HVAC
System Energy Savings Opportunities

Speaker Info

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- Wholly owned subsidiary of ConEdison since 2007
- Entered PC & D/B marketplace as BGA in 1986
- NAESCO accredited national ESCO
- ConEdison has powered New York City since 1823
- Oldest continuously listed company on the NYSE: ED
- $14+ billion in annual revenues
- $41+ billion in total assets
- Ranked #1 “greenest” utility in the US (Newsweek Magazine 2014)
- 6th largest solar developer in US (1.1 GW and growing)

Agenda

- Basic Definitions
- Elements of HVAC energy savings
- Air System Applications & Opportunities
- Water System Applications & Opportunities
- Rate Based Applications
- Q & A

Basic Definitions – Equipment Efficiency

- Seasonal Energy Efficiency Ratio (SEER)

$$SEER = \frac{\text{Cooling Season Total Capacity (Btu)}}{\text{Cooling Season Total Power Consumed(Kwh)}}$$

- Energy Efficiency Ratio (EER)

$$EER = \frac{\text{Full Load Cooling Capacity (Btuh)}}{\text{Full Load Power Input (Kw)}}$$

- Coefficient of Performance (COP)

$$COP = \frac{\text{Energy or Heat Output}}{\text{Energy or Heat Input}}$$

$$= \frac{EER}{3412 \text{ Btu/Kwh}}$$

Basic Definitions – System Performance

- Delta T ($\triangle$T)

  $\triangle T$ = Entering Temp – Leaving Temp

- Fan/Pump Affinity Laws
  - CFM(GPM) ∞ Speed(RPM)

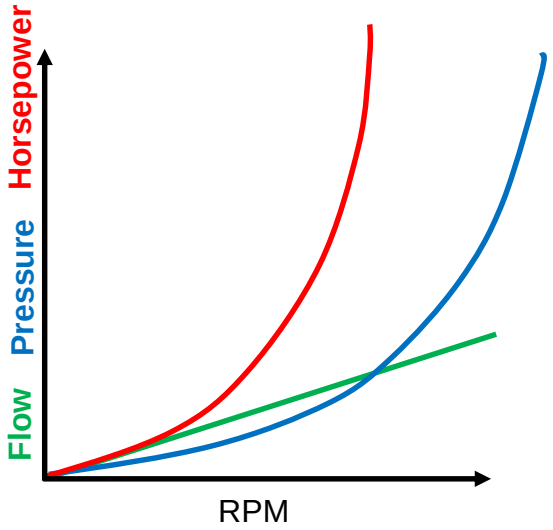
$$\frac{CFM_2}{CFM_1} = \frac{RPM_2}{RPM_1}$$

  - Pressure ∞ Speed (RPM)

$$\frac{SP_2}{SP_1} = \left(\frac{RPM_2}{RPM_1}\right)^2$$

  - Power (HP) ∞ Speed (RPM)

