

Boiler & Chiller Optimization

How to address seasonal changeover from boilers to chillers without sabotaging efficiency

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Overview

1: Challenges for Seasonal Changes

2: Good Practices

3: New Technologies



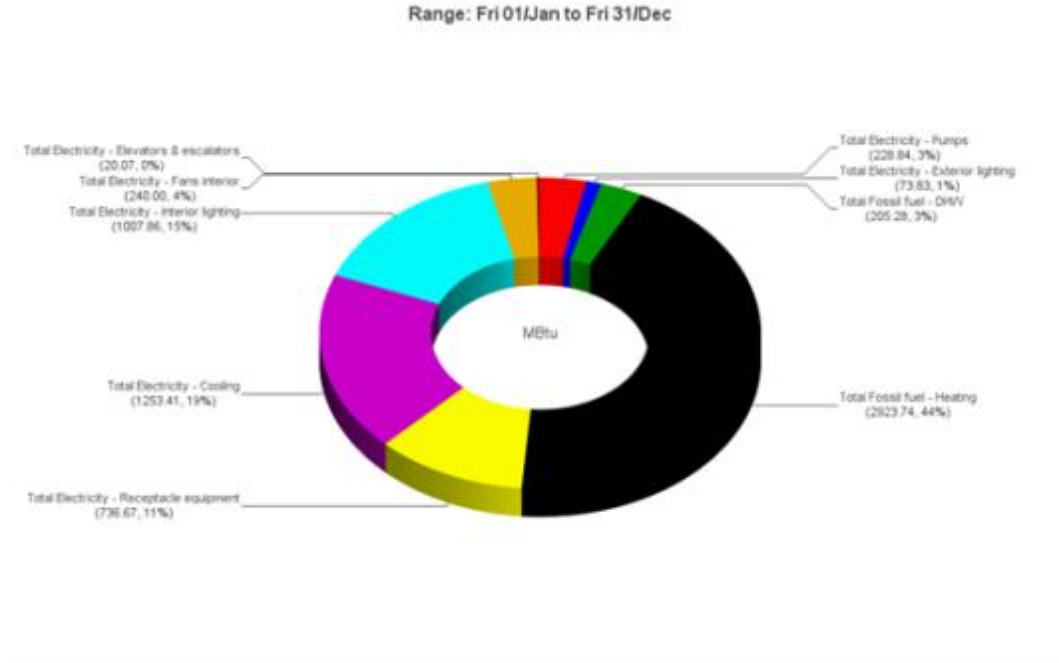
1:

Challenges for Seasonal Changes

Challenges for Seasonal Changes

Energy Pie Chart

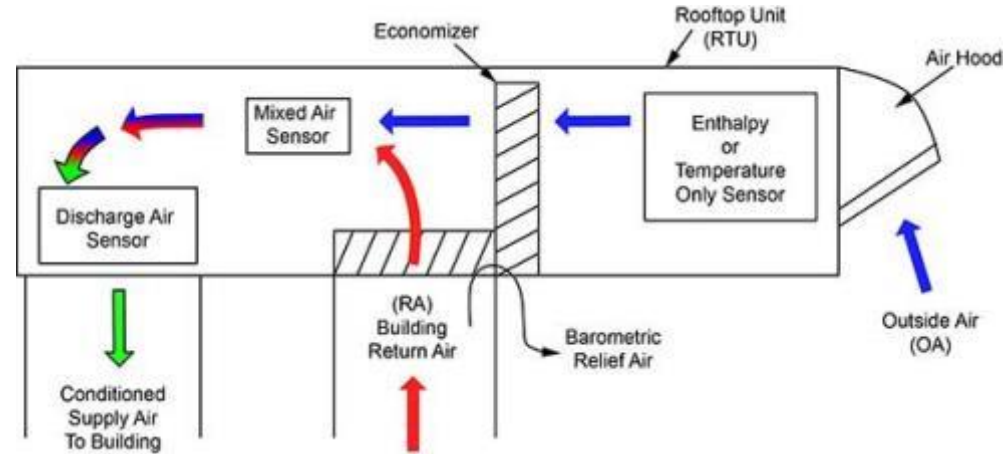
- Focus on Cooling, Pumps, and Heating
- Reductions in Lighting affect Heating
- Percentages May Change
 - Schedules
 - Internal Loads



