

# Cleveland Clinic Abu Dhabi Sustainability Case Study

Presented by  
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HOSPITAL BUILD

TED JACOB ENGINEERING GROUP



Offices

Patient Tower

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Gallery

FLUOR

Cleveland Clinic

ALDAR

MUBADALA DEVELOPMENT

HDR



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# Green Principals

(American Society of Hospital Engineers)

- Integration Design
- Site Design
- Water
- Energy
- Indoor Environmental Quality
- Material & Products
- Construction Practices
- Commissioning
- Operations & Maintenance
- Innovation



# Green Guidelines

- US Green Building Council (USGBC)  
LEED Green Building Rating
- Green Guide for Healthcare (GGHC)
- Emirates Green Building Council (EGBC)
- Abu Dhabi Green Buildings (ADGB)



# Design & Construction Rating Systems

CATEGORY	USGBC	GGHC	EGBC	ADGB
Sustainable Sites	14	21	13	15
Energy & Atmosphere	17	21	16	20
Water Efficiency	5	6	12	30
Materials & Resources	13	21	11	15
Indoor Environmental Quality	15	24	15	15
Innovation & Design Process	5	4	5	5
Total Points	69	97	72	100

CERTIFICATION	USGBC	GGHC	EGBC	ADGB
Certified	26 - 32	N/A	29 - 35	45
Silver	33 - 38	N/A	36 - 43	55
Gold	39 - 51	N/A	44 - 57	65
Platinum	52 or more	N/A	58 or more	75 or more



# Operations

CATEGORY	USGBC	GGHC	EGBC	ADGB
Integrated Operations	N/A	5	N/A	N/A
Transportation Operations	N/A	3	N/A	N/A
Energy Efficiency	N/A	18	N/A	N/A
Water Conservation	N/A	8	N/A	N/A
Chemical Management	N/A	5	N/A	N/A
Waste Management	N/A	6	N/A	N/A
Environmental Services	N/A	9	N/A	N/A
Environmental Preferable Purchases	N/A	11	N/A	N/A
Innovation in Operations	N/A	7	N/A	N/A
Total Points	N/A	72	N/A	N/A



# Unique Design Challenge

- Initial and Operating Costs
- Integrated Design
- Design for Medical Indoor Environment
- Continuously Changing Medical Technology
- Design for Future Expansion
- Design for Diverse Functions
- Diverse Occupancy and Operating Schedules