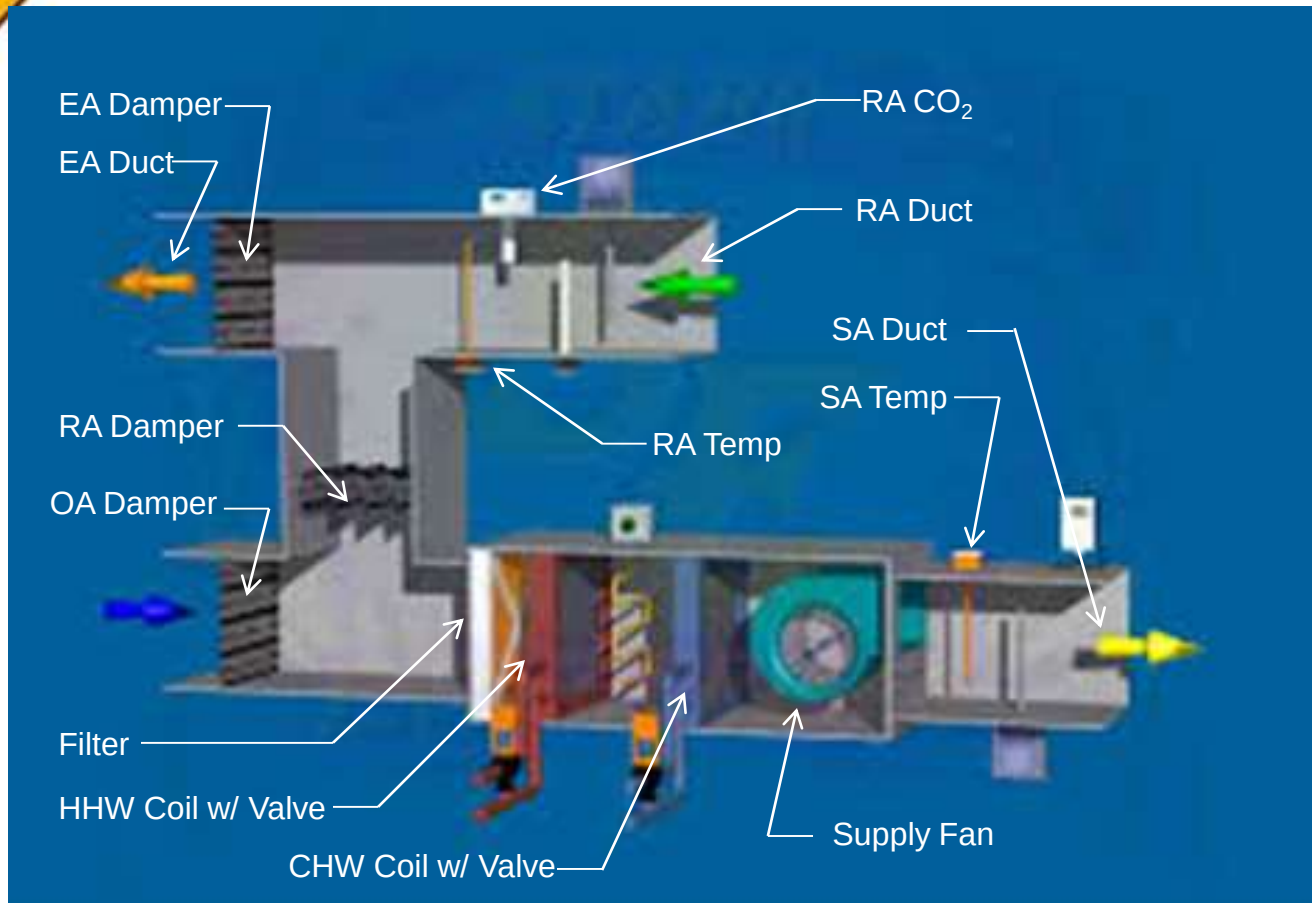
$$\frac{HP_2}{HP_1} = \left(\frac{RPM_2}{RPM_1}\right)^3$$



Elements of HVAC Energy Savings

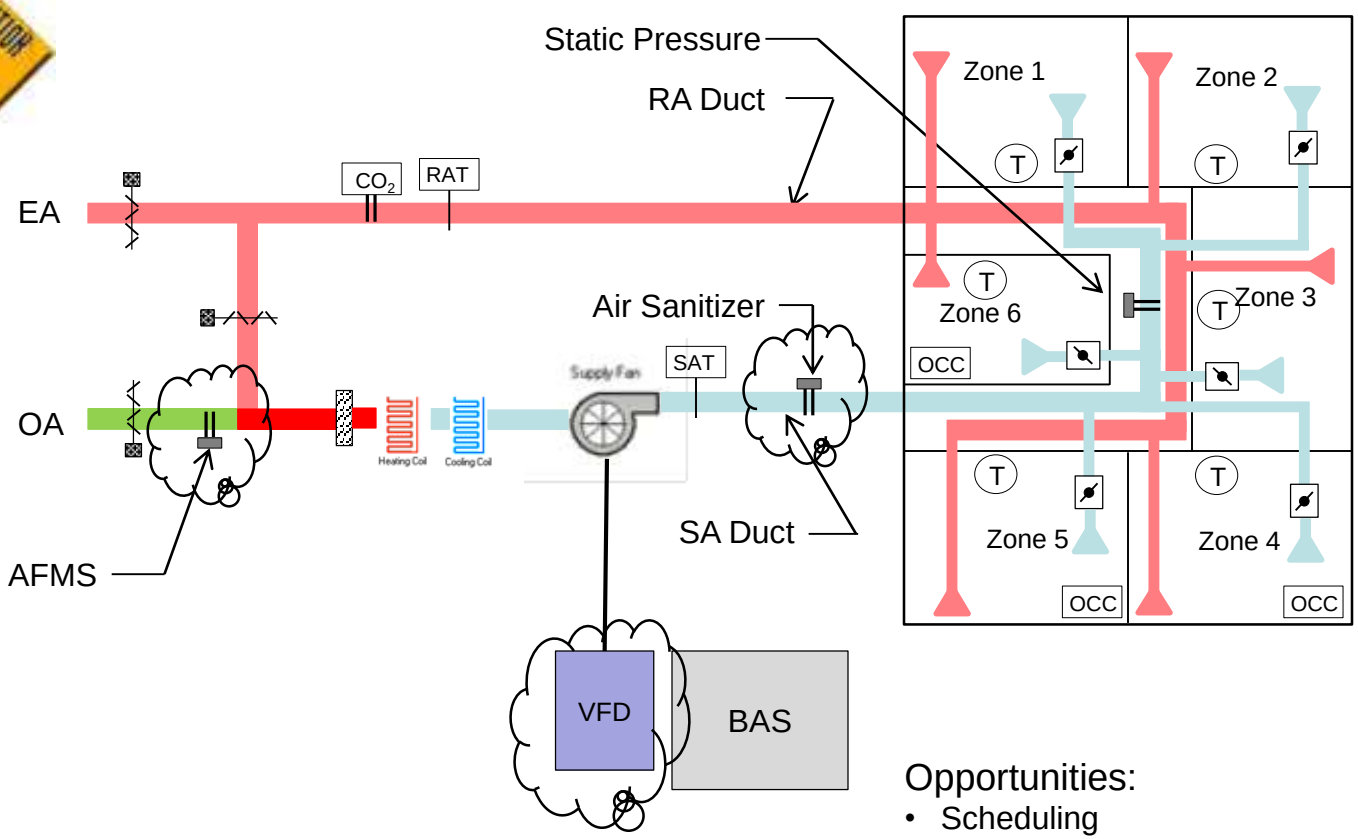
- Equipment Efficiency Improvements
- Improving System Delta T
- Controlling Outside Air Flow
- Reducing System Pump Energy
- System Configuration Modifications
- System Scheduling, Setback, & Optimization
- System Demand Reduction
- Utility Rate Based Plays