Challenges for Seasonal Changes

Air-Side Economizers

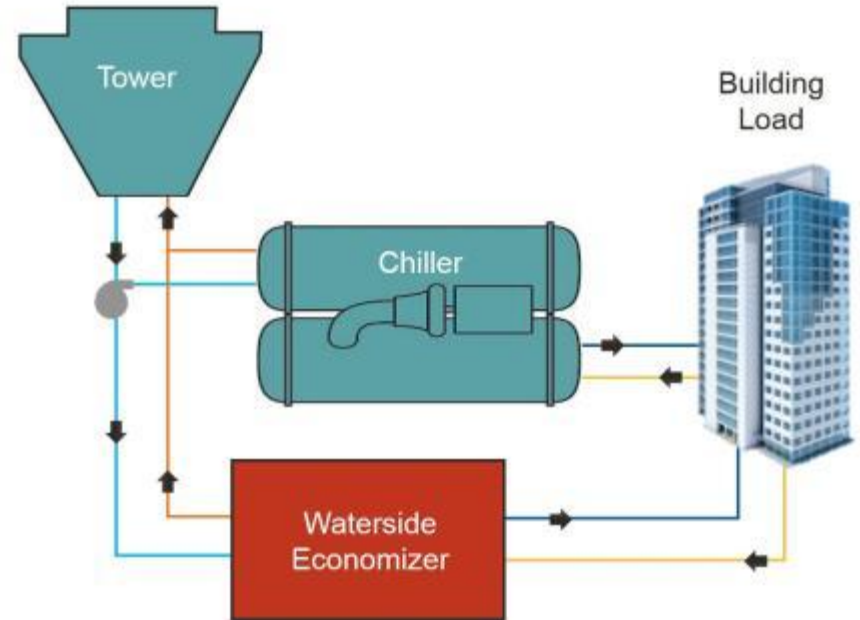
- Required By Code
- Changeover Points Difficult to Predict
 - 65 to 72 degrees F
 - Dependent on Internal Loads
- Air Systems Must Have Capacity
 - May Need More Air Than Full Cooling
 - 55 degree F versus 65 degree F (or higher)



Challenges for Seasonal Changes

Water-Side Economizers

- Use Instead of Air-Side Economizers
 - Less effective in our climate
- May Need Increase in Capacity
 - More Surface Area Required
 - Full Cooling Load at 50F DB/45F WB per Code



Challenges for Seasonal Changes

Night Purge

- Pre-Cool Spaces to heating setpoint
- Prolong Time Before Chiller Comes On
 - Disable heating for the day
- “Store” Energy in Building Components
 - Walls
 - Furniture



Challenges for Seasonal Changes

Morning Warm-Up

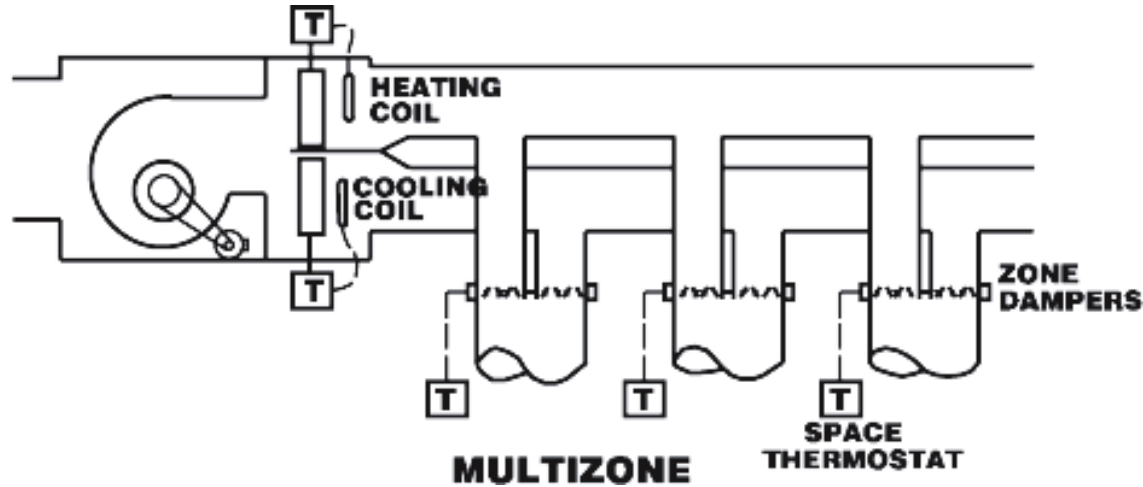
- Pre-Heat Spaces to cooling setpoint
 - Lockout Economizer & Mechanical Cooling
- Utilize Robust Central System
 - Reduce Runtime
- “Store” Energy in Building Components
 - Walls
 - Furniture




