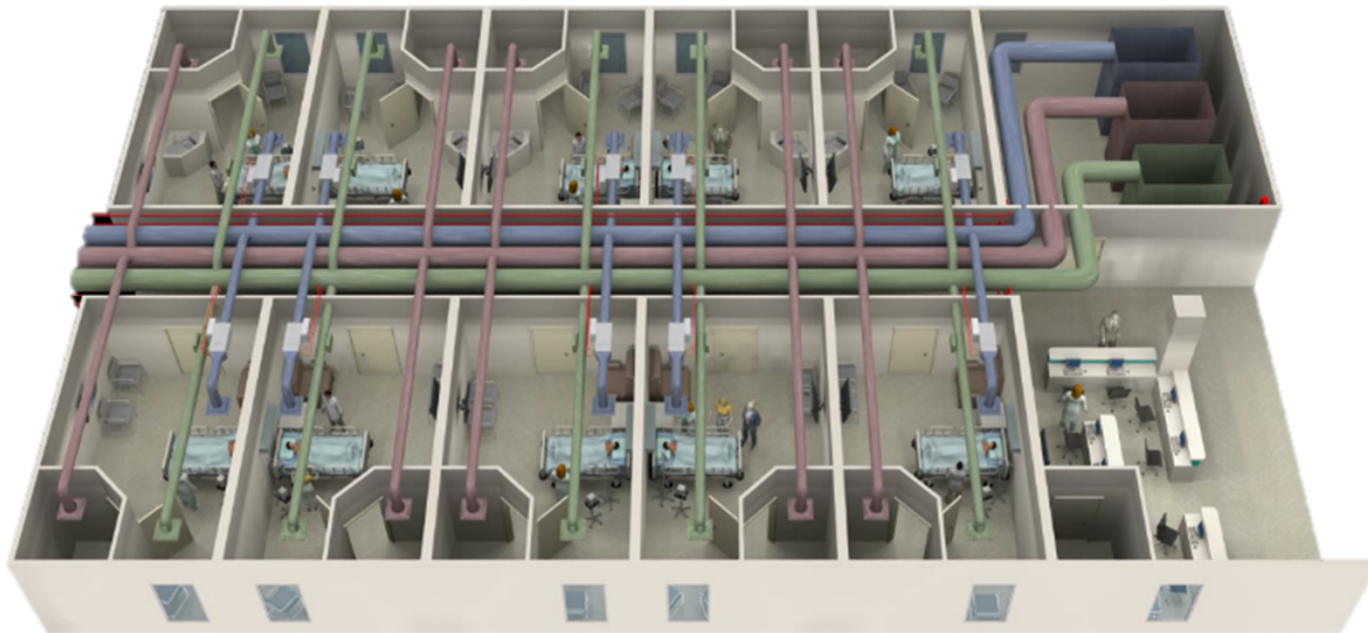
ACTIVE

- Chilled Beams are sensible only devices that use chilled or heated water supplied above the room dew point to heat or cool a space