# Unique UAE Design Conditions

- High Temperature
- High Humidity
- Sand Storms
- Water Shortage



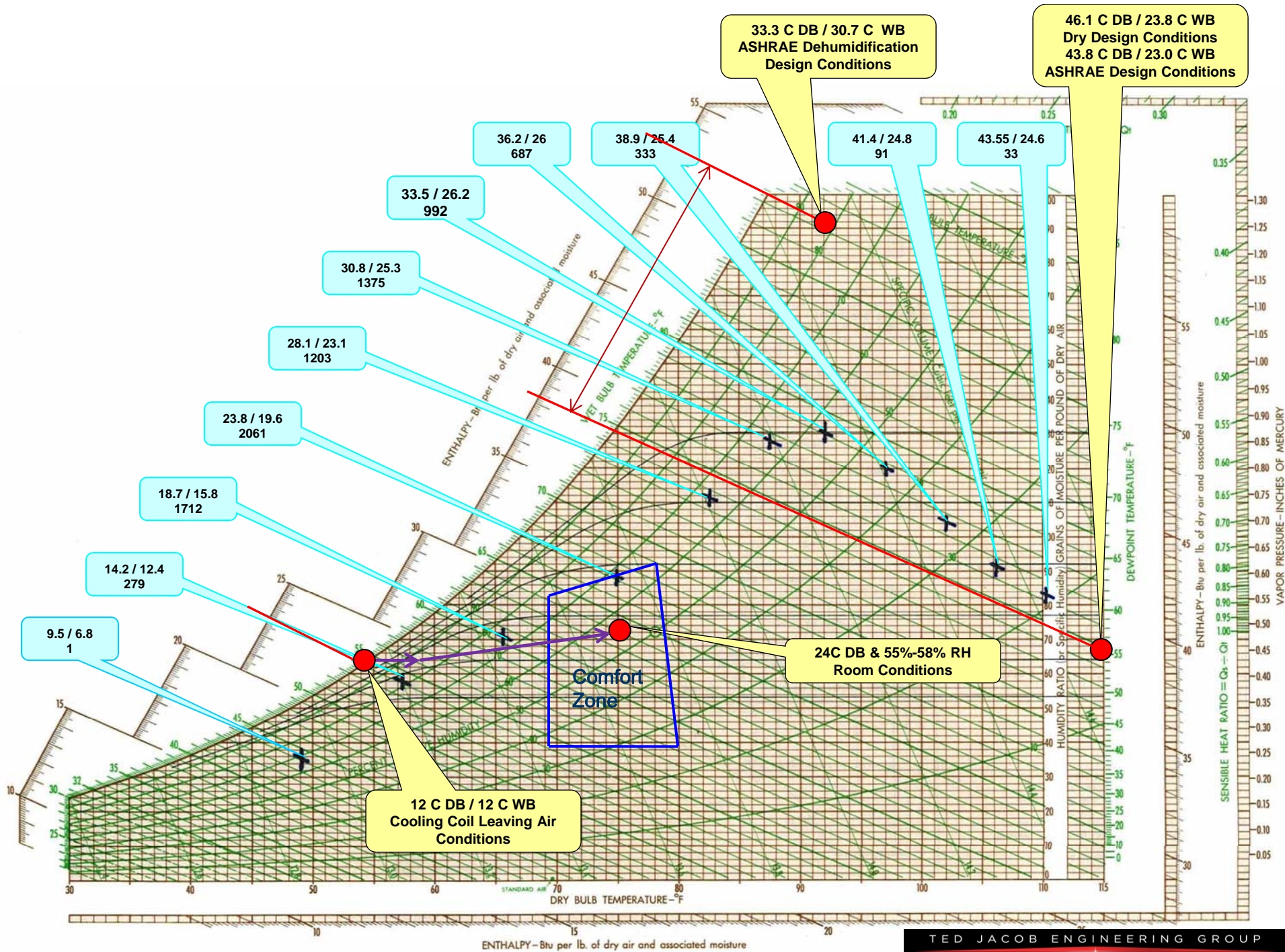


# Life Cycle Cost

## Sustainable Hospital vs. Traditional Hospital

- First Cost
- Operation Cost
- Replacement Cost
- Payback



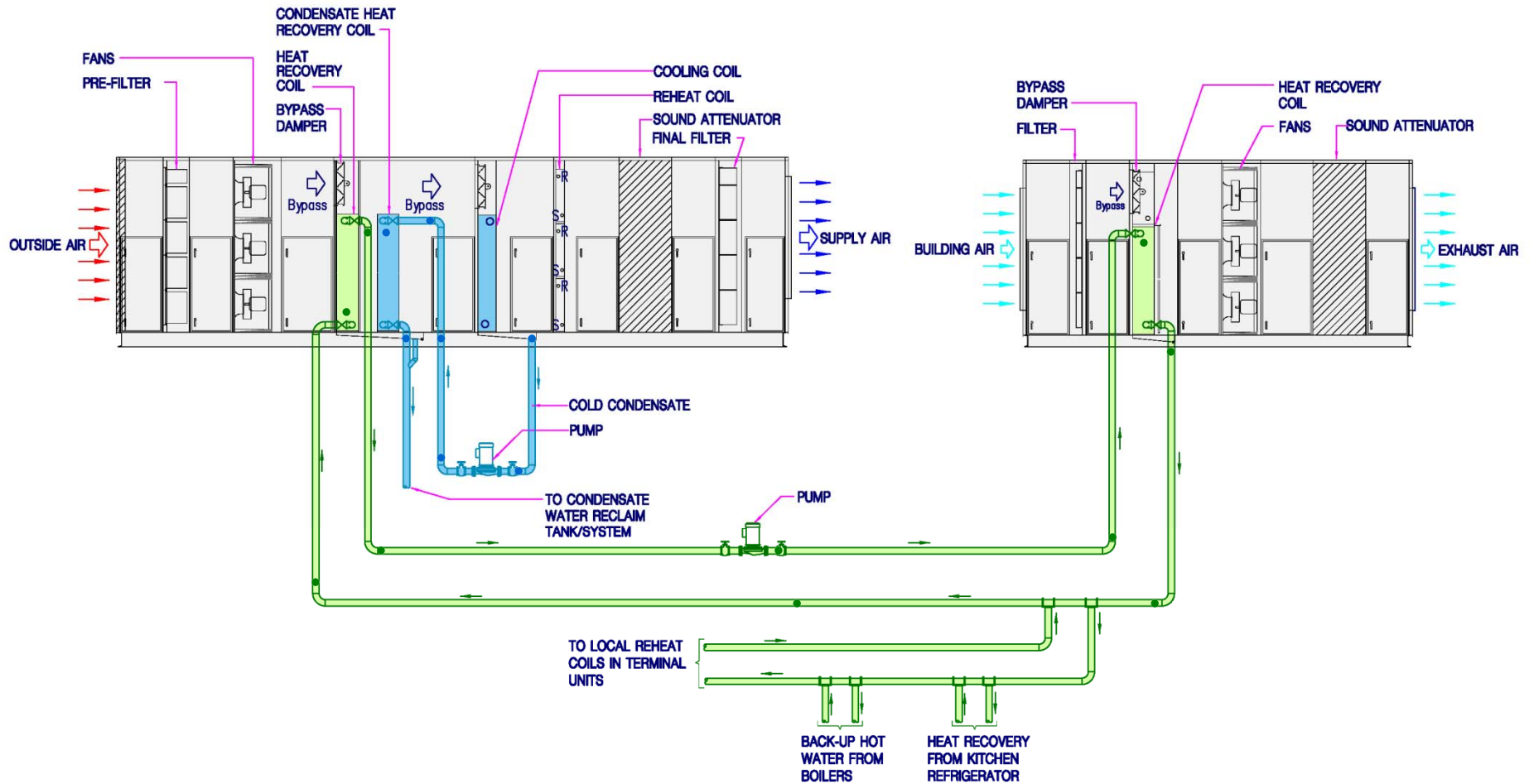


# Optimize Energy Performance

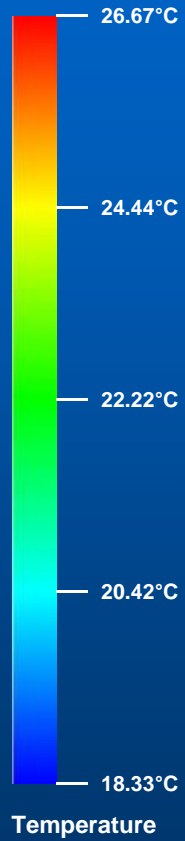
- Heat Recovery
  - Exhaust
  - Kitchen Equipment
  - Re-heat Coils
- Double Skin Defensive Buffer Zone
- Variable Air Volume
- Displacement Ventilation



# Heat Recovery



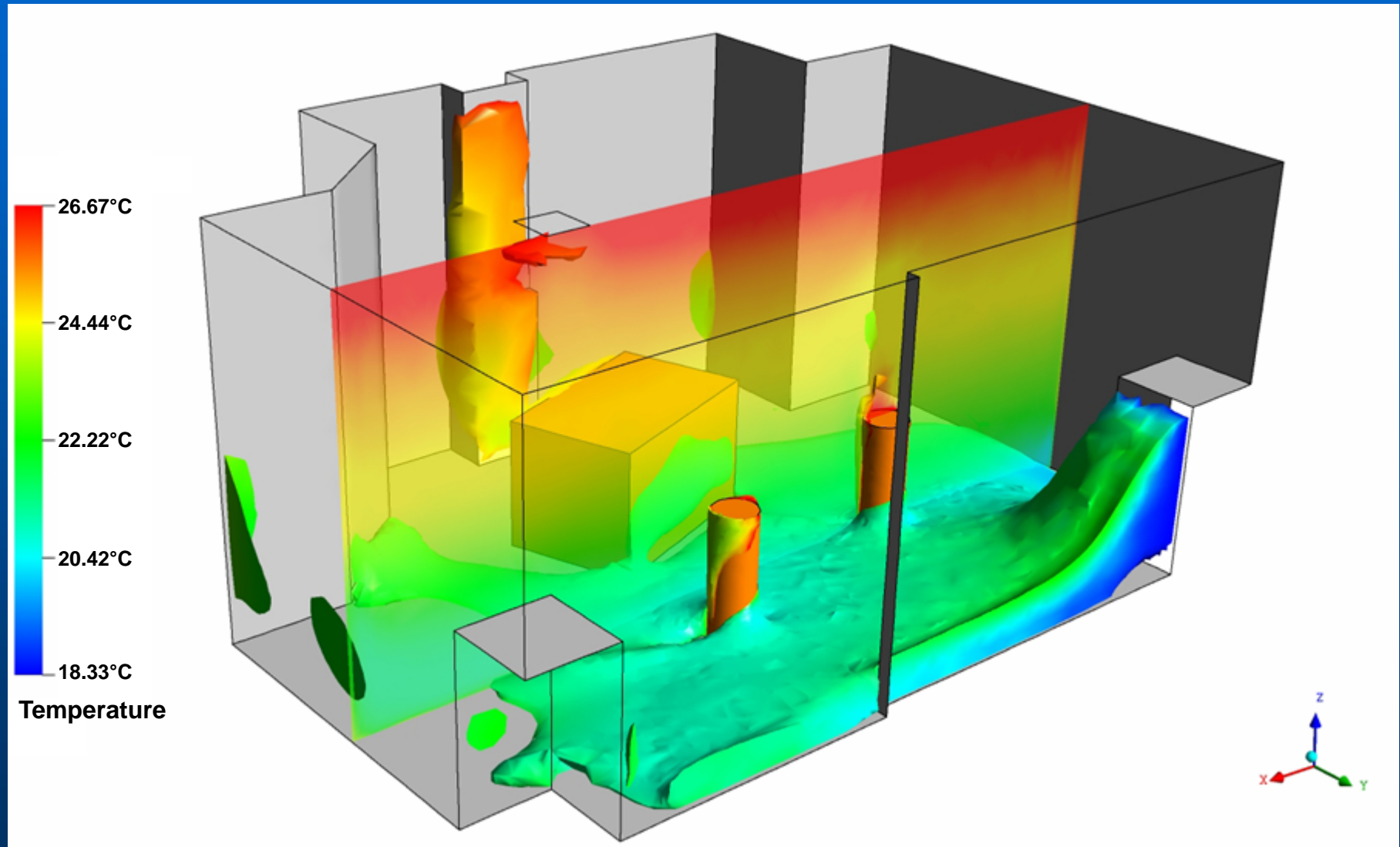
# Displacement Ventilation



## Smoke Test



# Displacement Ventilation



# Displacement Ventilation

## 240 CFM @ 7.2 AC/HR

Cooling: 18.0 °C Supply Air

Height	Room	Window	Bath
9'-0"	-	-	-
8'-6"	23.6	24.7	22.2
8'-0"	23.3	23.6	21.9
7'-0"	22.8	23.6	21.9
6'-0"	22.8	22.5	21.7
5'-0"	22.7	22.5	21.8
4'-0"	22.7	22.3	22.2
3'-0"	22.0	21.9	22.2
2'-0"	21.0	21.6	21.3
1'-0"	-	-	-