Challenges for Seasonal Changes

Simultaneous Heating and Cooling Loads

- Replace Inefficient Systems
 - Multi-Zone AHU's
 - Single Fan Dual Duct Systems
- Separate Out Constant Cooling Loads
 - Technology Cooling Loads





2:

Good Practices

Good Practices

Relaxed Setpoints

- Set Up or Down Hydronic Setpoints
 - Potential for 5% Energy Savings
- Set Up or Down Supply Air Setpoints
 - Use Occupancy Sensors
 - Wider Range of Comfort (68F to 78F)



Good Practices

Improve Pumping Efficiency

- Variable Flow
 - Variable Frequency Drives on Pumps
- Good Pump Control
 - Pressure Independent Control Valves
 - Automatic Flow Balancing Valves
- Minimum Flow Through Boilers and Chillers



Good Practices

Decisions, Decisions

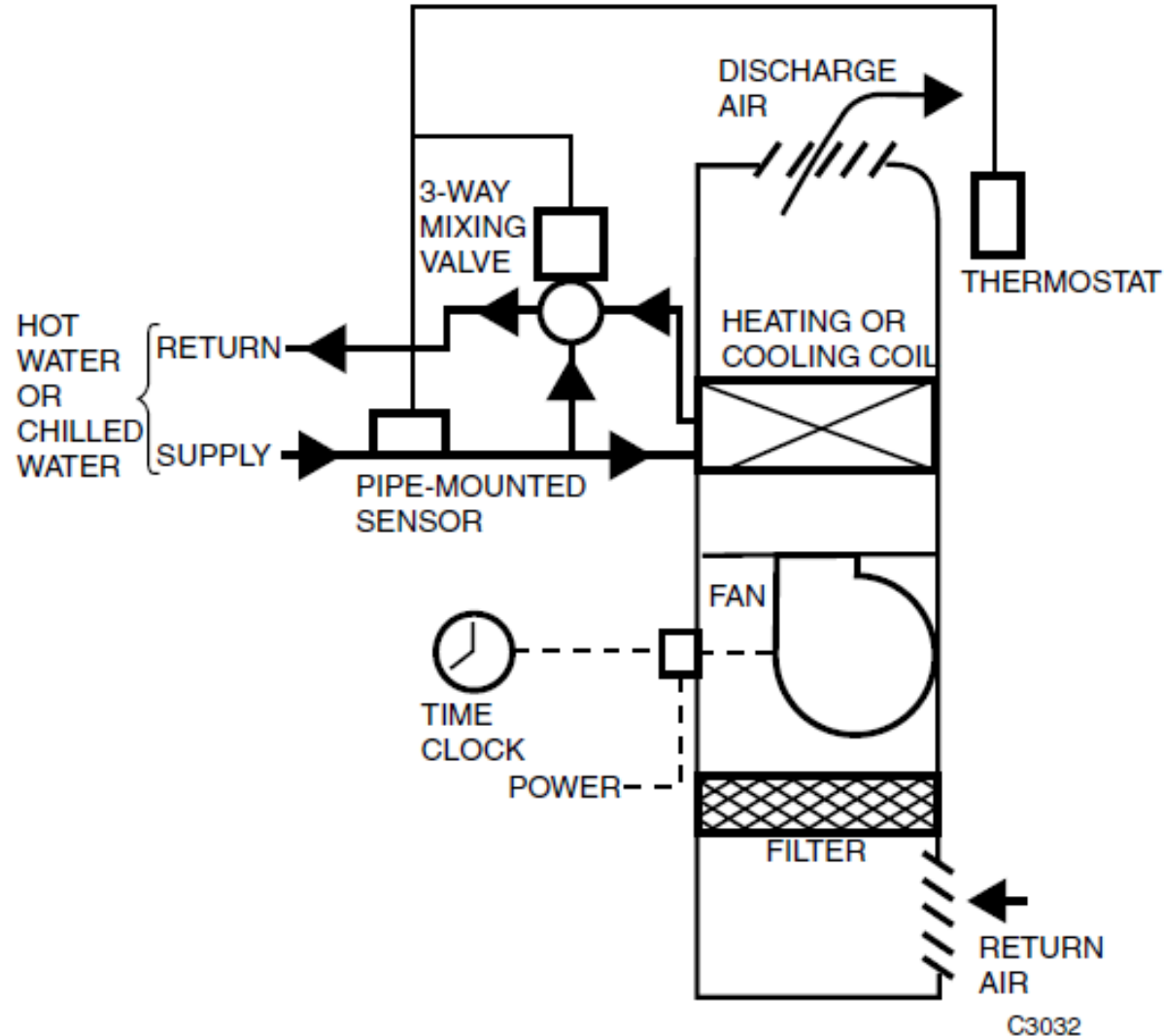
- How Long Will Boilers Run During Day or Week?
 - After Hours Activities
 - Weekend Events
- How Long Will Chillers Run During Season?
 - Shutdown in Fall
- How Long Will Boilers Run During Season?
 - Shutdown Boilers in Spring