Air Systems Applications & Opportunities



Variable Air Volume CHW/HHW System

Air Systems Applications & Opportunities

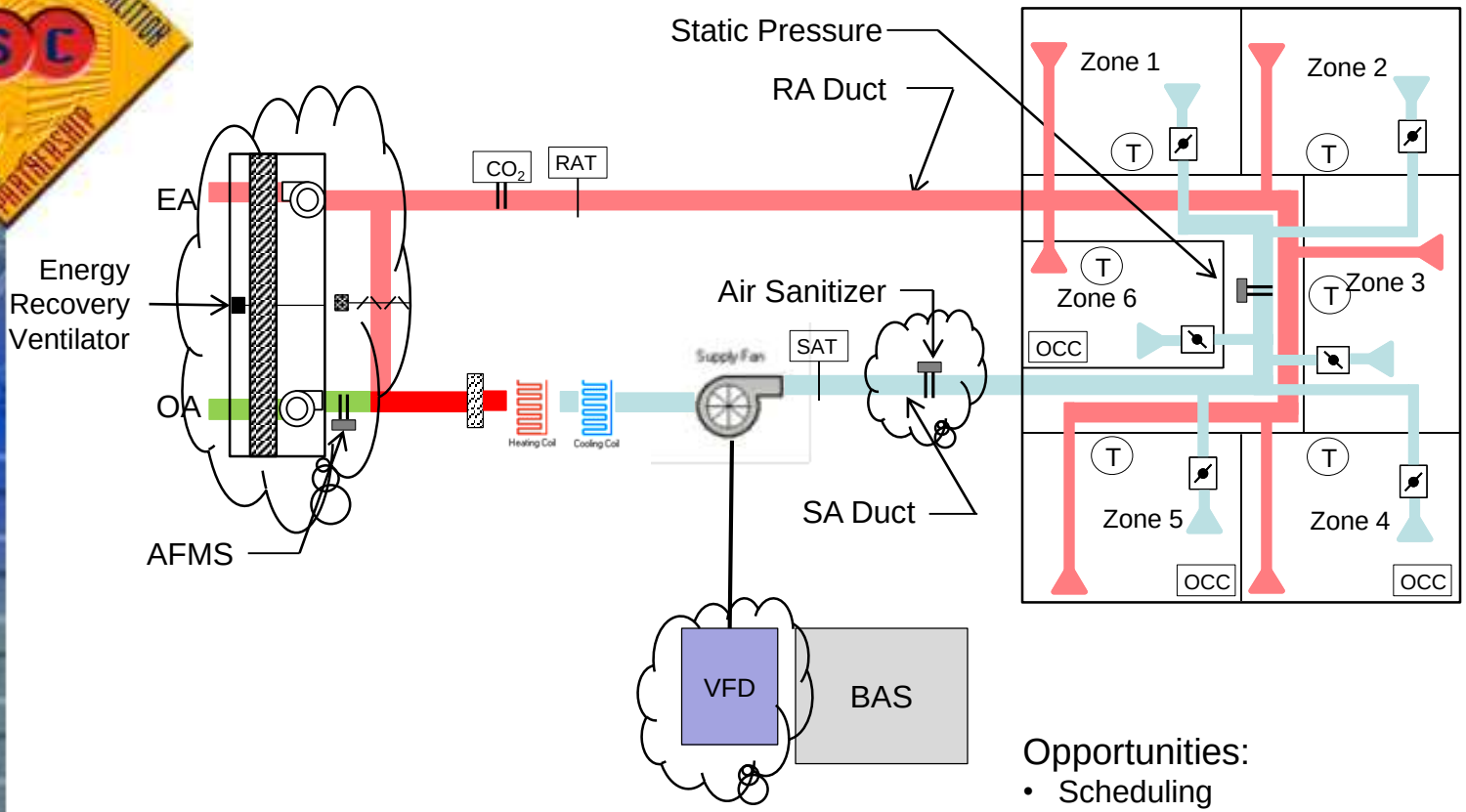


Opportunities:

- Scheduling
- Demand Control Ventilation
- Reduced Ventilation Rate
- System Modifications

Variable Air Volume CHW/HHW System

Air Systems Applications & Opportunities



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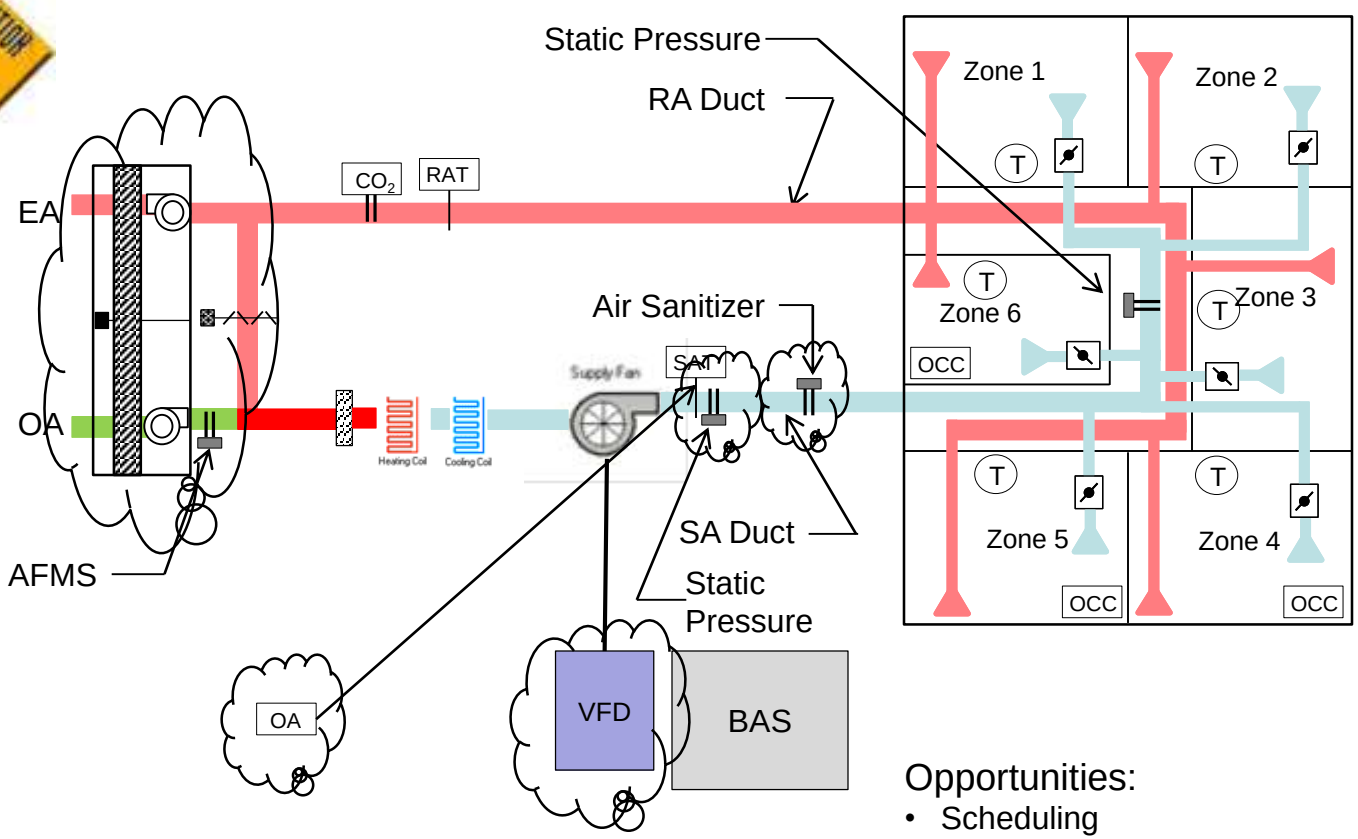
Air Systems Applications & Opportunities