## 120 CFM @ 3.6 AC/HR

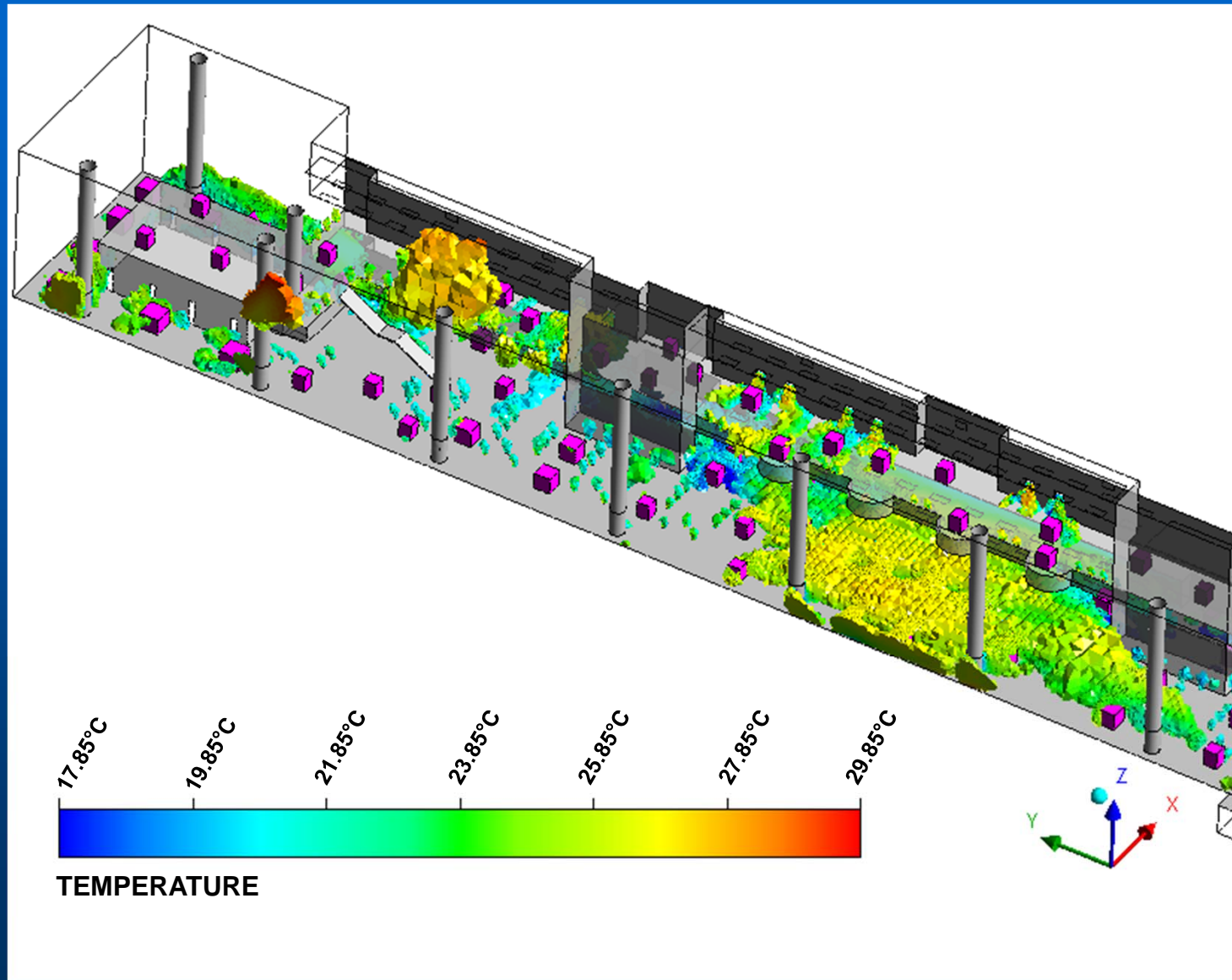
Cooling: 18.0 °C Supply Air

Height	Room	Window	Bath
9'-0"	-	-	-
8'-6"	24.1	24.4	21.1
8'-0"	23.7	24.4	21.3
7'-0"	23.6	23.5	21.6
6'-0"	23.4	23.3	21.9
5'-0"	23.3	23.3	22.2
4'-0"	23.3	23.3	22.2
3'-0"	23.0	23.3	22.3
2'-0"	21.2	20.5	22.5
1'-0"	-	-	-