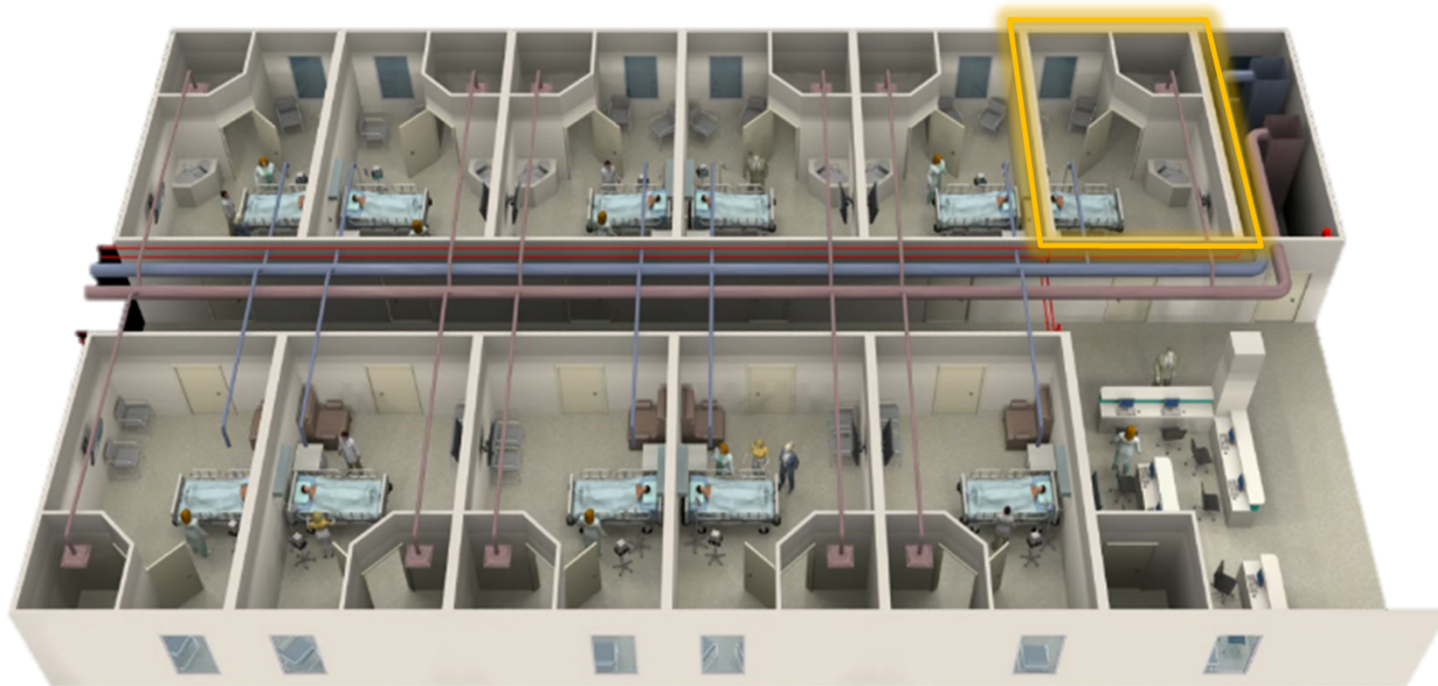
CHILLED BEAMS

TYPICAL VAV LAYOUT



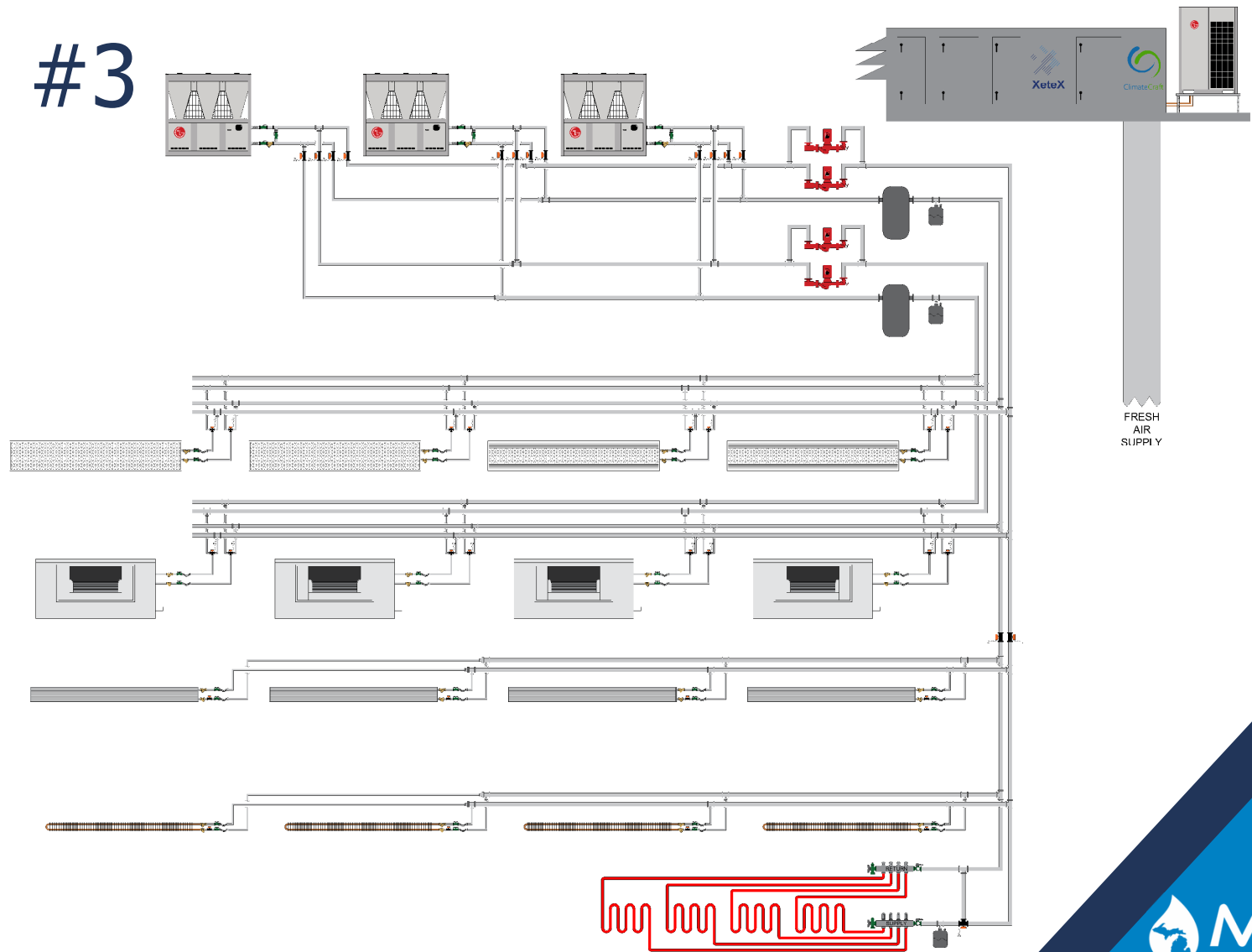
CHILLED BEAMS

TYPICAL BEAM LAYOUT

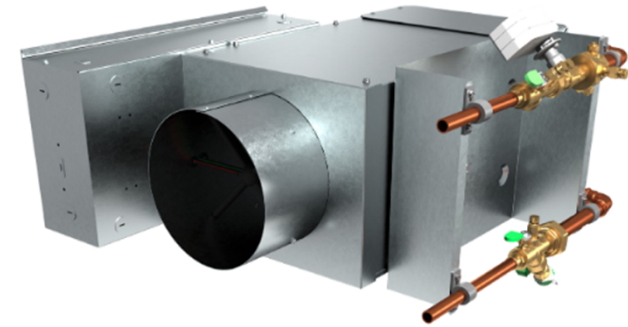
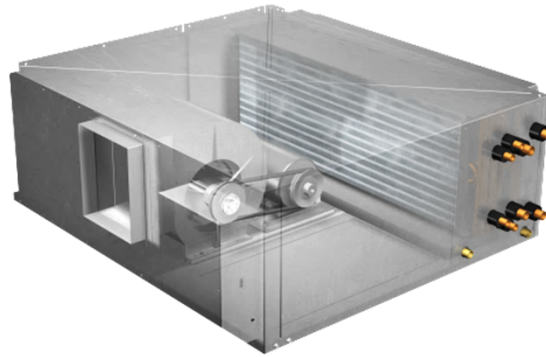