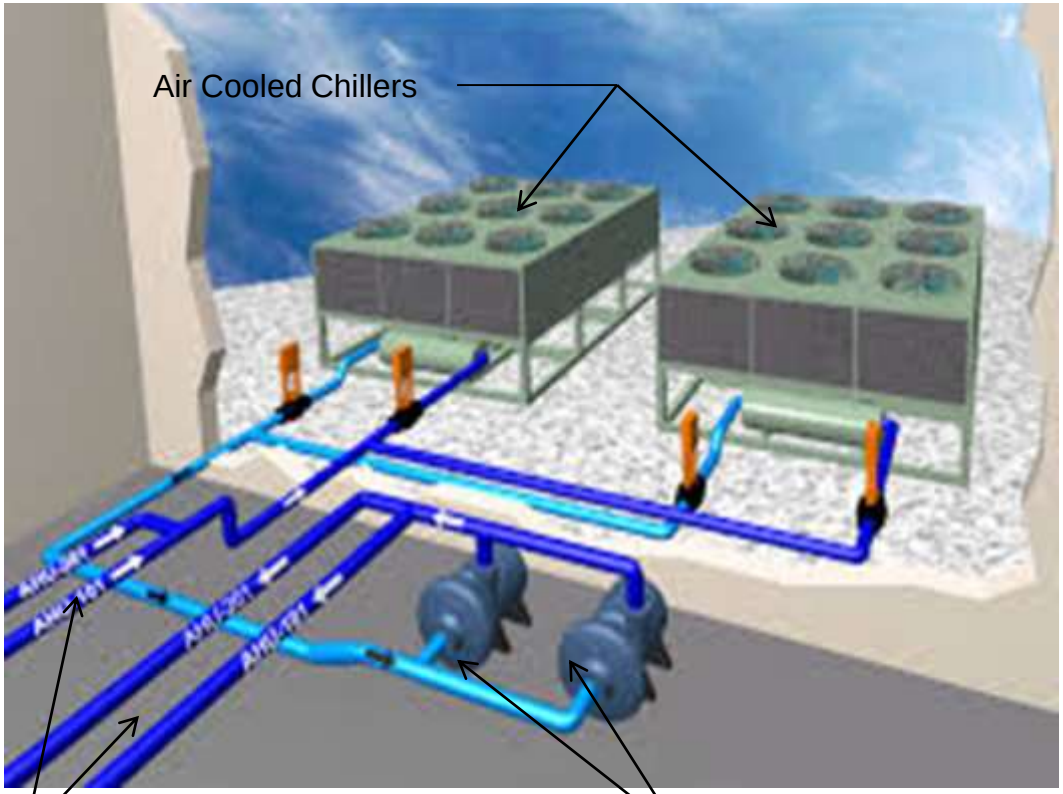


Opportunities:

- Scheduling
- Demand Control Ventilation
- Reduced Ventilation Rate
- System Modifications
- System Demand Reduction
- Reduce Pump Energy

