Disease Resilient and Energy-Efficient Centralized Air-Conditioning Systems

Webinar 2 - Energy-Efficient Centralized Air-Conditioning Systems

8th Sep 2021

Energy Efficient Centralized Air Conditioning Systems

Asian Development Bank

Webinar Series

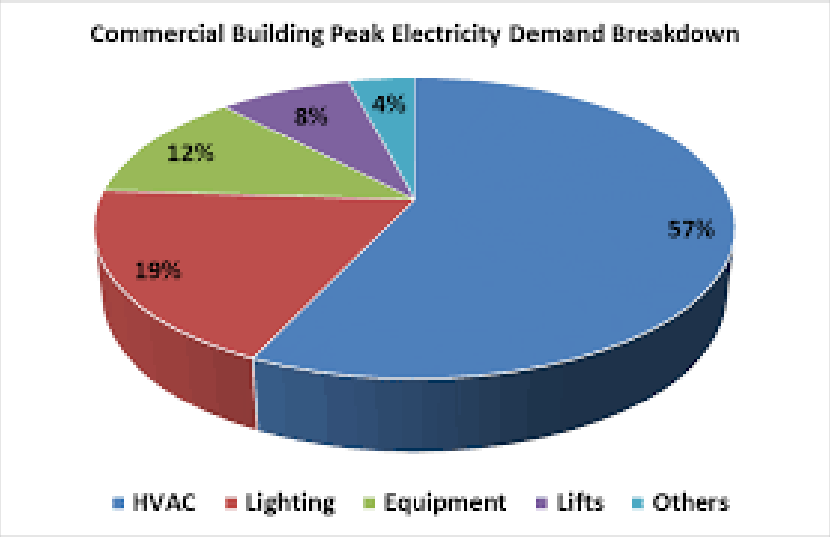
Session Coordinated by ADB TA 6563

C Subramaniam
LEED Fellow
Principal Consultant
3S Green and SSS Consultants
HVAC – IBMS – Green Buildings

Energy Efficient
Centralized Air Conditioning Systems

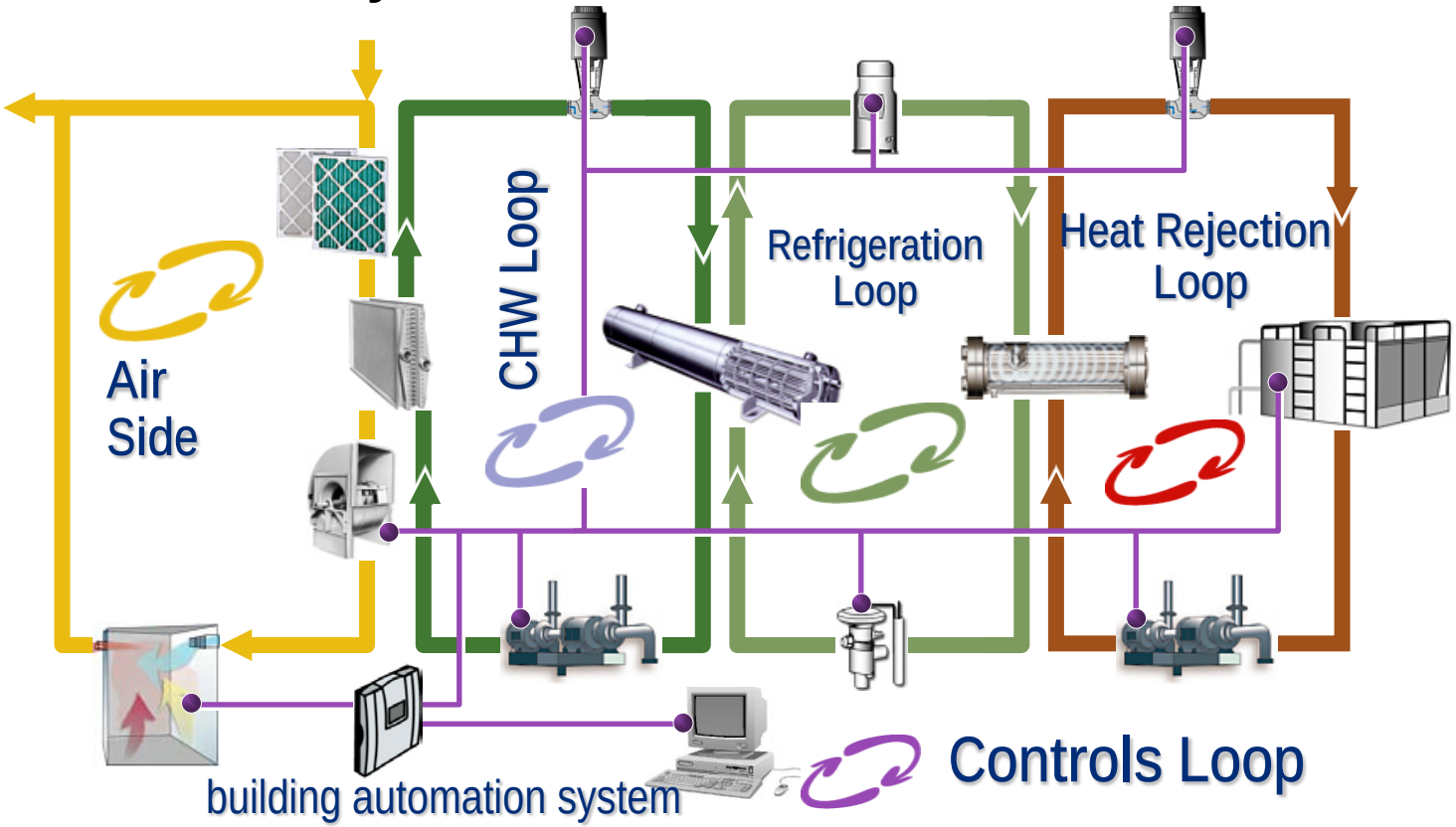
- Overview of Energy spread in a commercial building and approach
- Best design practices for Energy Efficient HVAC Systems
  - Integrated Comfort System and Earthwise Systems
- Energy Efficient Strategies & Alternate Design Concepts
- How to achieve operational excellence
- Summary

HVAC is a major energy consuming component in a facility ….



… how to handle this huge varying load optimally ?