## Room Temperature Profile

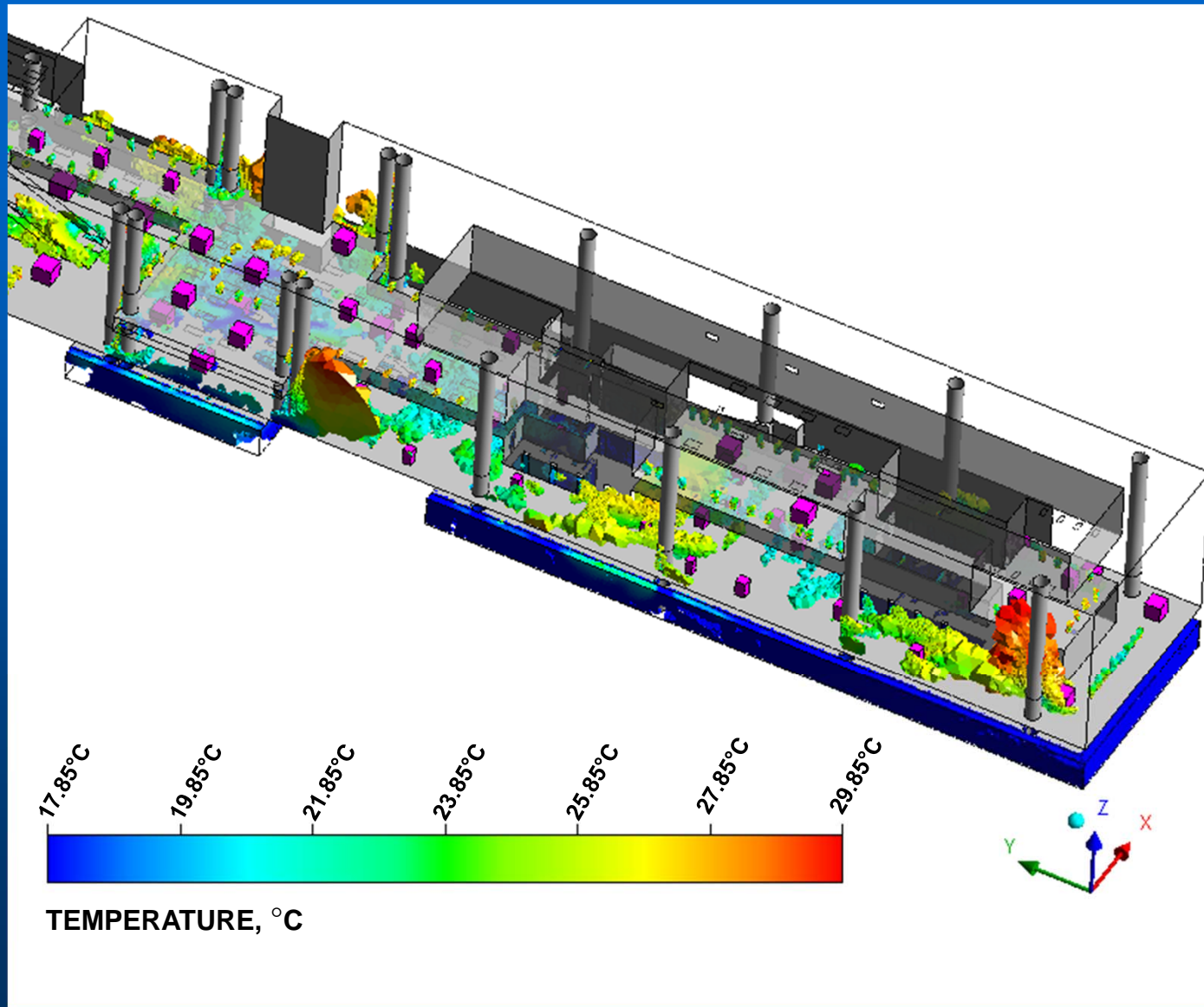


# Displacement Ventilation

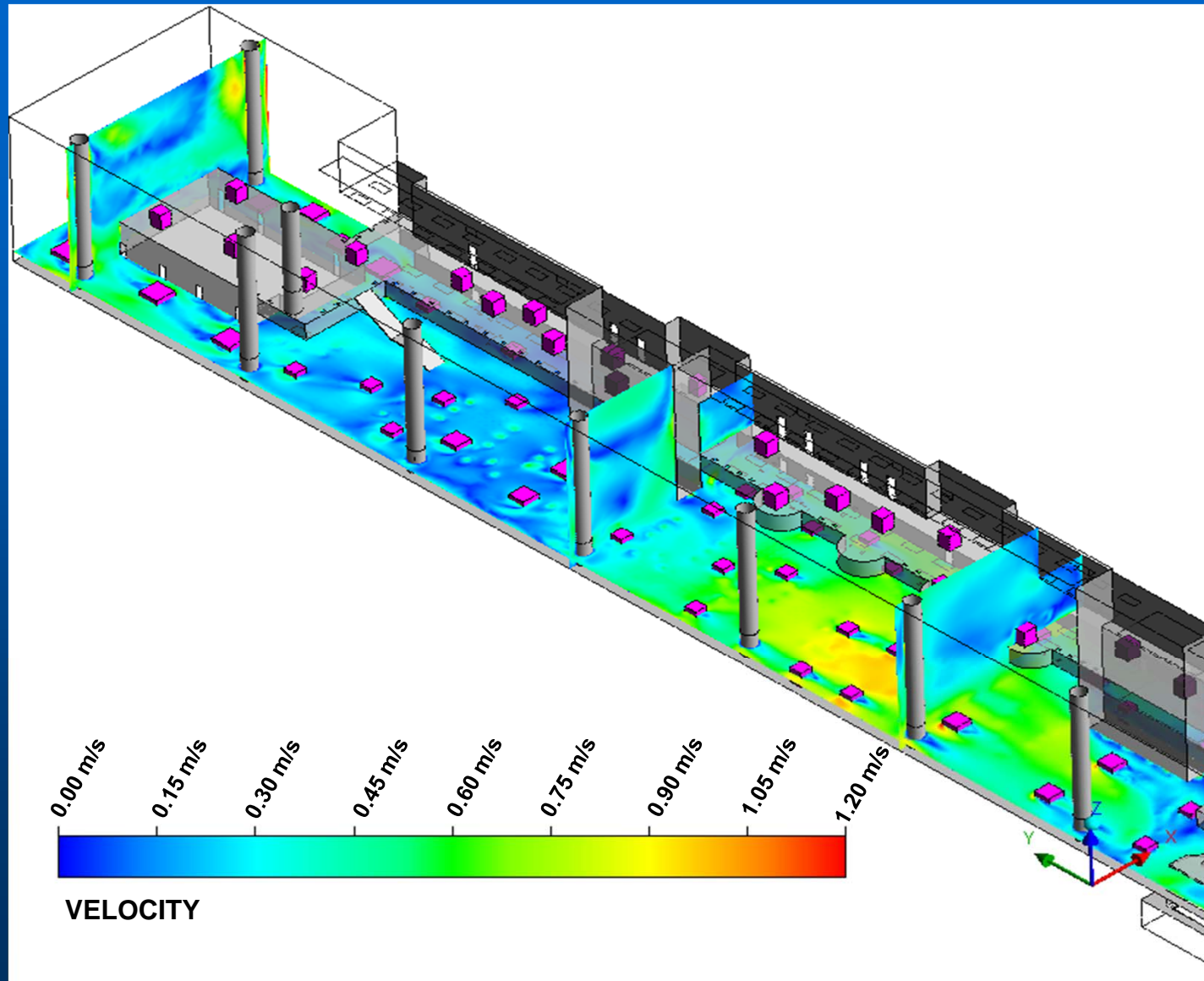




# Displacement Ventilation



# Displacement Ventilation





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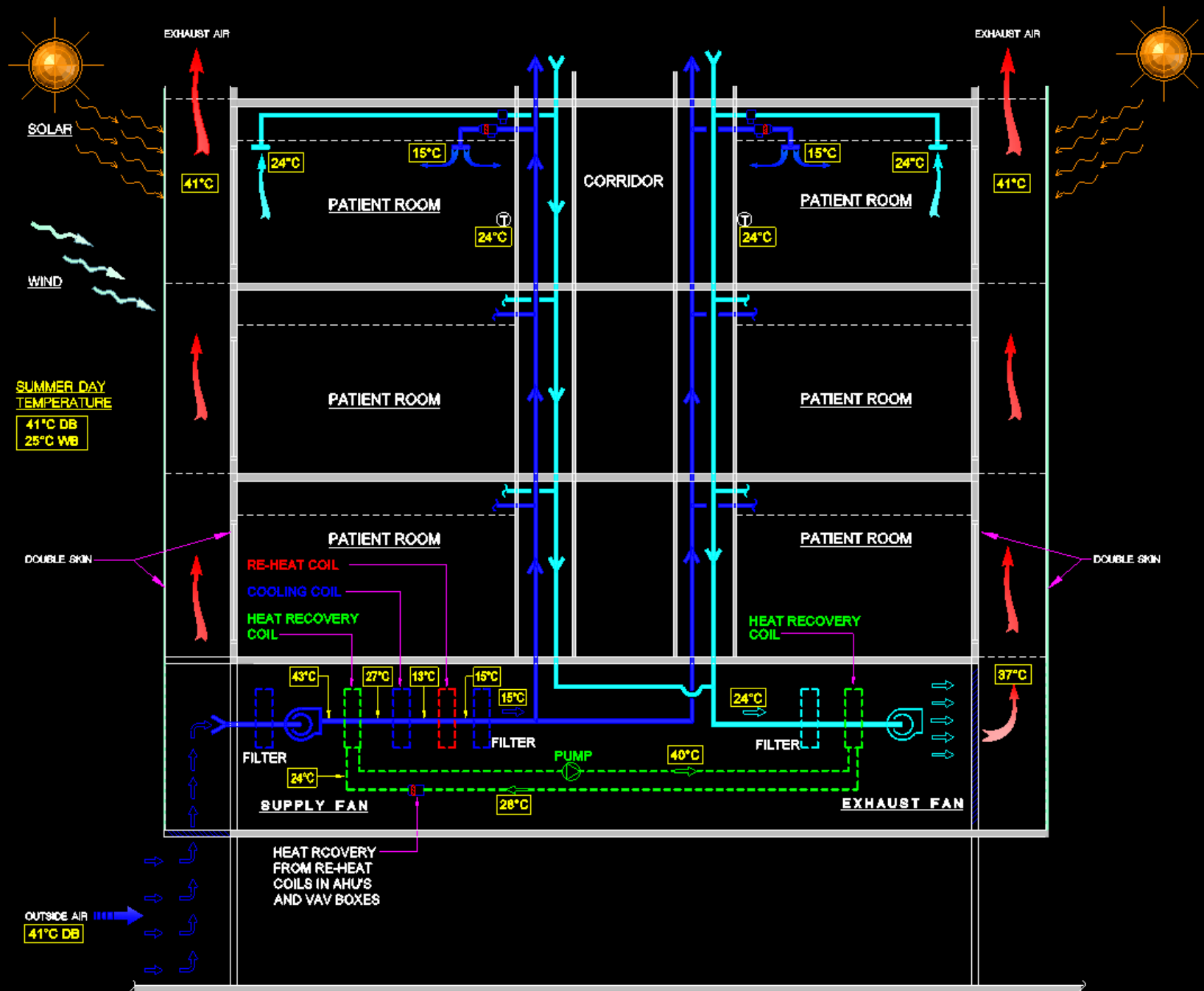
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DEVELOPMENT DEVELOPMENT