Good Practices

Two Pipe System

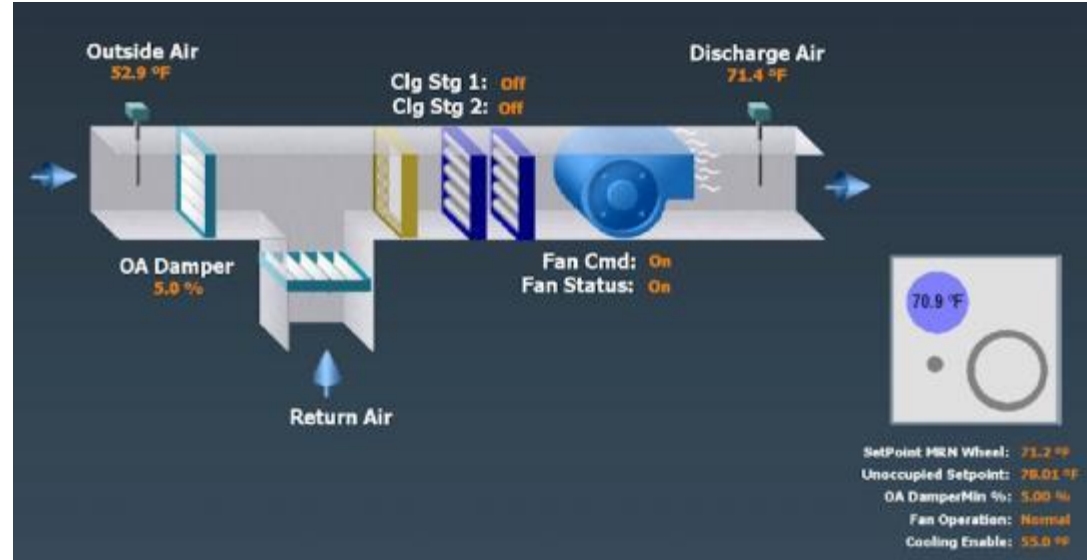
- 15 degree F Deadband in Outside Air Temp
- In Heating or Cooling at Least 4 Hours
- Changeover Point No More Than 30F Apart
- Challenge to Size Infrastructure