Five Cycles of an HVAC System



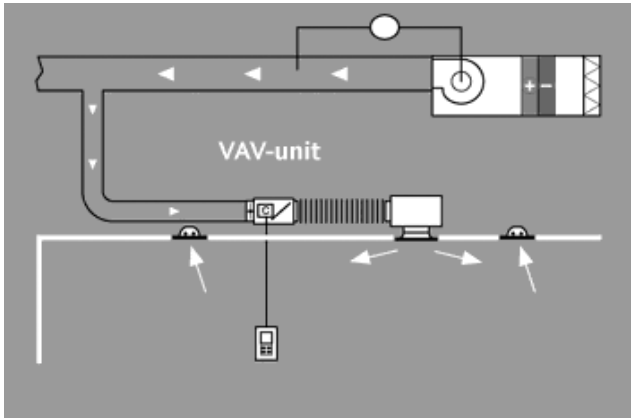
each component has an impact on the other in terms of performance

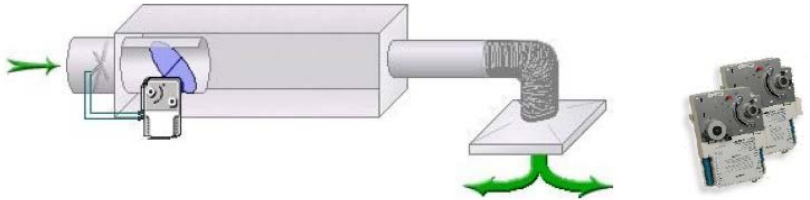
Best Design practices for Energy Efficient CAC Systems

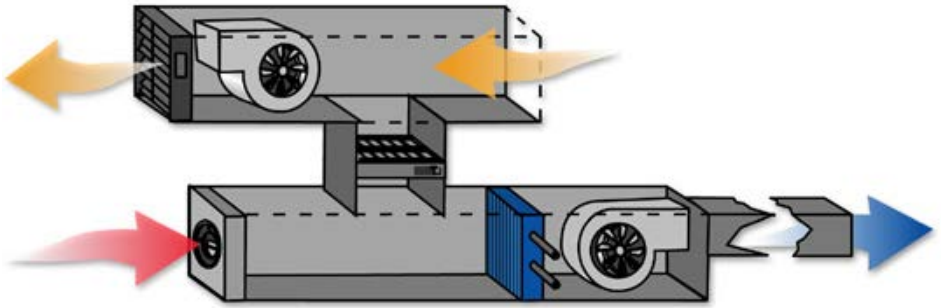
- **Airside Systems**
- **Chilled Water System Design aspects**
- **Chiller Plant Management & Controls**
- **Condenser Water System Design aspects**
- **Refrigerant & Environmental aspects**
- **Equipment and SYSTEM Selection aspects**

Airside Options

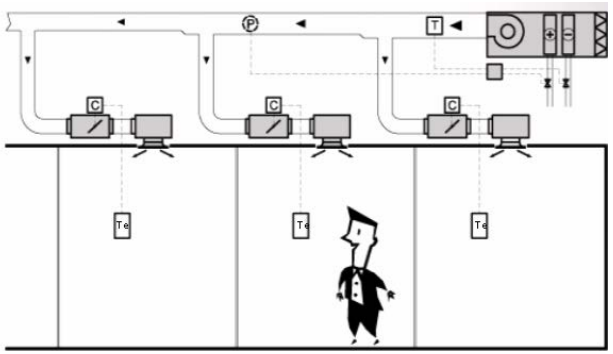
- Airside Options
  - CAV Systems
  - VAV Systems
  - Treated Fresh Air Systems
  - Demand Controlled Ventilation
  - Economizers



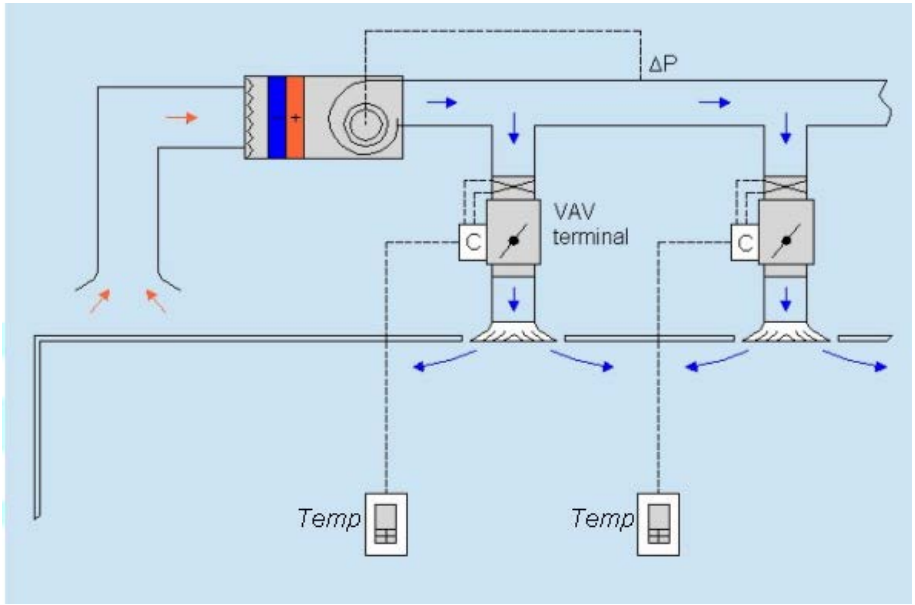




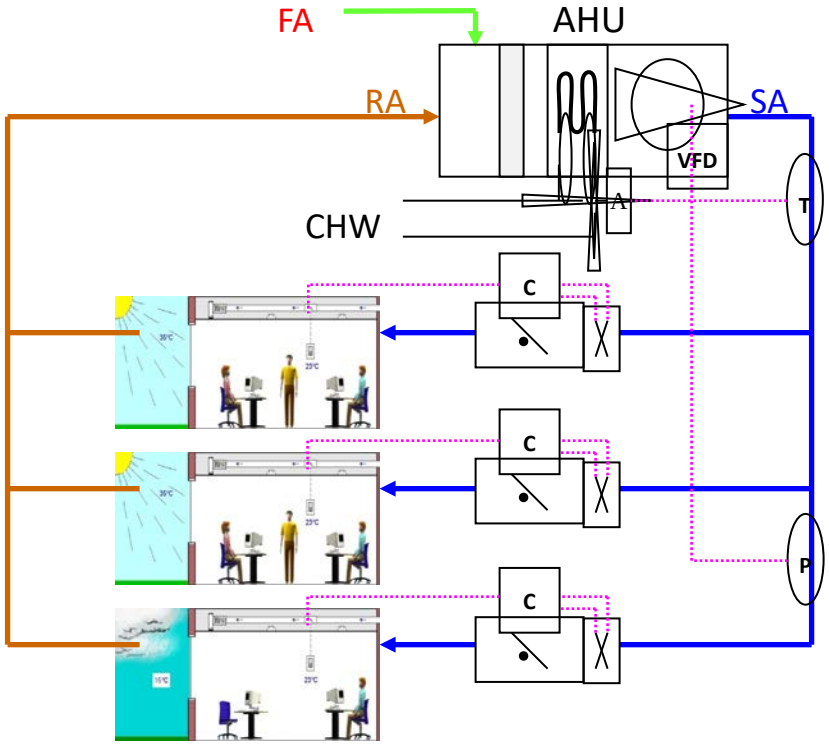
Benefits of VAV System & Pressure Independent