SYSTEM #3

4-PIPE



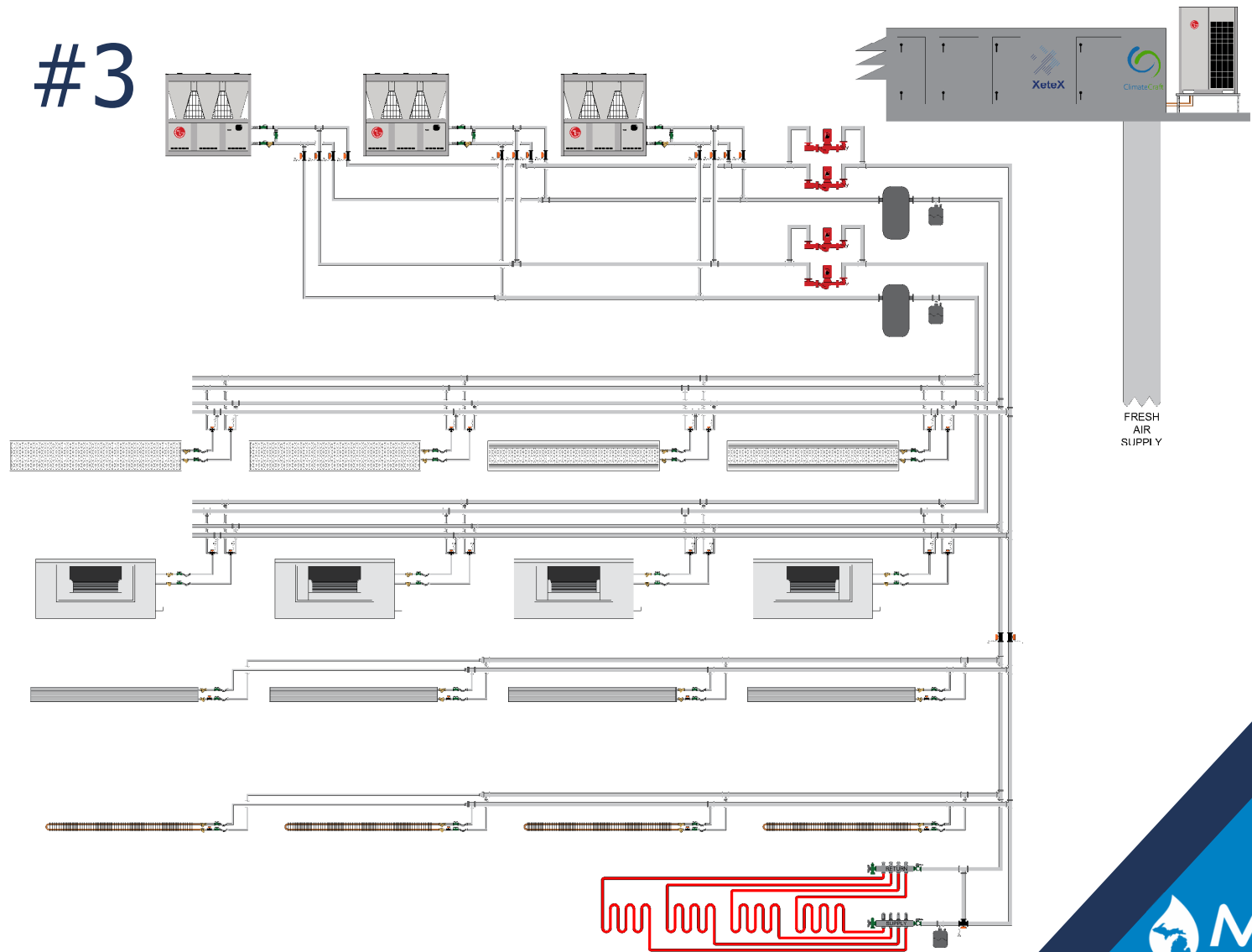
FAN COIL UNITS & VAV



- Pre-engineered for low water temperature applications
- Building in Seattle is currently running on 95° F hot water