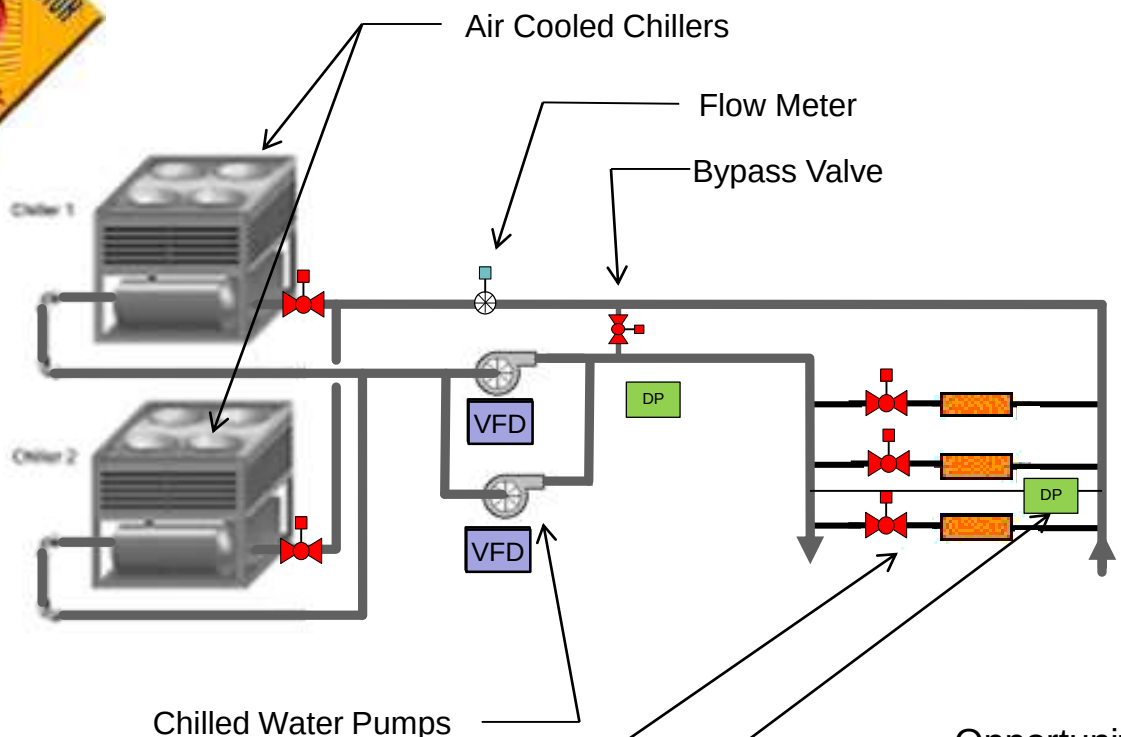
Variable Air Volume CHW/HHW System

Water Systems Applications & Opportunities



Air Cooled Chilled Water System

Water Systems Applications & Opportunities



Opportunities:

- Equipment Efficiency
- Scheduling
- Pump Energy Reduction
- System Modification