- VAVS Energy Efficient System
- Individually controllable
- High comfort level
- Low sound level
- Modulating controls
- Accurate pressure and air volume control

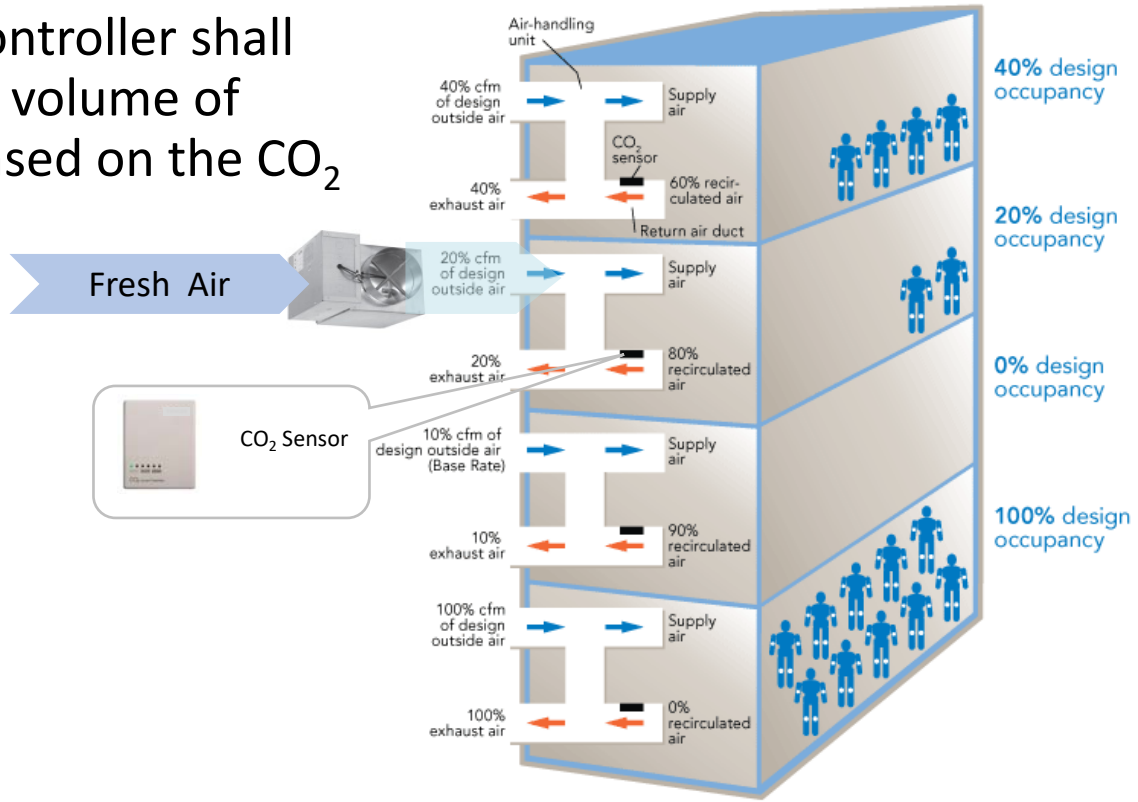


VAV control in a Centralized AC System



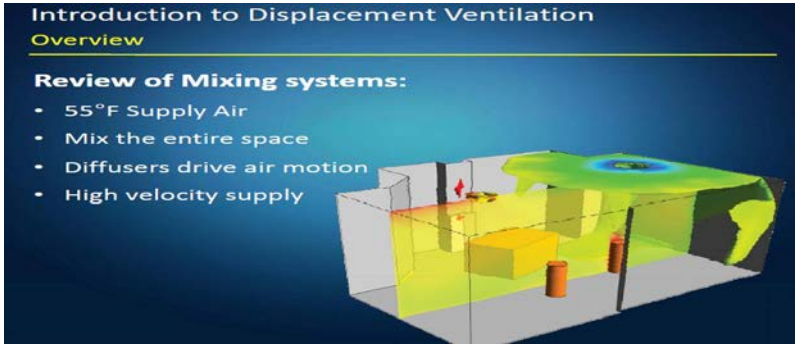
Demand Control Ventilation

The VAV Controller shall control the volume of fresh air based on the CO_2

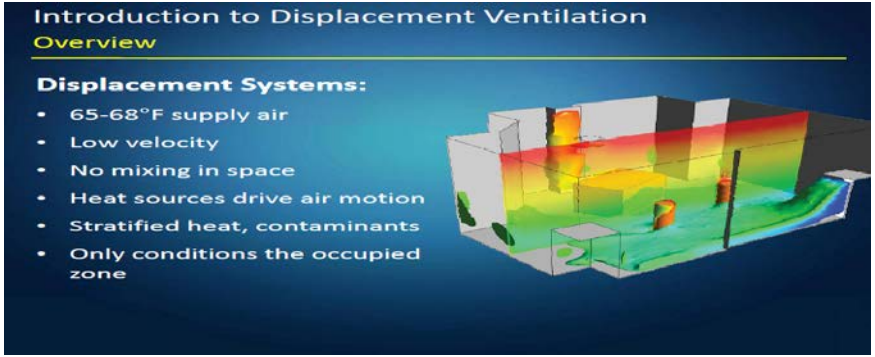


Room Air Diffusion Methods

- Mixing Systems.



- Displacement Systems.