SYSTEM #3

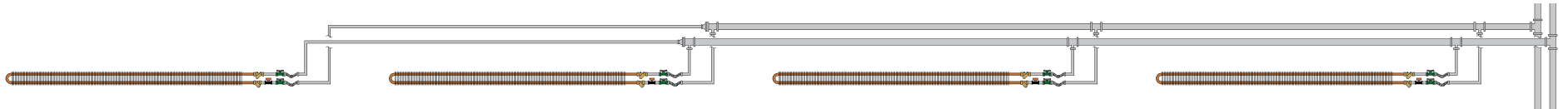
4-PIPE



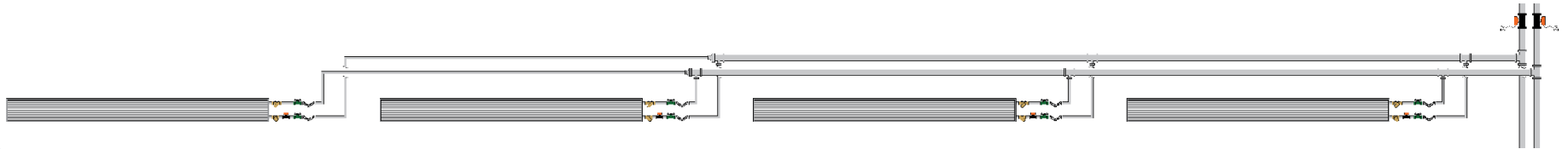
Trench Heaters

Finned Tube

FINNED TUBE & CONVECTION