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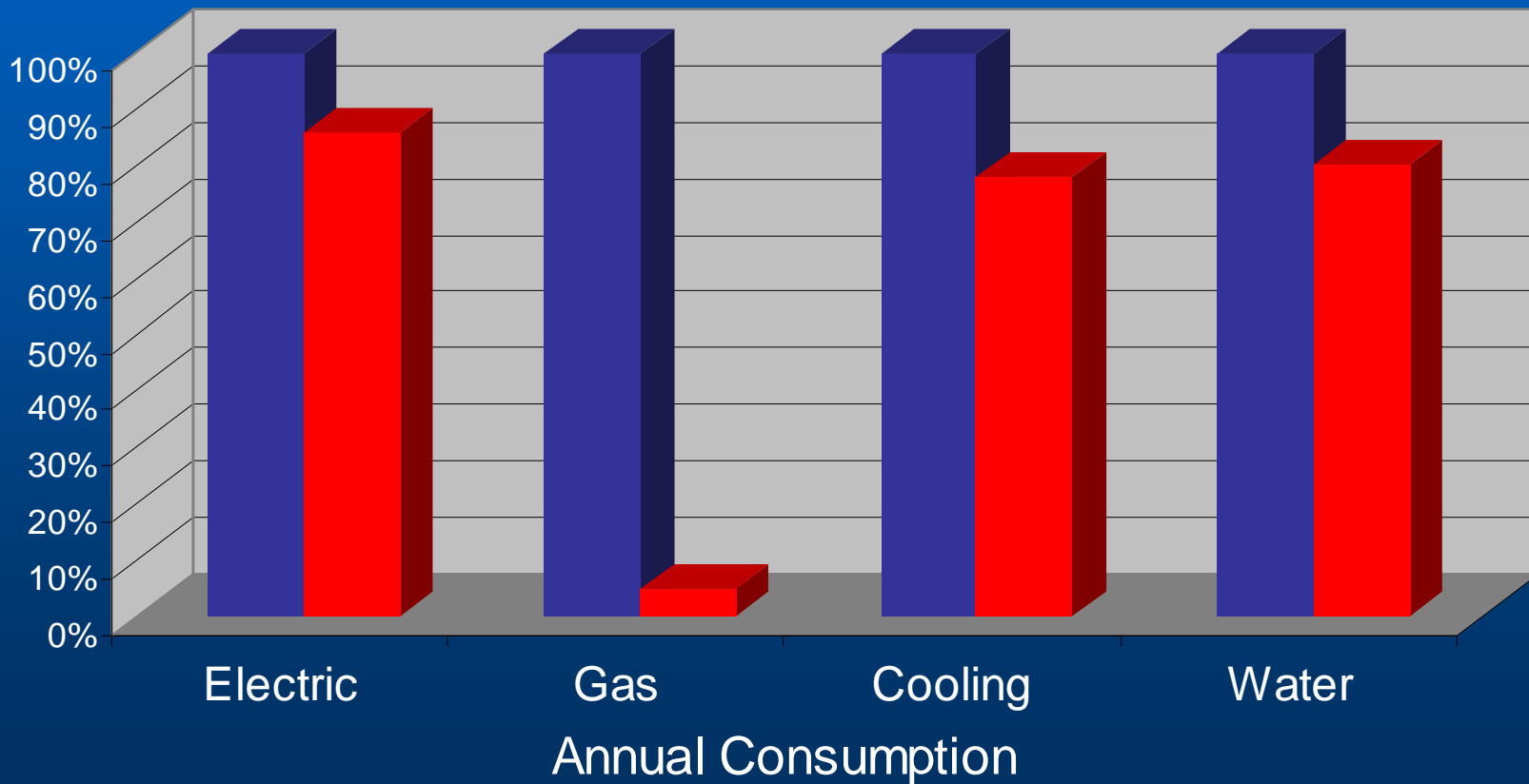
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# HVAC System Options

