Energy Sources and Understanding Energy Waste/Inefficiencies

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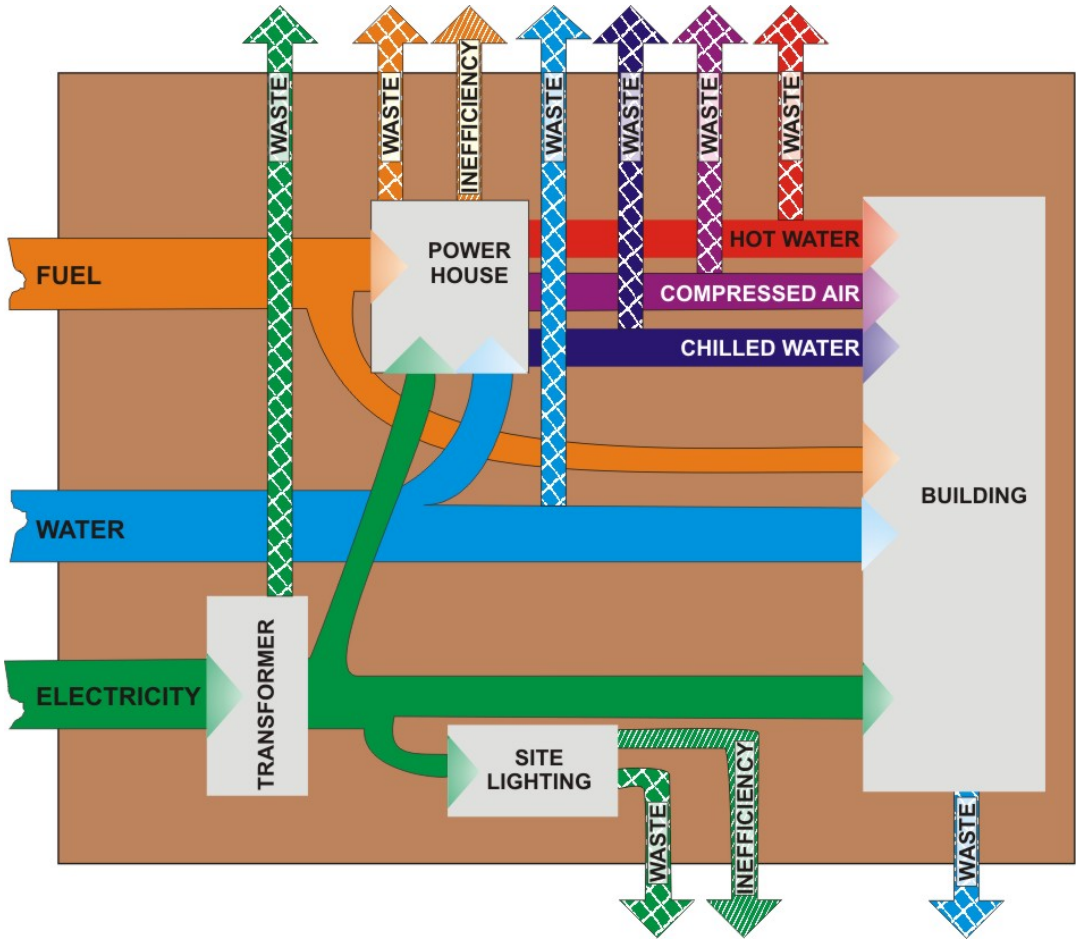
Overview