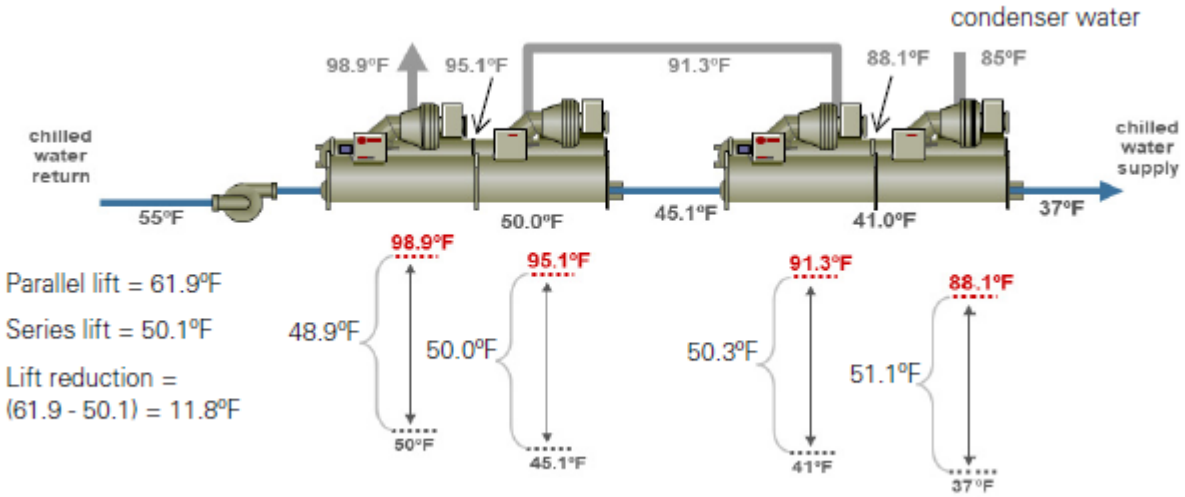


- Under floor Air Distribution Systems

CHW System Design aspects

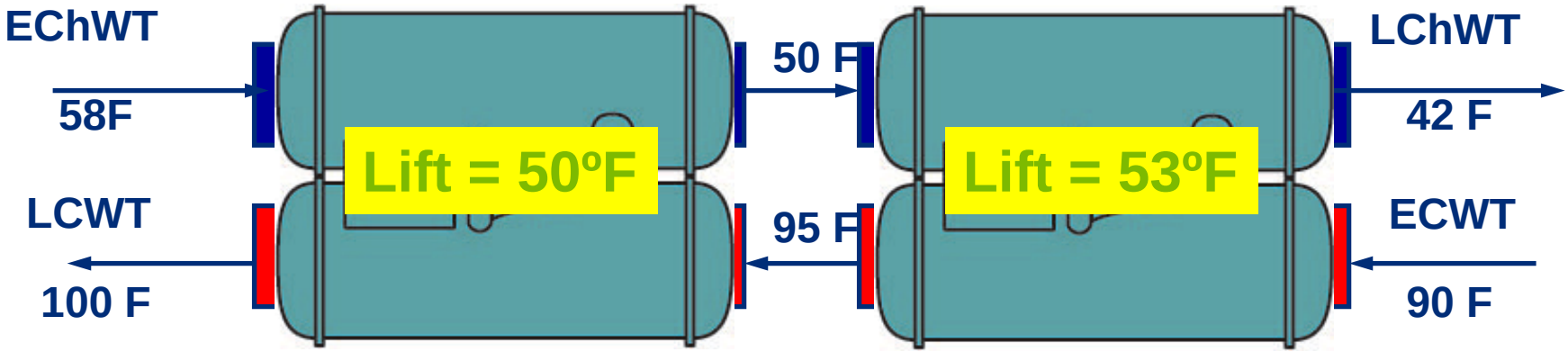
- **Chilled Water System Design aspects**
  - **Constant Primary/Variable Secondary CHW Systems**
  - **Variable Primary Flow CHW Systems**
  - **Series-Counterflow CHW Systems**
  - **High delta T Systems on evaporator and condenser**
  - **Heat Recovery Chillers**

CHW System Design aspects



Lift versus chiller power

Configuration	Lift	Reduction (%)
Parallel	61.9°F	baseline
Series counterflow	54.05°F	12.7
Series counterflow duplex	50.1°F	19.1

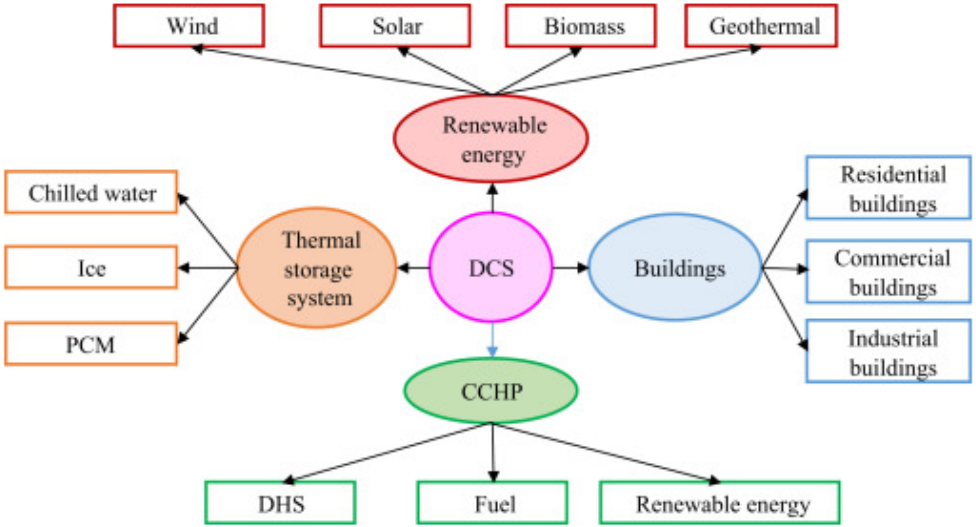


District Energy Systems

Important parameters considered for selecting number of chillers.