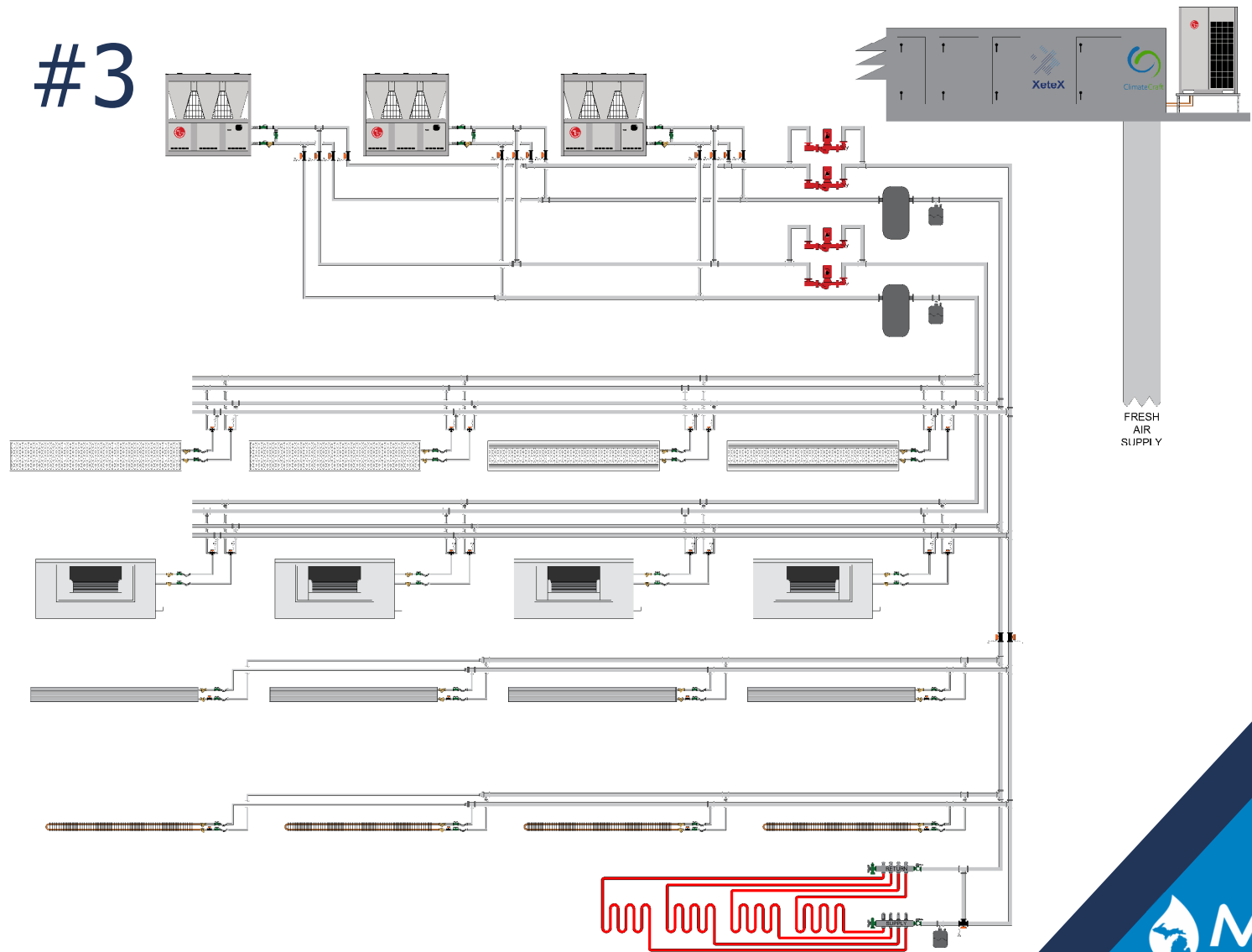


TRENCH HEATERS



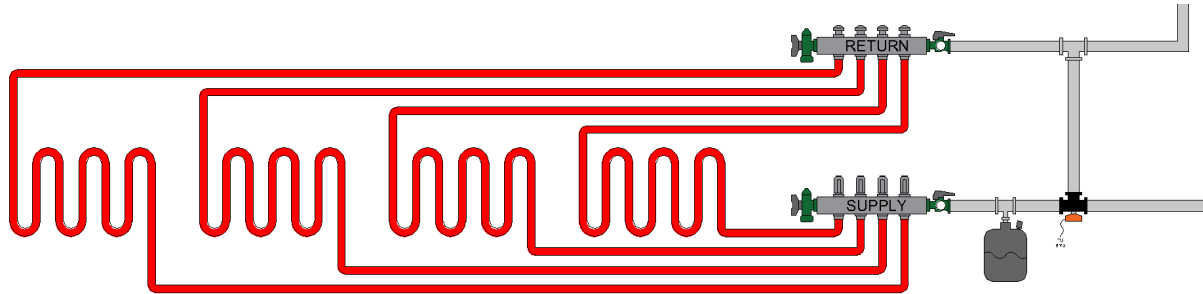
SYSTEM #3

4-PIPE