Air Cooled Chilled Water System

Water Systems Applications & Opportunities

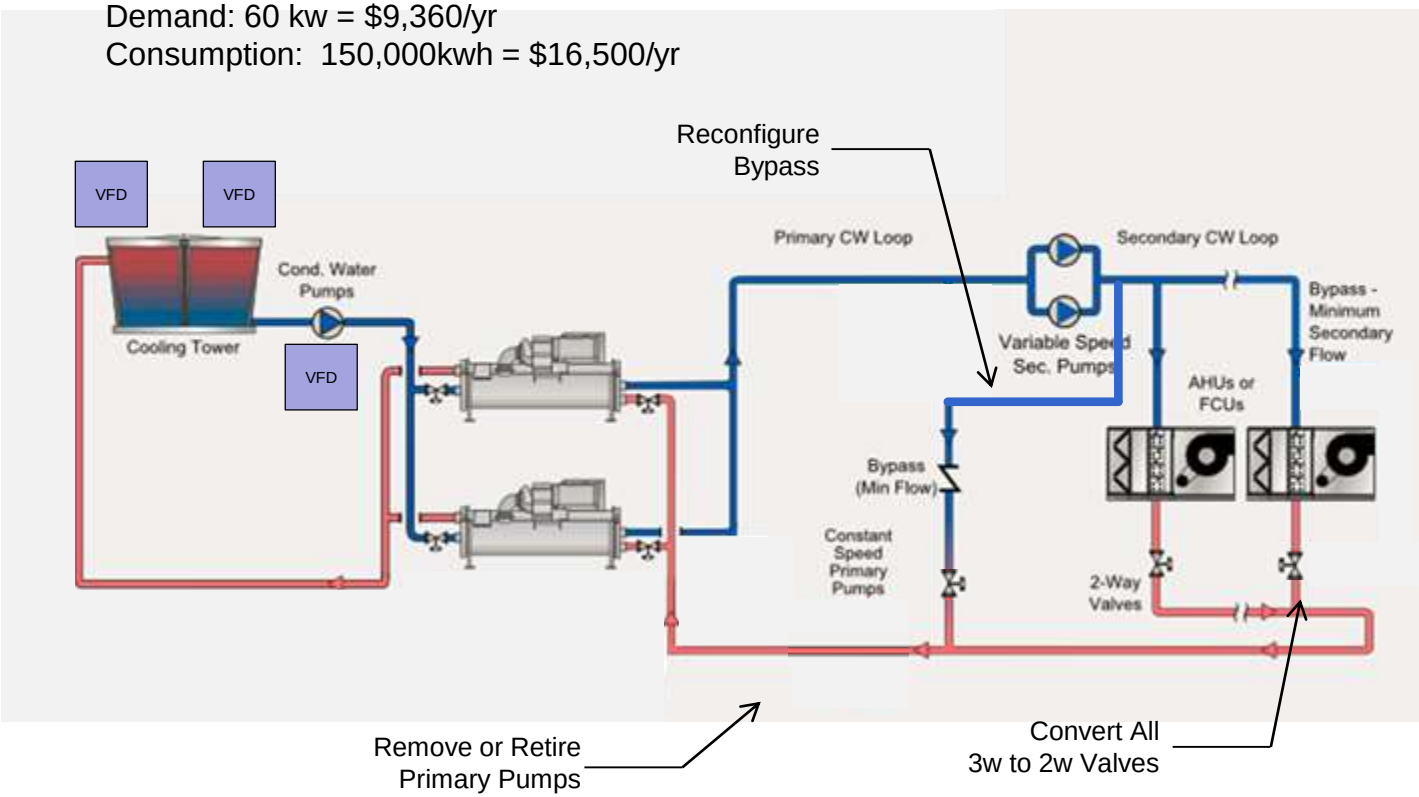
Water Cooled Chilled Water System

Water Systems Applications & Opportunities

Opportunities:

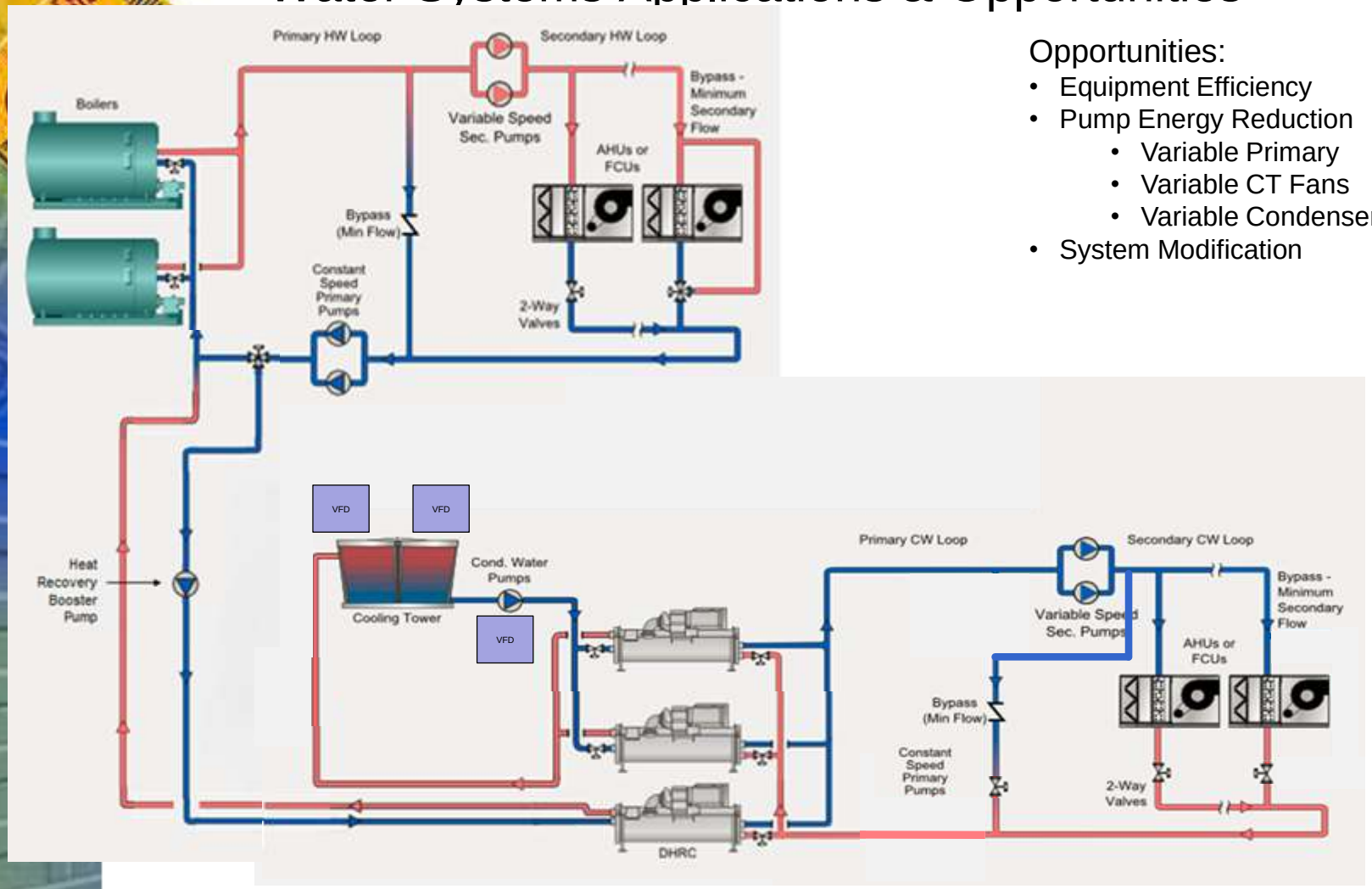
- Equipment Efficiency
- Pump Energy Reduction
  - Variable Primary
  - Variable CT Fans
  - Variable Condenser
- System Modification