- Anticipated- Peak diversified Cooling loads
- Winter- Minimum loads
- Average Cooling load
- Energy efficiency
- Phased Development and Construction

Diversity can be **50% to 80%**

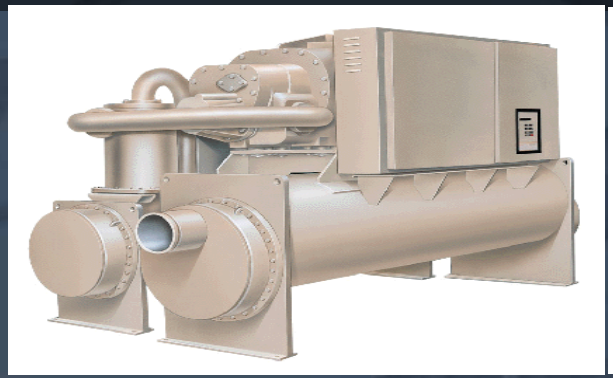


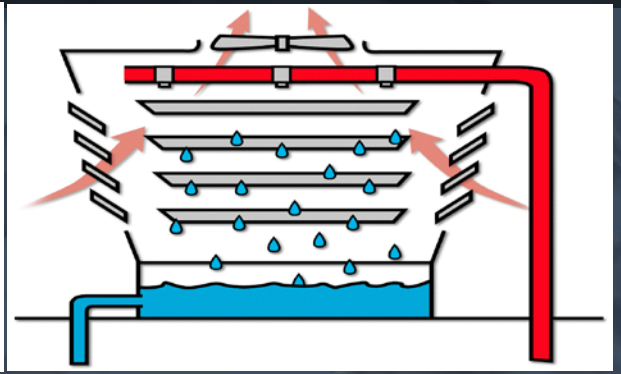
Load Determination

- key to energy savings in a Chiller Plant

also when you bring the additional chiller with its auxiliary components to the circuit and when the same is removed when not required are important factors to achieve energy savings

Chiller/Cooling Tower Optimization

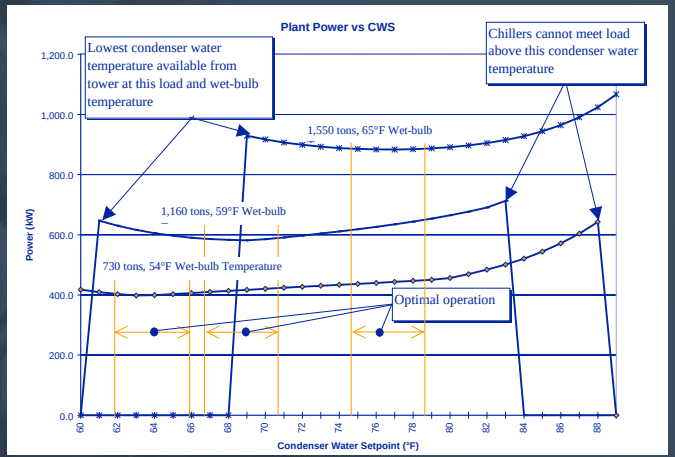




Condenser Water System
Design aspects & Controls

Load
CW Temp
Chiller Design

Wet Bulb
Load
CW Temp
Tower Design

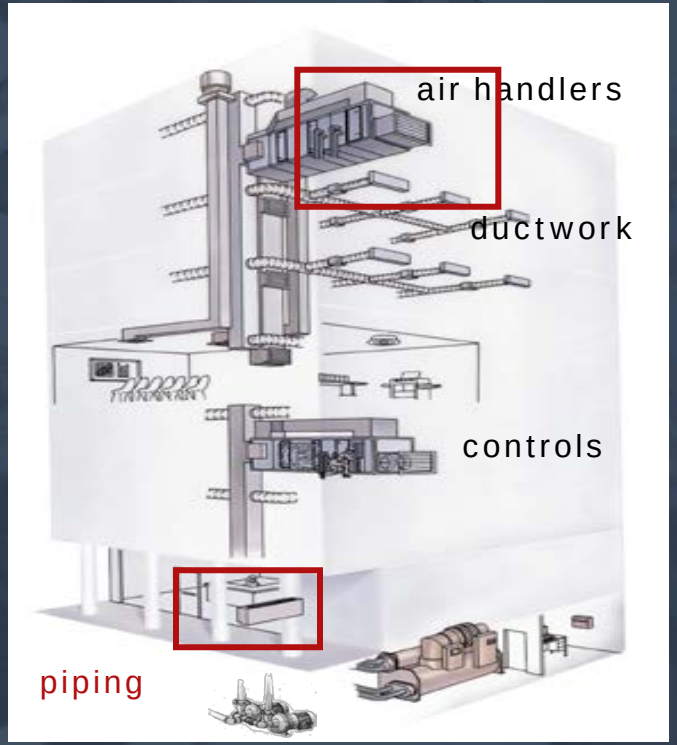


Equipment Selection aspects

- Equipment Selection aspects
  - Chillers with best efficiency for the application
    - Centrifugal
    - Water Cooled Screw /Air Cooled Screw
  - Variable Air Volume Systems

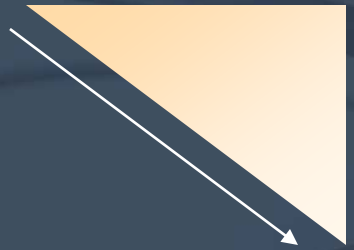
Low Flow, Low Temperature, High Efficiency Systems