■ Return Air Constant Volume

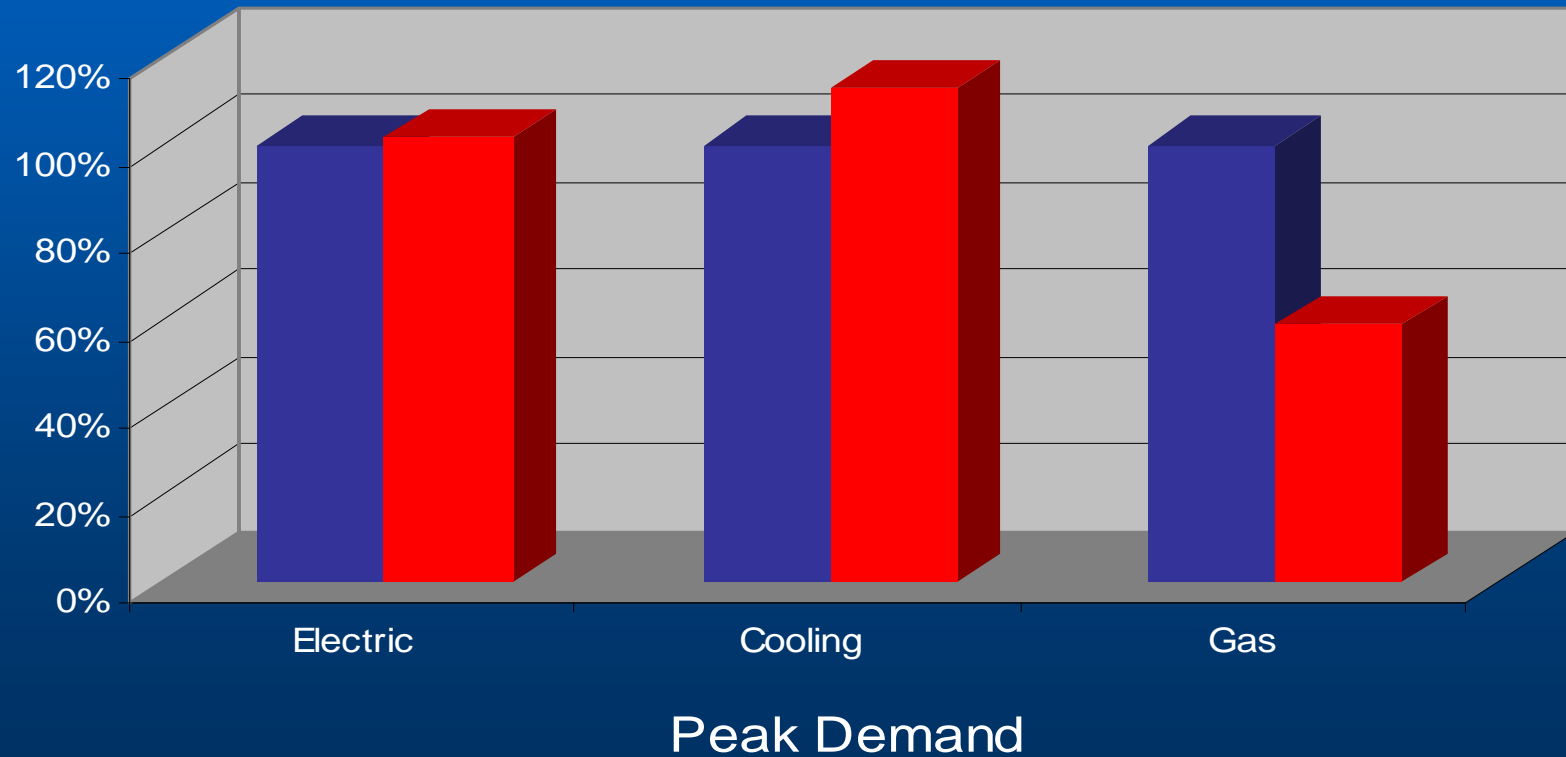
■ 100% Outside Air Variable Volume



# HVAC System Options

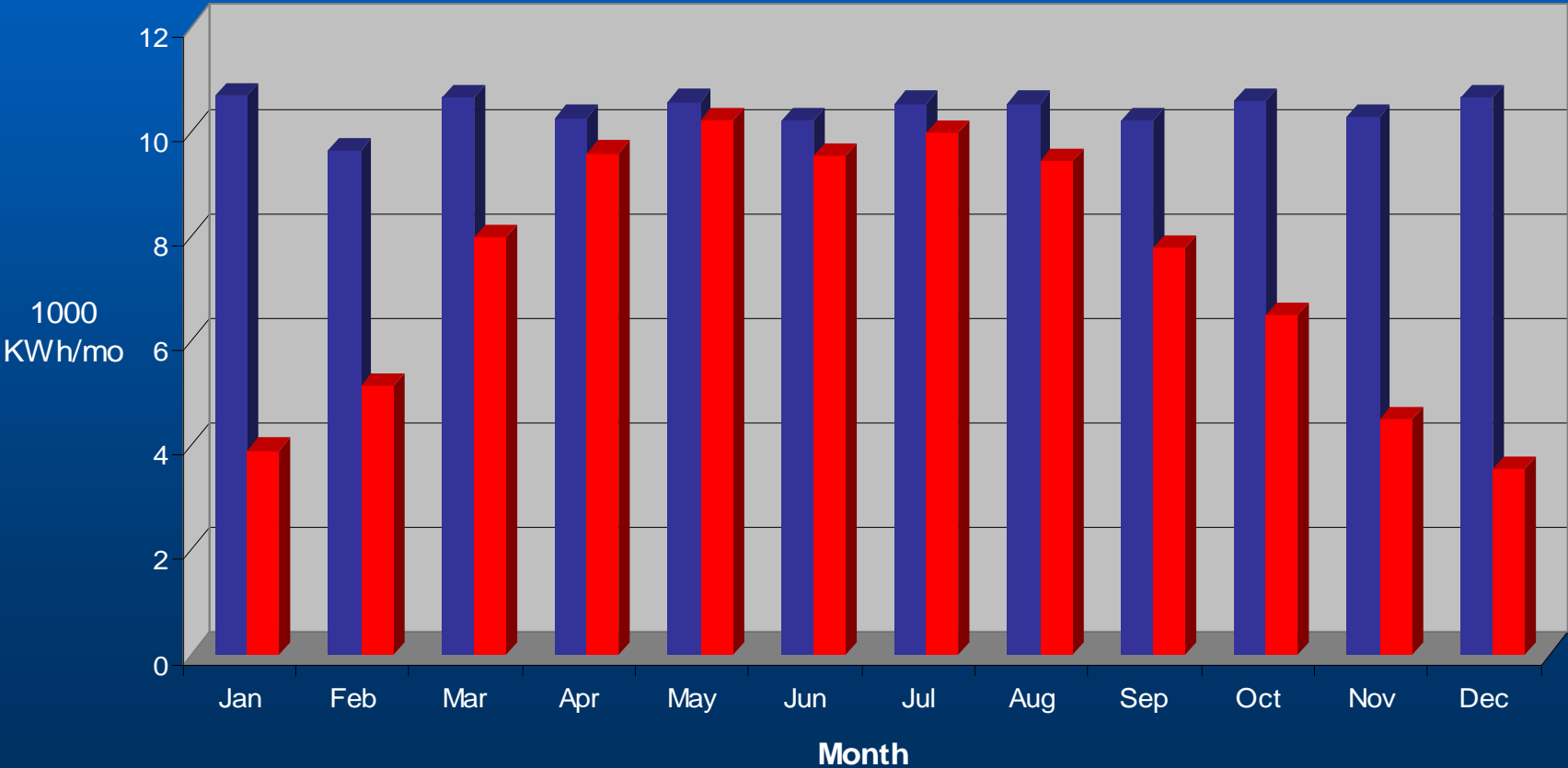
■ Return Air Constant Volume

■ 100% Outside Air Variable Volume



# Solar Hot Water

■ Domestic water heating demand      ■ Domestic water heating by solar



# Water Efficiency

- Eliminate Potable Water Use for Medical Cooling
- Potable Water Measurement and Verification
- Reduce Use of Potable Water in Building Systems Equipment
- Provide System to Capture AHU Condensate