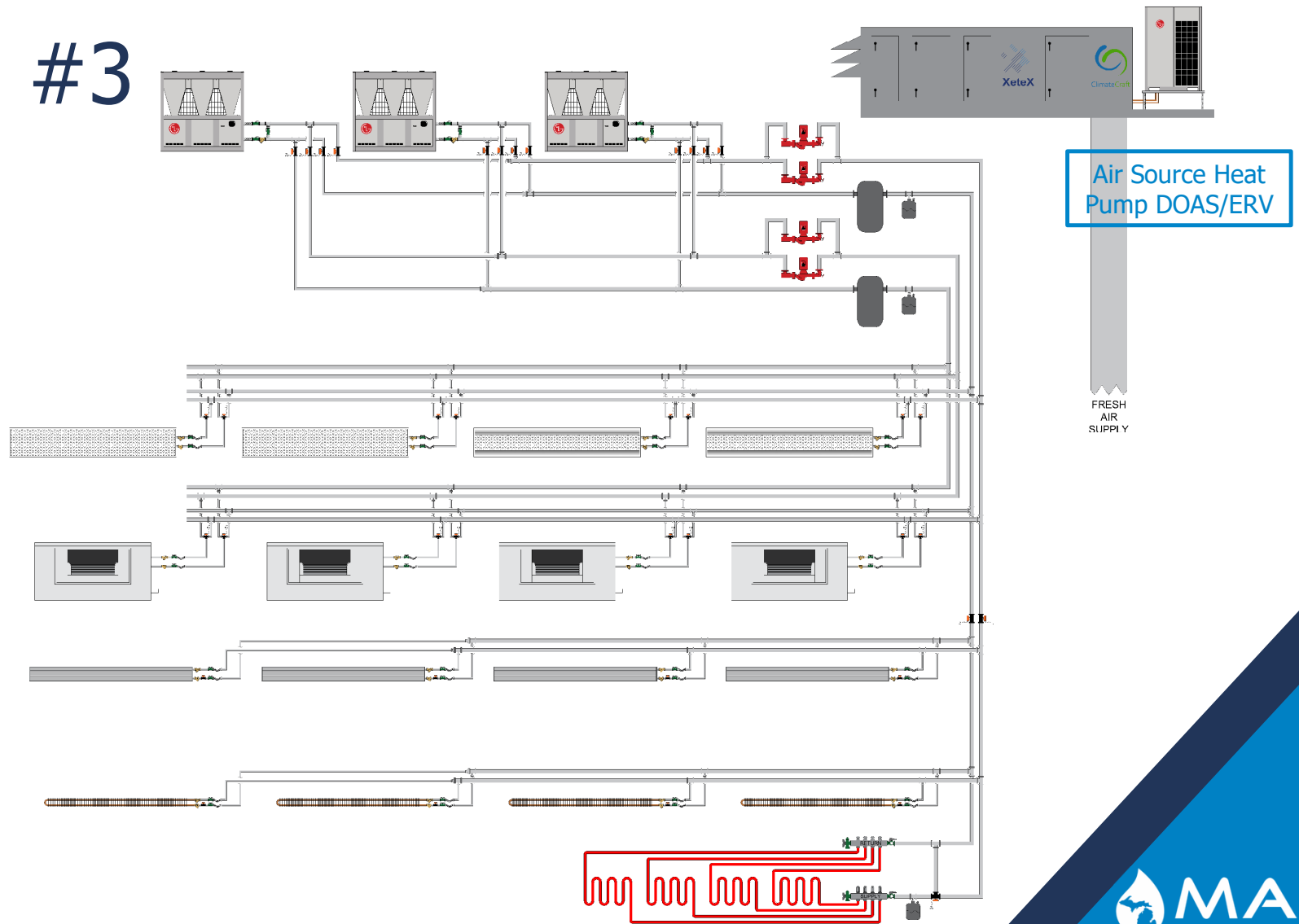
Radiant Heat

RADIANT FLOOR & SNOWMELT

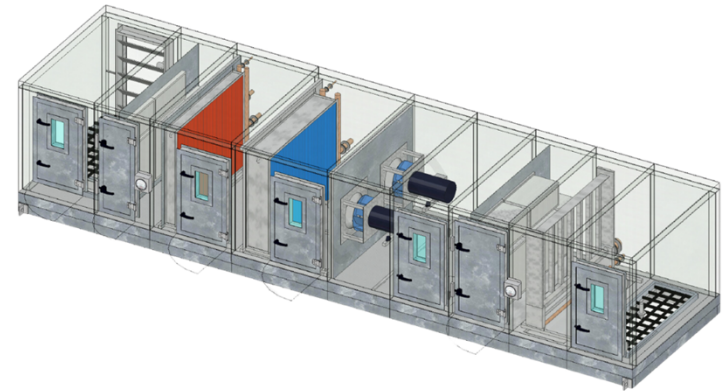
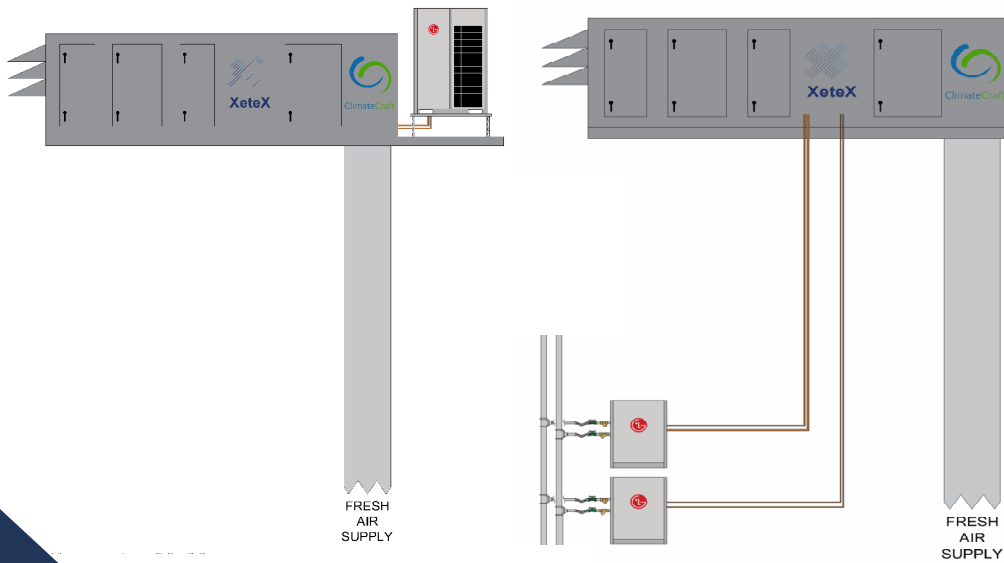