Airflow Optimization &
hence Energy Savings



Low Flow Rates Save in First Cost, and Improve Dehumidification

Supply temperature



Temperature differential

Flow rates

Fans

Ductwork

Pump

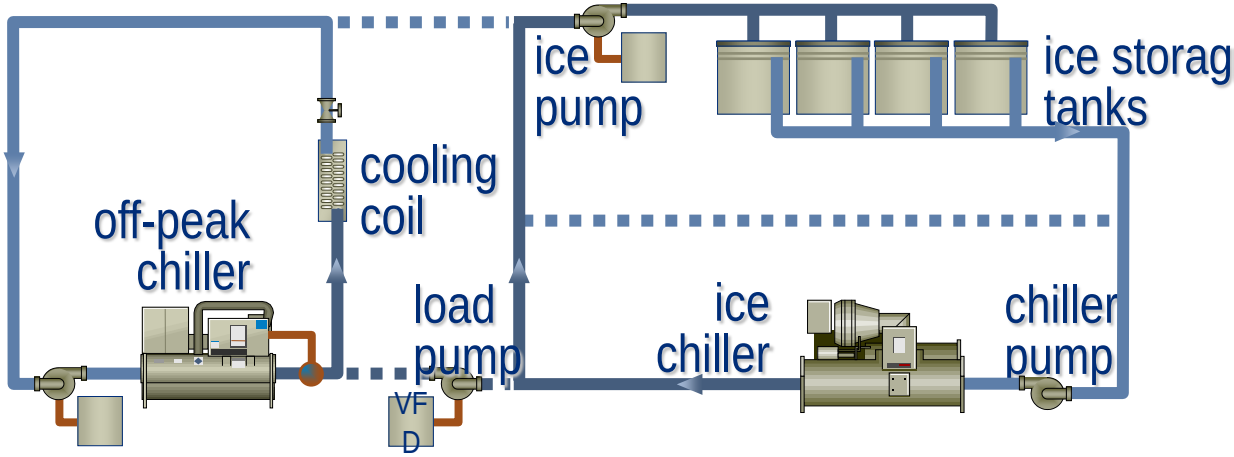
Piping

Energy Efficient Strategies & Alternate Cooling and Heating Concepts

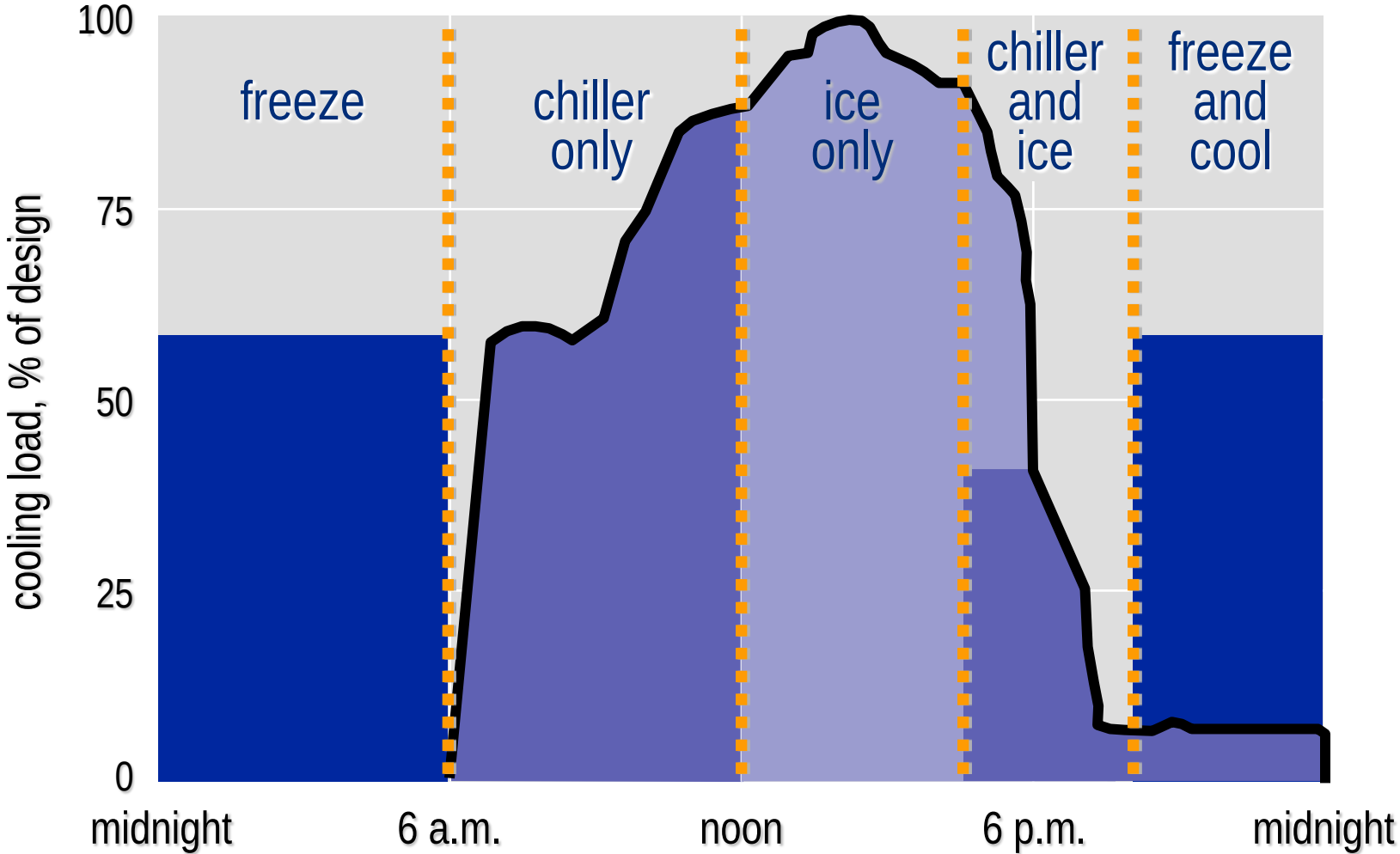
- Waterside
  - Heat recovery based on applications
  - Geothermal
  - Cogeneration
  - Thermal storage
- Airside
  - Exhaust-air energy recovery
- Alternate Design Concepts
  - Radiant Cooling Applications
  - Ground Sourced Heat Pumps
  - Earth Air Tunnel Systems

thermal storage - Benefits

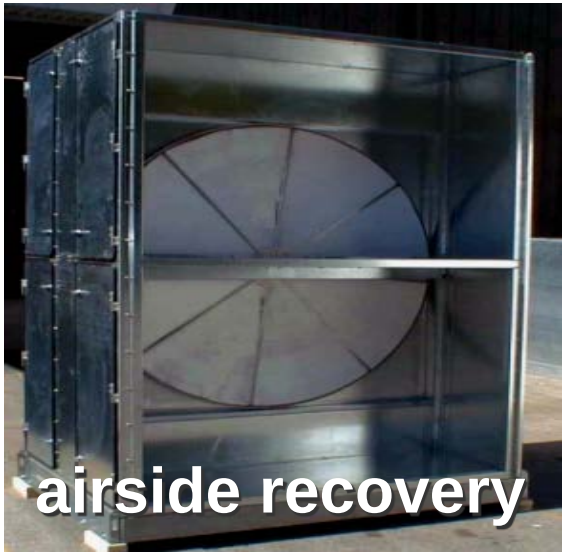
- Reduces energy costs
  - Shifts equipment operation to off-peak hours
- Reduces airside costs, both capital and operating
  - Permits colder supply air



Optimal Ice Melt Rate, Peak Shaving, Strategic Control



energy recovery & economizers

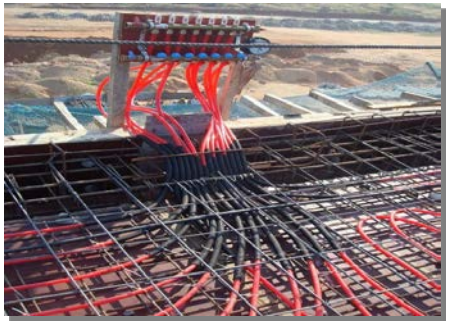


Comply with ASHRAE Standard 90.1

- Economizers can give additional energy savings in select climate zones
- Airside energy recovery required in smaller systems and more climate zones