Good Practices

Direct Digital Control

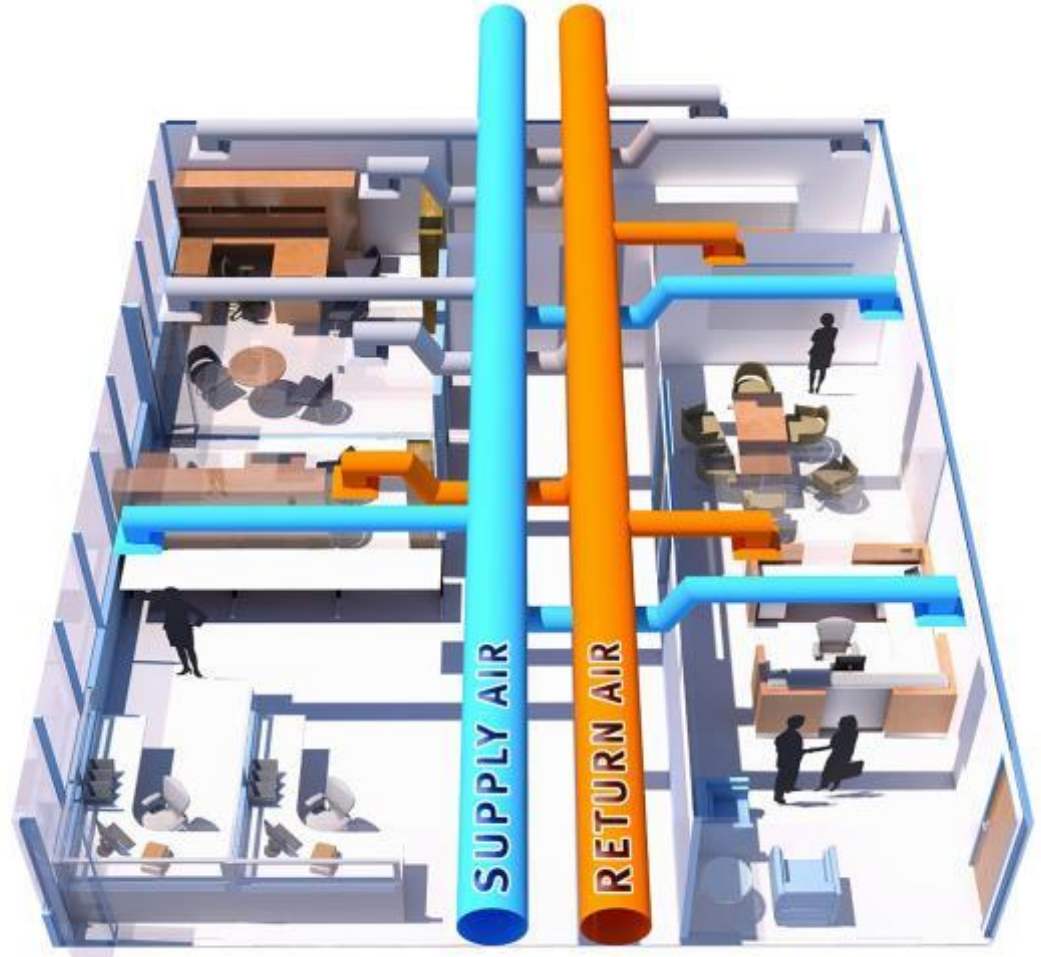
- Reset Supply Temperatures
 - Cooling or Heating Load/Demand (Best)
 - Outside Air Temperature
- Scheduling
 - Events
 - Time of Day
 - Time of Year
 - Anticipating Load (Weather Forecasting)



Good Practices

Zoning of Systems

- Timed Override VAV Groups
- Group Similar Occupancies
 - Classroom Pods
 - Administration
 - Commons and Kitchen
 - Library
 - Gyms and Locker Rooms



Good Practices

Chiller Sizing

- Size Systems for Actual Load
 - Chiller Sized for Maximum Occupancy
 - Diversity
 - Gym and Commons, not Classrooms
 - Auditoriums, Large Assembly
- Maximize Temperature Difference
 - Size Coils and Chiller for High Delta T
 - Careful with Remodels
 - Existing Coil Surface Area



Good Practices

Boiler Sizing

- Two Boilers: Two Thirds of Overall Load Each
 - Some Safety Factor, Warm-up Capacity
- Domestic Water Loads, Smaller Third Boiler
 - Convertor Off HW System
 - Standalone Water Heater Best
- High-Efficiency Condensing Boilers
 - Highest Efficiency at Lowest Return Temp
 - Size Coils Appropriately



Good Practices

Chemical Treatment

- Scaling of Coils
 - Reduces Effectiveness
- Clogging of Heat Exchangers
 - Changes Flow and Heat Transfer
 - Reduces Effectiveness




Good Practices

Air Elimination

- Affects Heat Transfer
- Allow Means for Air Release
- Air in System Damages Equipment
 - Pump Cavitation, Pitting on Impeller





3:

New Technologies

New Technologies

Radiant Delivery Systems

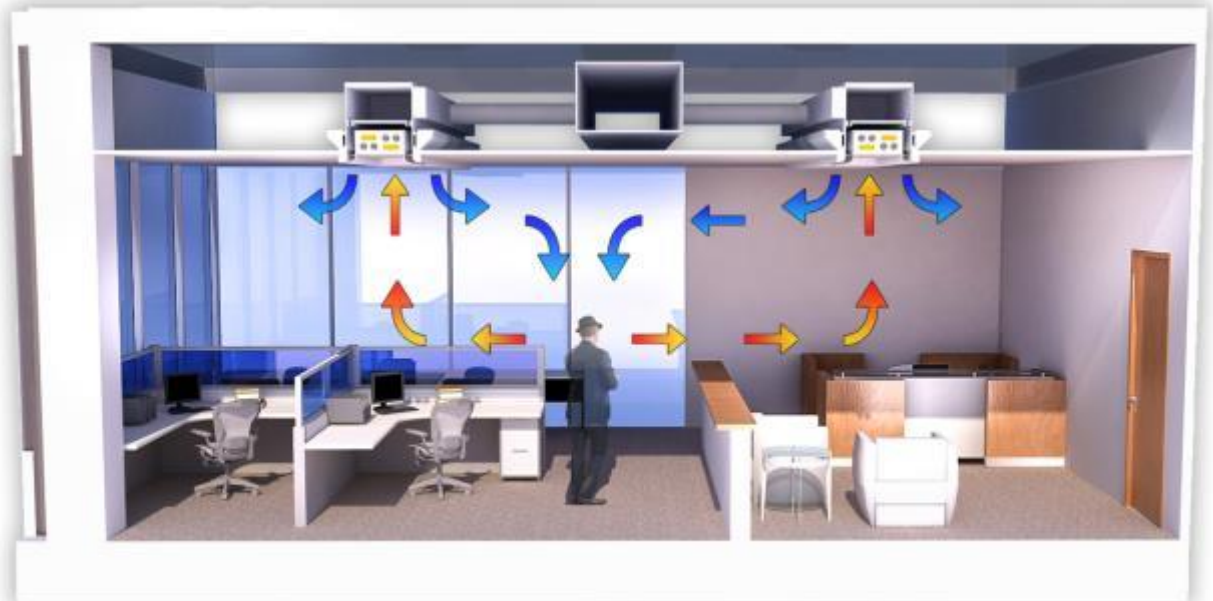
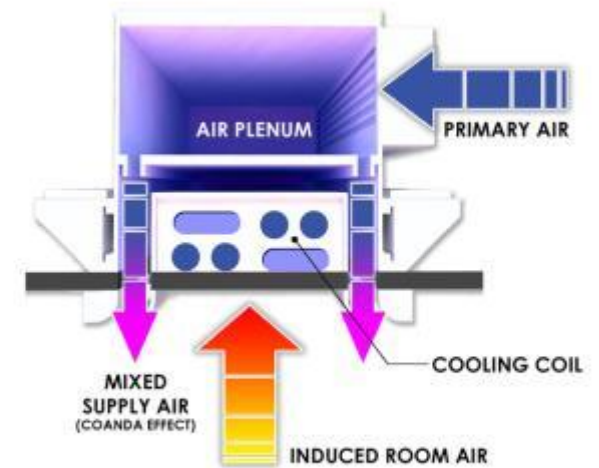
- Radiant Slabs
 - High Volume Spaces
 - Lobbies
 - Gyms
 - Heating and Cooling
 - Low Quality Heat Sources



New Technologies

Radiant Delivery Systems

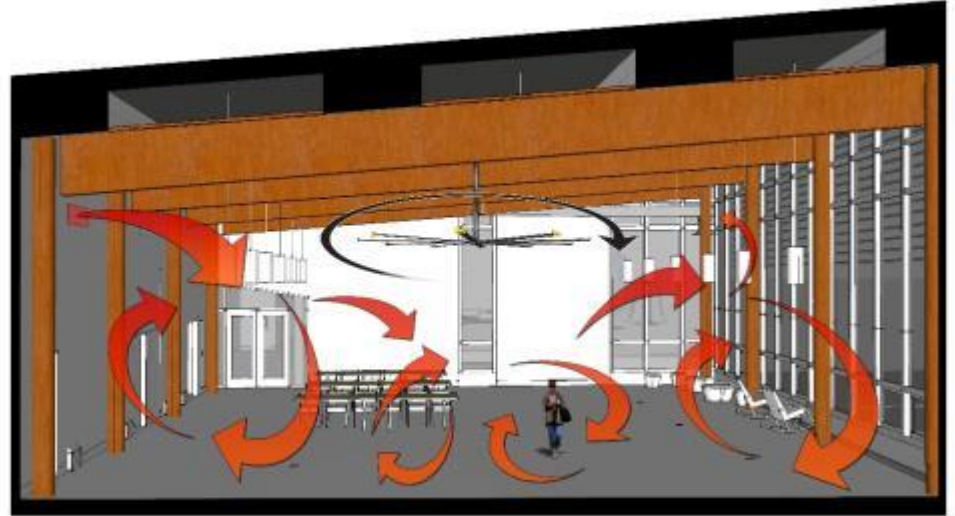
- Chilled Beams/Sails/Panels
 - Applicable in Classrooms, Offices, Labs
 - Humidity Control Important