SYSTEM #3

4-PIPE

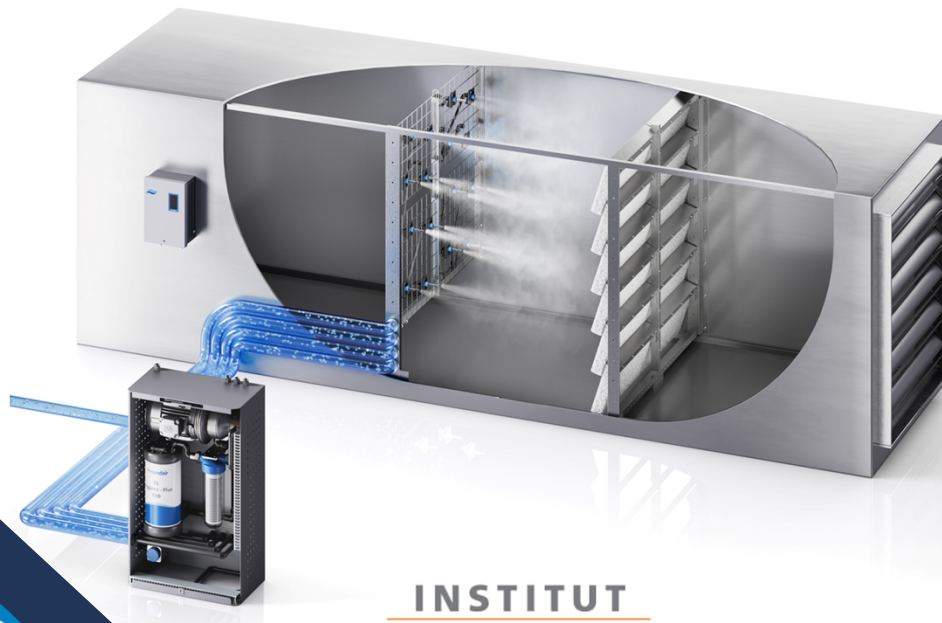


DOAS, ENERGY RECOVERY, & AIR HANDLING

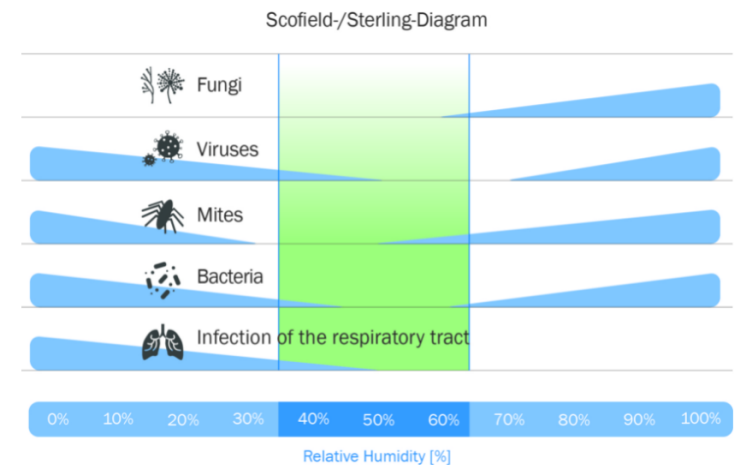


HUMIDIFICATION

- Adiabatic systems – no steam production required
- Water treatment
 - Reverse osmosis, carbon filter, and UV required to maintain hygiene levels.