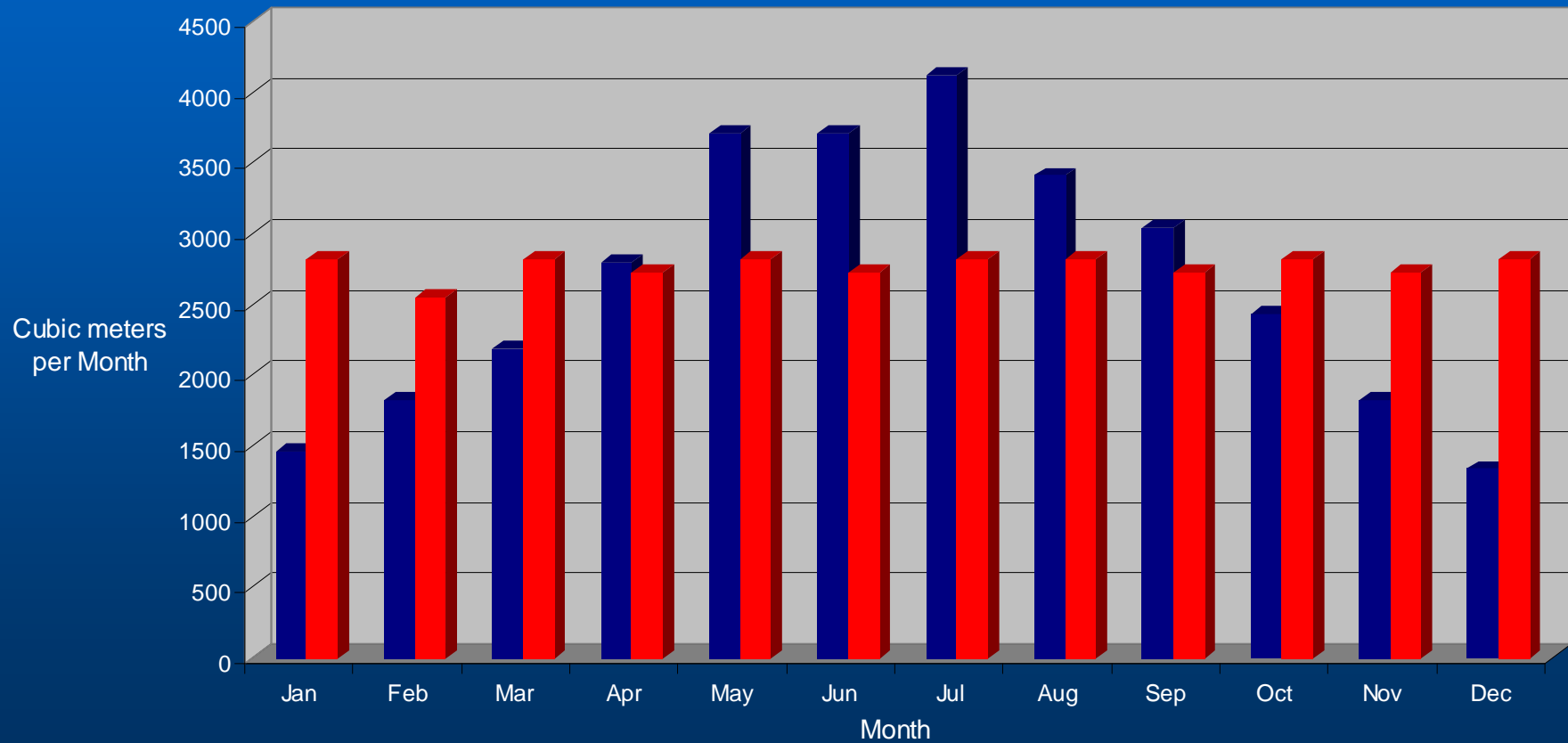




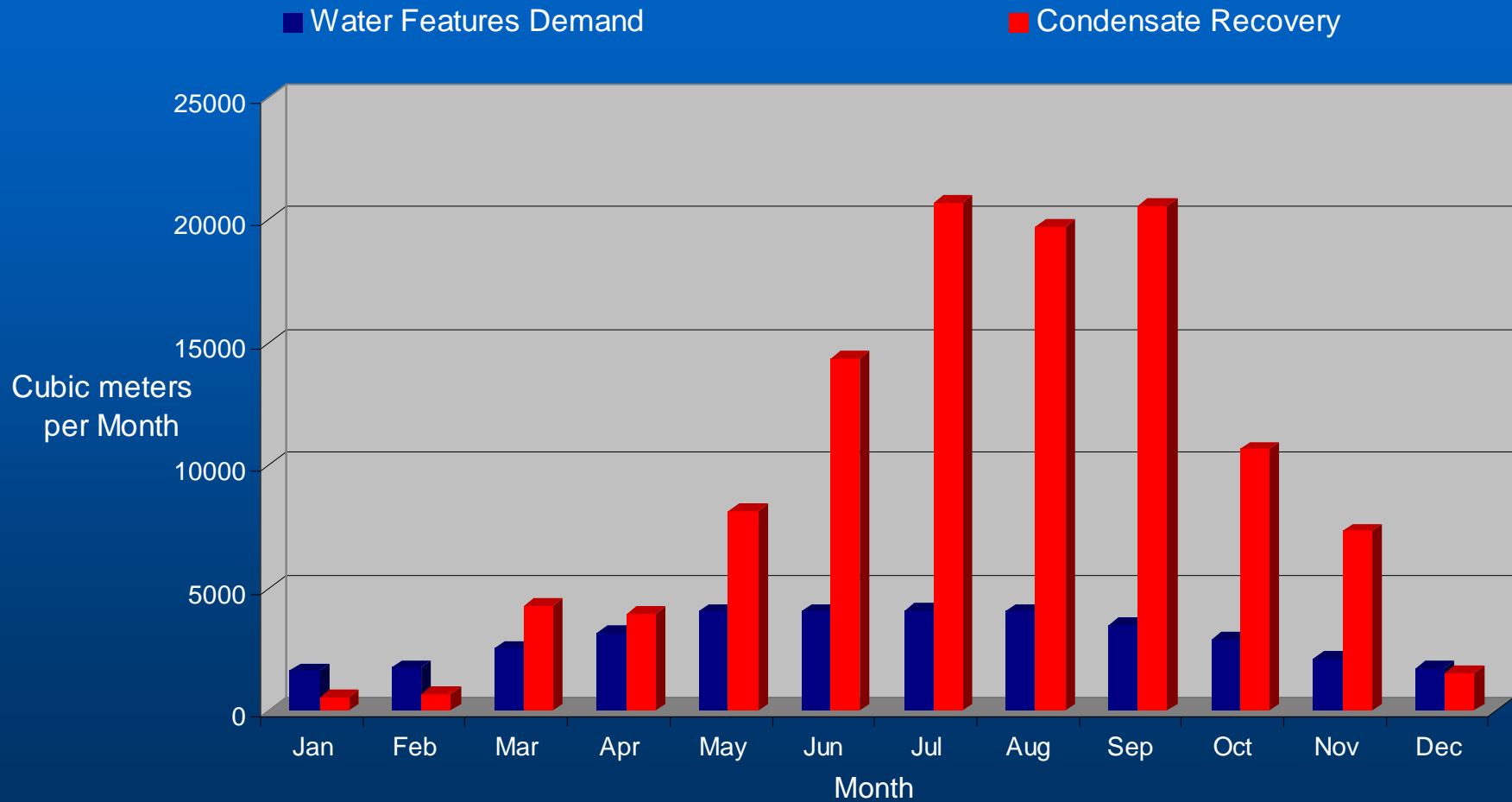
# Grey Water Recovery

■ Irrigation Demand

■ Grey Water Recovery



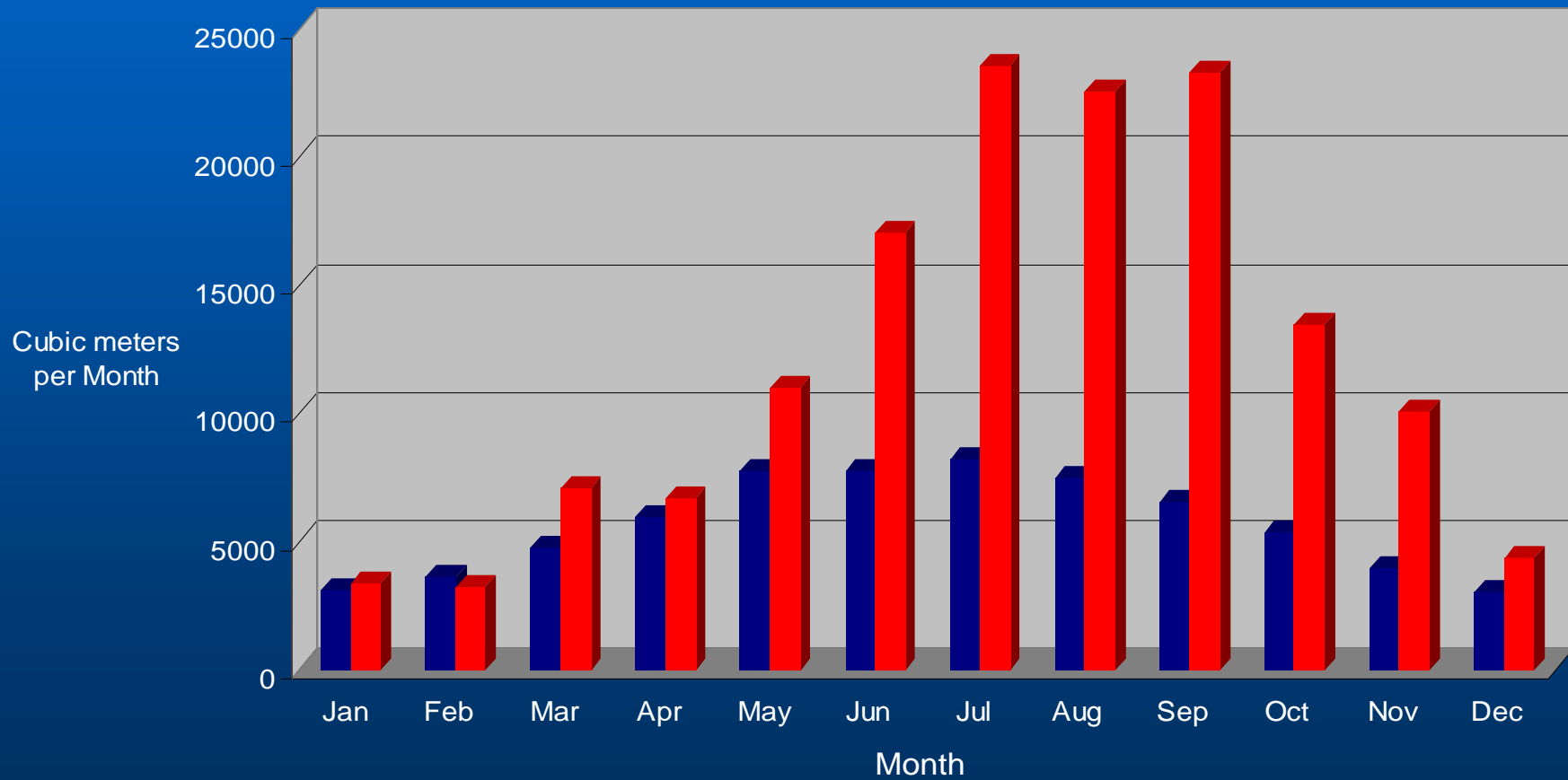
# Condensate Water Recovery

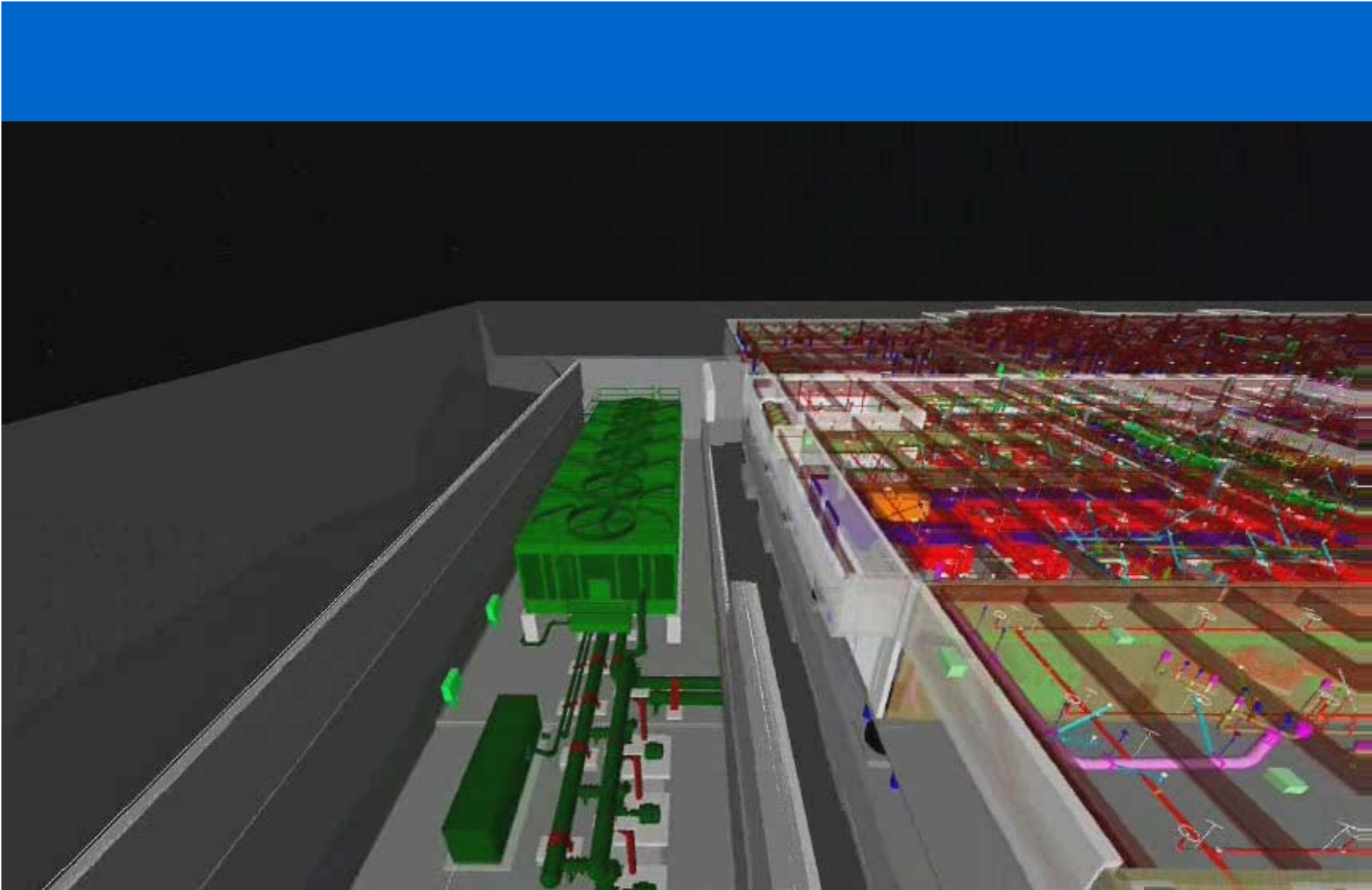