New Technologies

Ceiling Fans

- Paddle Wheel
 - Classrooms
 - Offices
 - 4 degree F Increase in Setpoint
- High Volume/Low Velocity
 - Gyms
 - Commons
 - Warehouses
 - Shops



New Technologies

Loop Pressure Control

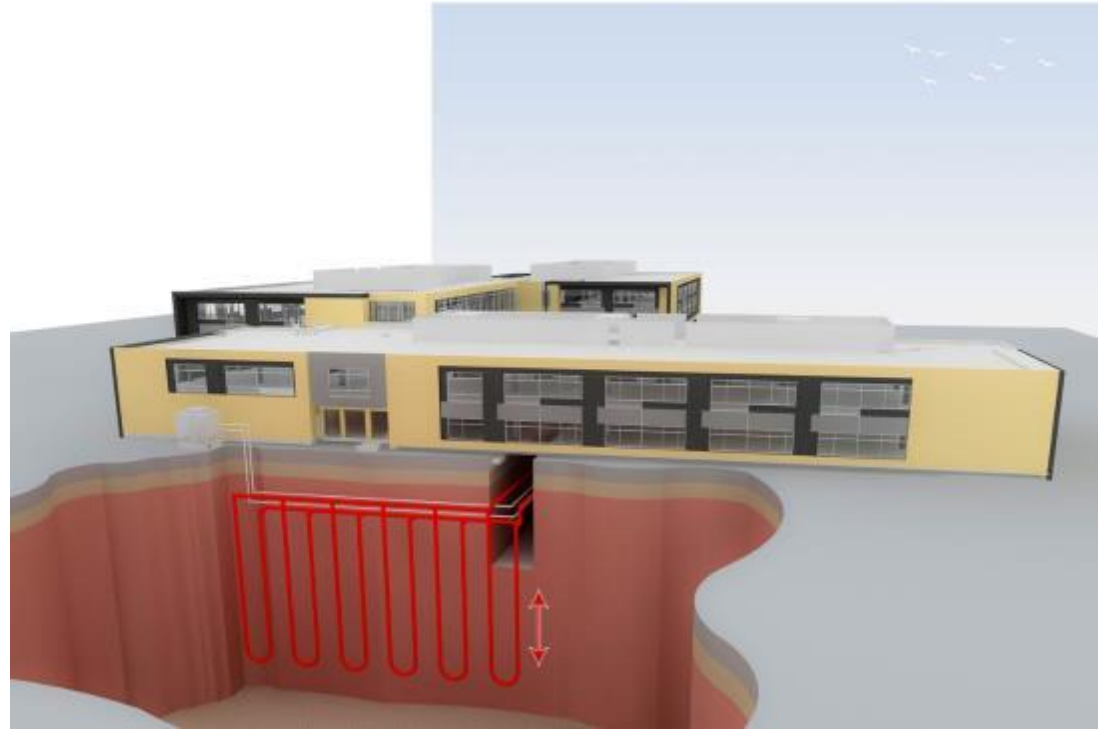
- Pressure Independent Control Valves
 - Dynamically Adjust Flows in Branches



New Technologies

Heat Recovery / Heat Sinks

- Exhaust Airstreams
- Irrigation Systems
- Rainwater Harvesting Tanks
- Fire Protection Storage Tanks
- Swimming Pools
- Geo-Exchange Systems
 - Ground Loop
 - Vertical or Horizontal Bores



New Technologies

Heat Pump Chillers

- Heating and Cooling Simultaneously
- Use Heated Water for Base Load
- Backup Heating Source Recommended
- Air-Cooled or Water-Cooled
- Modular
- Use with Geo-Exchange Systems
 - Ground Loop
 - Vertical or Horizontal Bores





Thank You.

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