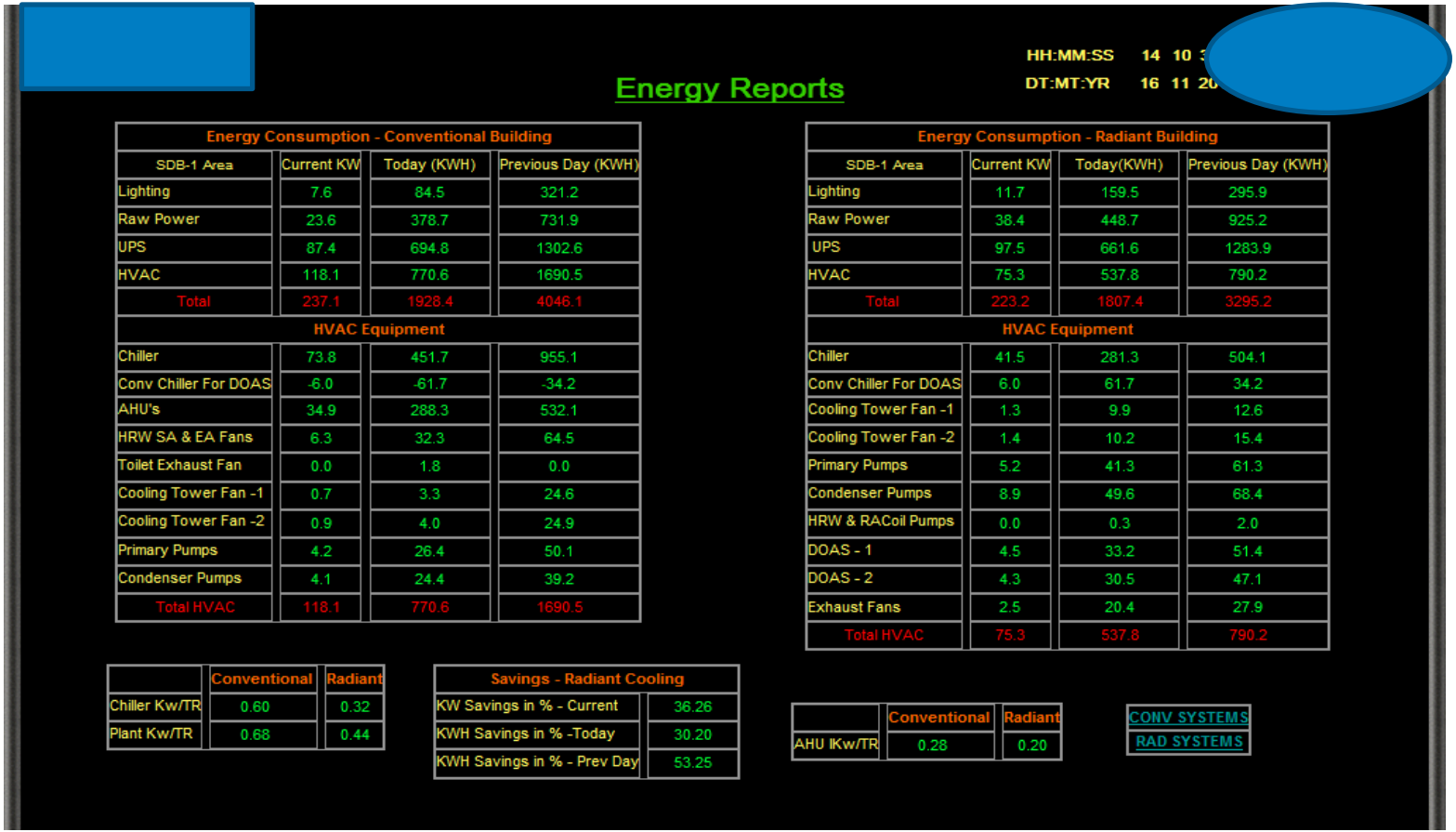
Alternative cooling and heating strategies

- Evaporative cooling - 3 stage
- Heat recovery wheel/Free Cooling
- Radiant cooling/Chilled beams
- High efficient equipments


