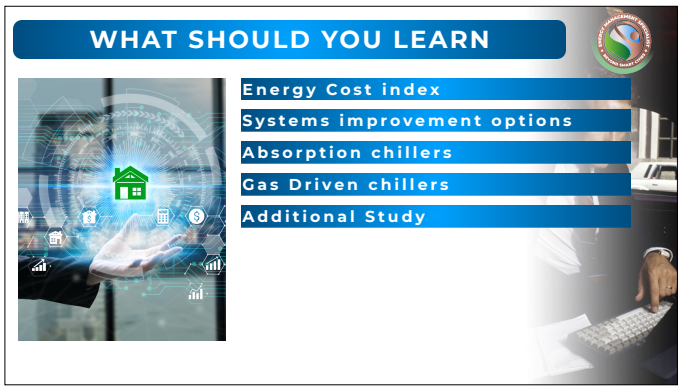
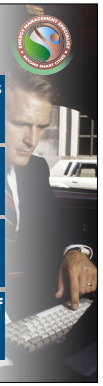
BEYOND
SMART CITIES
HVAC SYSTEMS - CEM REFRESHER
ONLINE TRAINING COURSE
KRISHNAJI PAWAR, LEED AP BD+C,GSAS CGP,ISO 14001:2015,GCP
ENERGY SPECIALIST CURRICULUM
FUNDAMENTALS FOR ENERGY ENGINEERS

BEYOND
SMART CITIES
TYPES AND FUNCTIONS OF HVAC SYSTEMS
FOR ENERGY PROFESSIONALS
KRISHNAJI PAWAR, LEED AP BD+C,GSAS CGP,ISO 14001:2015,GCP
ENERGY SPECIALIST CURRICULUM

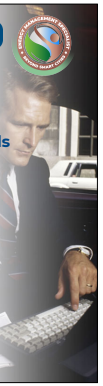

WHAT SHOULD YOU LEARN
Energy Cost index
Systems improvement options
Absorption chillers
Gas Driven chillers
Additional Study

ENERGY COST INDEX +



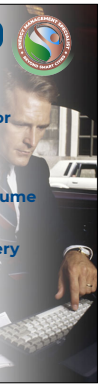
- The Energy Cost Index is sometimes used as a simpler and more meaningful measure of energy efficiency.
- ☑ The Energy Use Index is somewhat misleading since all MJ are not really equal.
- ☑ Electric energy is much higher quality energy than oil or gas, and it costs about three times as much per end use MJ.
- ☑ The Energy Cost Index adds up all costs of energy and divides result by total square metres of conditioned space.

SYSTEM IMPROVEMENT OPTIONS



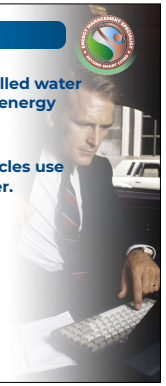
- ☑ Make building envelope improvements to reduce HVAC load
  ➡ insulation, high performance windows and roofs
- ☑ Replace old HVAC units and chillers with more efficient models
- ☑ Possibly downsize units and chiller
  ➡ Energy Star (US) and ASHRAE say chillers are oversized 60% in US.
- ☑ Consider multiple chillers
- ☑ Consider a chiller with a variable speed drive

SYSTEM IMPROVEMENT OPTIONS



- ☑ Consider a chiller with a variable speed drive
- ☑ Consider installing a small chiller or separate HVAC system for 24/7 loads
- ☑ Use VSDs on pumps, cooling towers
- ☑ Replace constant volume systems with VAV - variable air volume systems
- ☑ Consider adding a gas engine driven chiller with heat recovery for hot water
- ☑ Retrofit to DDC controls
- ☑ Use cooling towers where possible

ABSORPTION CHILLERS

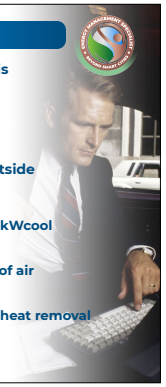


- Absorption chillers can produce large quantities of chilled water using very little electric power and energy. Their prime energy source is heat from hot water or steam.
- Absorption chillers have no CFCs. Most absorption cycles use either ammonia and water or lithium bromide and water.
- Absorption chillers are not very efficient.
  - ➡ Single stage -- COPs about 0.6 - 0.8
  - ➡ Two-stage -- COPs about 1.0 - 1.2

GAS DRIVEN CHILLERS

- Gas engine driven chillers offer significant electric demand savings, and good part-load performance.
- Most applications are in areas with high demand rates and low or moderate gas rates.
- In many cases, heat recovery and beneficial use of the heat is necessary for this approach to be cost-effective.
- Dual drive chillers are available (electric and gas).
- PowerCold Corp, Alturdyne Corp, Jenbacher

CEM REVIEW PROBLEMS



1. In a vapor compression cycle air conditioner, the refrigerant is always in the vapor state.
   A) True B) False
2. A roof top air conditioner has an EER of 9.2. What is its COP?
3. Reheat may still be needed in an HVAC system even if the outside temperature is very high.
   A) True B) False
4. A roof top air conditioner has an EER of 13.5. What is its kWin per kWcool rating?
5. How many kWh electric input is used to provide 120 million kWh of air conditioning with a system having a COP of 3.0?
6. How many kWh electric input is used to provide 100 million kJ of heat removal (air conditioning) with a system having a COP of 5.0?

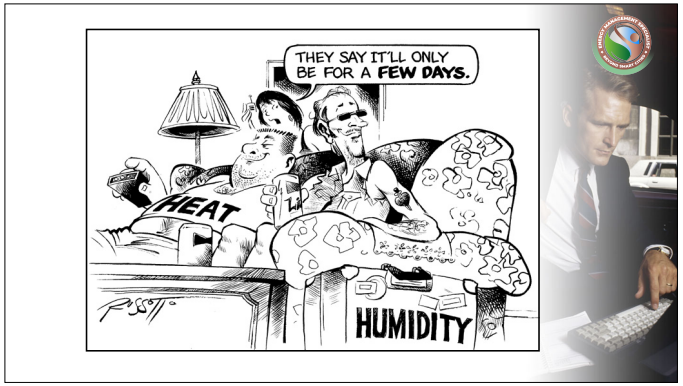
HVAC SYSTEMS ADDITIONAL

Latest Results on Chilled Water Pumping

- Study just out from the Air-Conditioning and Refrigeration Technology Institute (2004) on "Variable Primary Flow Chilled Water Systems: Potential Benefits and Application Issues."
- To measure energy use and savings of VPFCWS, ARTI conducted an extensive study that compared these systems' energy use with that of other common systems, including:
  - ➡ Constant flow/primary-only CWS

ARTI CWS STUDY (CONTINUED)

- Constant primary flow/variable secondary flow CWS
- Primary/secondary CWS
- Primary/secondary CWS with a check valve installed in the decoupler According to the ARTI study, the VPFCWS:
- reduced energy use 3 - 5%
- reduced first cost by 4 - 8%
- Reduced life cycle cost by 3 - 5% compared to conventional constant primary flow/variable secondary flow CWS.


THEY SAY IT'LL ONLY BE FOR A FEW DAYS.
HEAT
HUMIDITY

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THANK YOU
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