2000: .60 kw/ton
2016: .48 kw/ton
500 ton Chiller for 2500hrs/yr
Demand: 60 kw = $9,360/yr
Consumption: 150,000kwh = $16,500/yr



Water Cooled Chilled Water System

Water Systems Applications & Opportunities



Opportunities:

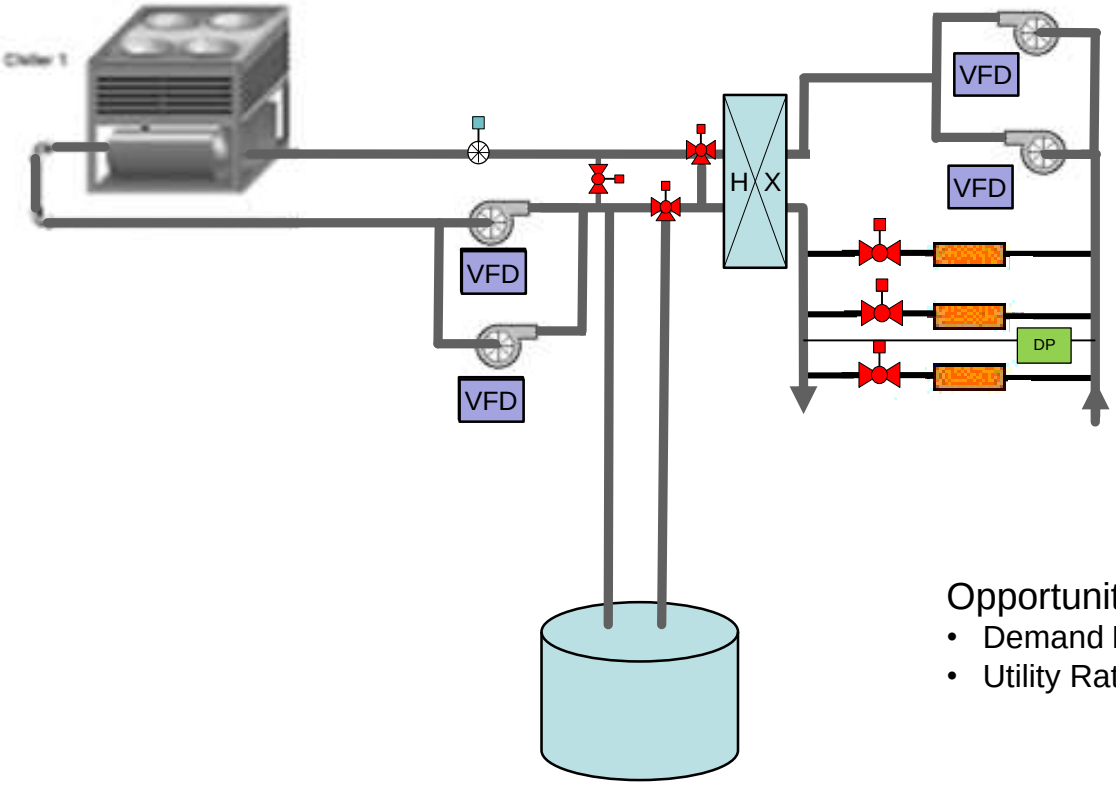
- Equipment Efficiency
- Pump Energy Reduction
  - Variable Primary
  - Variable CT Fans
  - Variable Condenser
- System Modification

Water Cooled Chilled Water System

Water Systems Applications & Opportunities

Thermal Storage Chilled Water System

Water Systems Applications & Opportunities



Opportunities:

- Demand Reduction
- Utility Rate Play

Thermal Storage Chilled Water System

HVAC System Conclusions

- Most energy intensive system in a building
- Most expensive system to replace/modify
- Any system can be improved
- Opportunities abound
- Take advantage of utility rebate programs
- Take a long term approach to evaluation

Questions?