Radiant cooling pipes embedded in the slabs

Smart buildings – Trending and Analysis of Energy Data

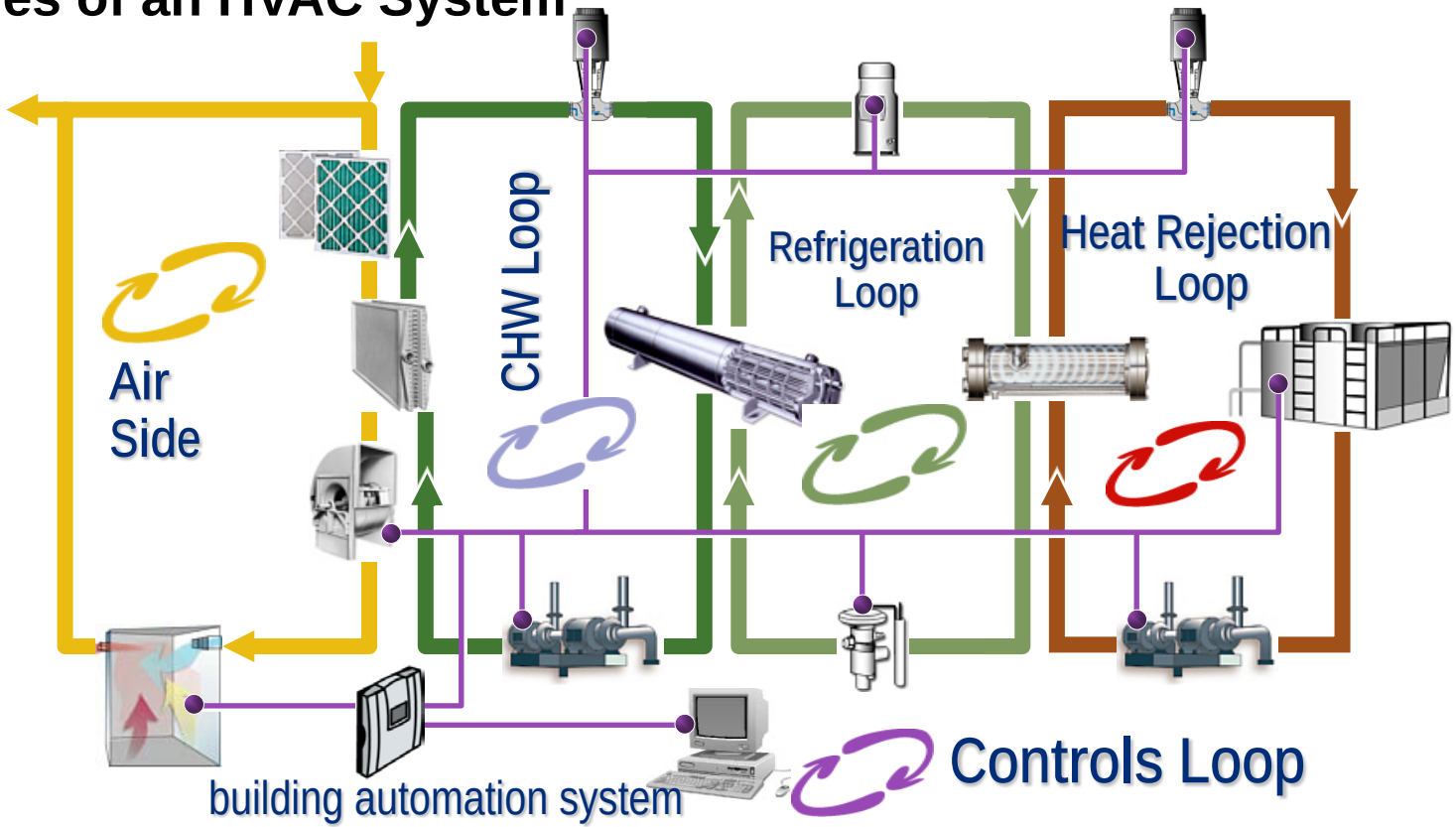



Rr 13 8/9
KILOWATTHOURS
Meter is on the Building &
NOT on the equipment
Cl 200 240V 3W FM2S 60Hz

Measure, Monitor & Control

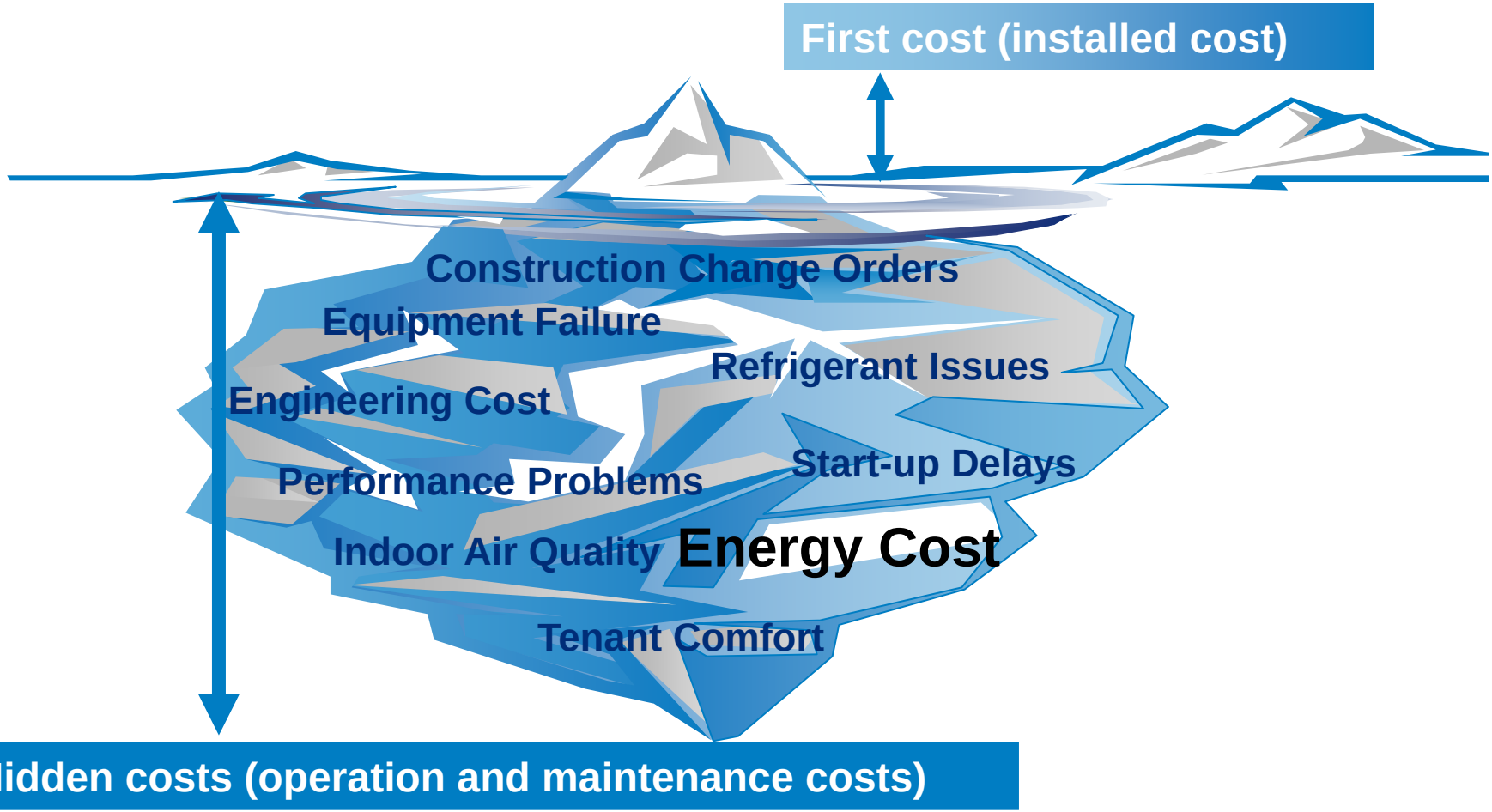
- You cannot control what you cannot measure !
- Energy metering, measuring, logging and analysis are very critical
  - Starting point for energy efficiency measures in existing & new buildings

Five Cycles of an HVAC System



Each and every component needs to perform in the most optimum level to achieve Energy Savings

Total Cost of Ownership & Life Cycle Impact Approach



SMART way of achieving Operational Excellence in Centralized Air Conditioning Systems

S – Systematic and Integrated approach
M – Measurable and Controllable
A – Achievable
R – Recurring Savings
T – Total Cost of Ownership

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Thank
You
Asante
Merci
Obrigado
Multumesc
Spasibo
Juspaxar
Arigato
Grazie
Dank Je
Matondo
Vinaka
Welalin
Kia Ora
Salamat
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subbuhvac2@gmail.com