**INSTITUT
FRESENIUS**



ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

- Washington state is imposing a carbon tax, so Providence St. Peter Hospital conducted a decarbonization case study in partnership with ASHE to determine the impacts.
- The challenge:
 - Fully eliminate carbon processes (excluding emergency generators)
- The goal:
 - Determine the cost and carbon impact of multiple options

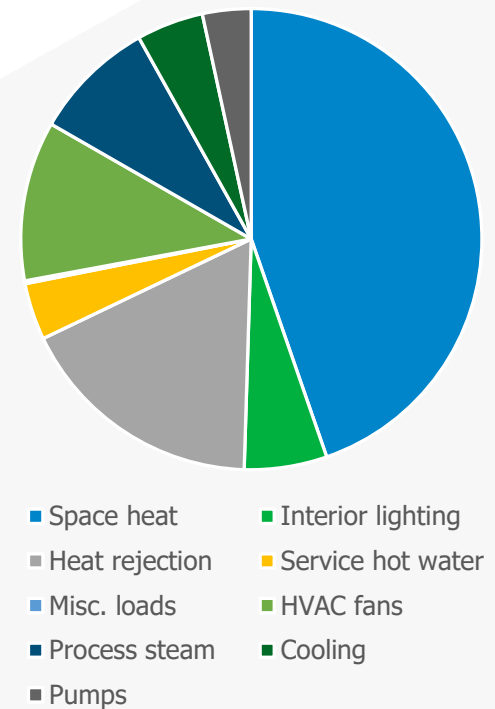


ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

- Energy model takeaways
 - The largest source of energy consumption by a wide margin is space heat
 - Second largest is heat rejection or cooling
 - Third largest is HVAC fans
- HVAC is an energy pit!

Calibrated Energy Model End-Use Percentages



ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

Conclusion of 5 scenarios:

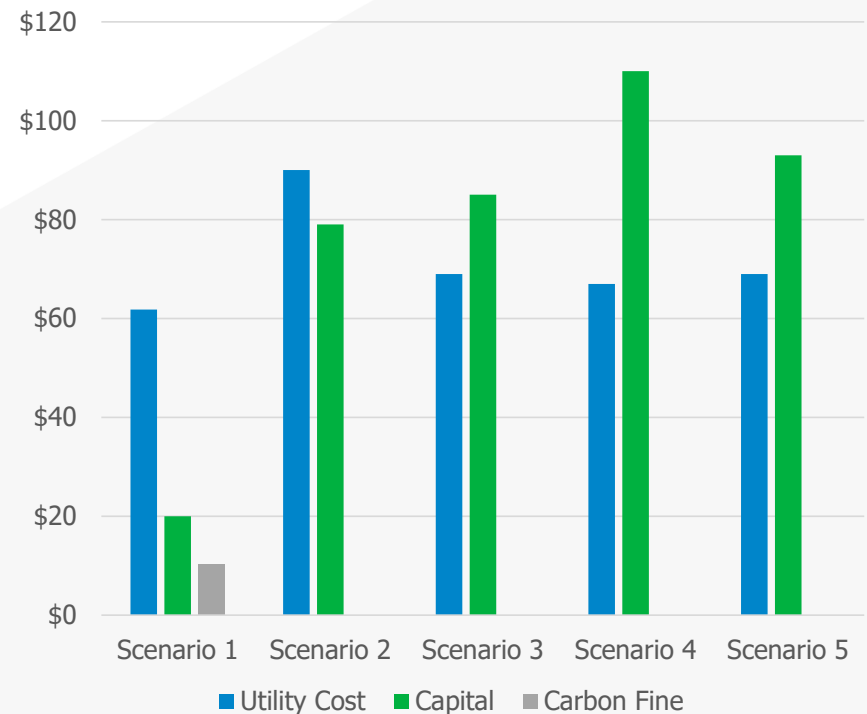
1. Business as usual
2. Replacing dual-fuel boilers with electric resistive boilers, leaving everything else the same
3. Demand side energy saving measures, electrified process load, and 16 MMBtu/h heat pump plant
4. Adding envelope energy saving measures (better windows and improved insulation) to scenario 3, reducing heat load to 11 MMBtu/h
5. Removing wall insulation from option 4 as this is a costly improvement with little impact

ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

- Conclusion of 5 scenarios:
 1. Business as usual
 2. Electric heat
 3. Full heat-pump decarbonization
 4. Heat pump decarbonization with full envelope improvements
 5. Heat pump decarbonization with window improvement only

Estimated Cost/Sqft (2024 thru 2041)



ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

- Conclusion
 - Seattle has vastly different design conditions to Michigan
 - No humidification load
 - Much more mild winters
 - This is a full replacement study
 - No tax credits or rebates were considered



ASHE CASE STUDY

PROVIDENCE ST. PETER HOSPITAL SEATTLE

- Case Study Takeaways for SMSHE
 - Decarbonization is costly
 - If you need to replace existing systems, decarbonization should be a consideration
 - Explore rebate and tax opportunities
 - Conduct a detailed energy study on your building



QUESTIONS?

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Case Study:
ashe.org/sustainability/electrifying-heat-existing-hospital