# Reclaimed Water (Grey Water and Condensate)

■ Irrigation and Water Feature Demand

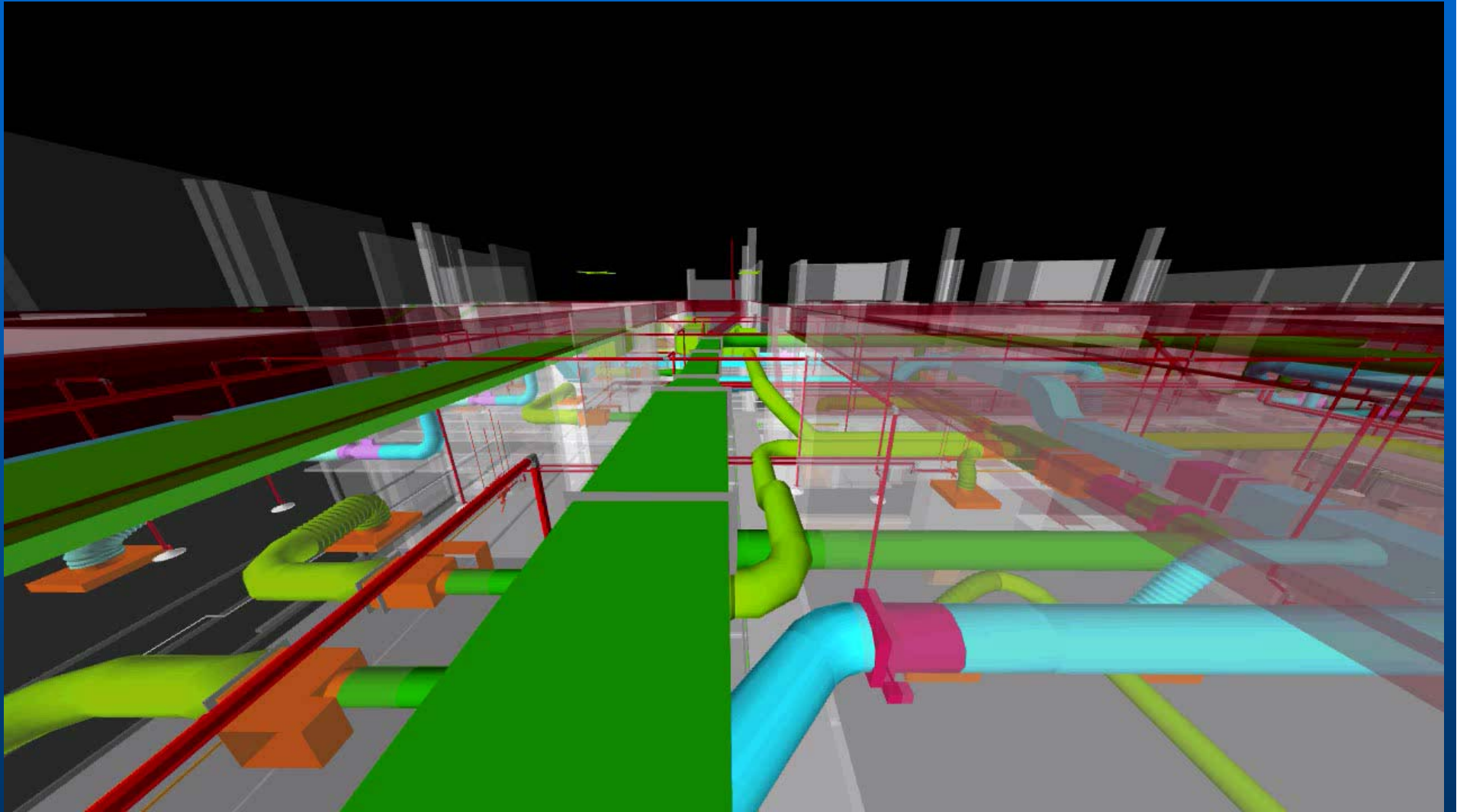
■ Grey Water and Condensate Recovery





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