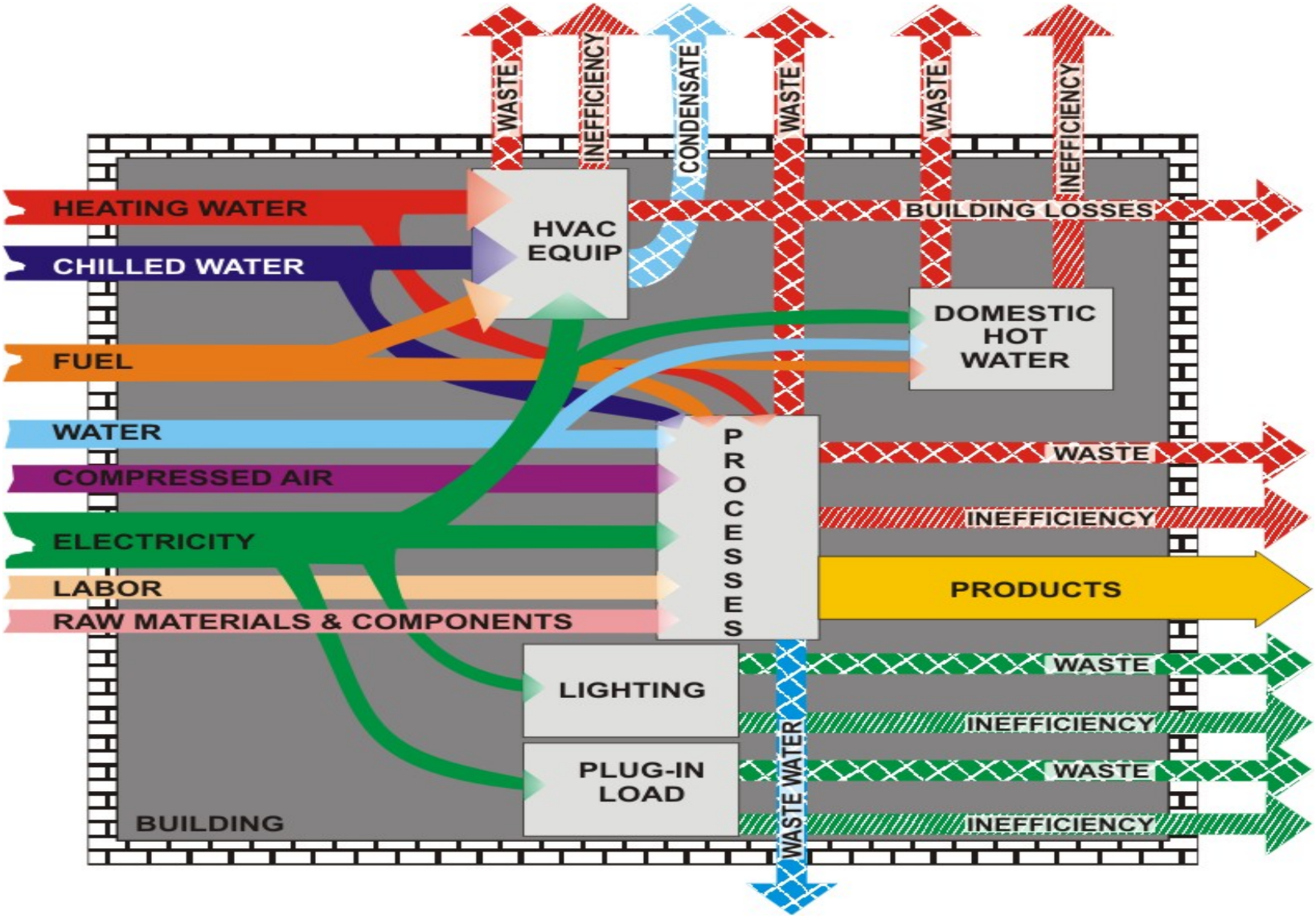
- Energy systems
- What is waste and inefficiency
- What to look for during a site survey
- Specific system waste & inefficiencies

Energy Sources

- Electricity
- Fuel
  - Natural gas
  - Fuel oil
  - Coal
  - Solid waste/Wood scraps
- Water



BUILDING OPTIMIZATION



ENERGY OPTIMIZATION ASSESSMENT Goals

- Eliminate waste
  - Poor maintenance
  - Improper system operation
  - Waste recovery
- Improve efficiency
  - Replace existing
  - System upgrade

Eliminate waste

Poor Maintenance

- System leaks
- Uncalibrated controls
- Dirty filters

Eliminate waste

Improper System Operation

- Failure to turn equipment off
- Running wrong equipment for conditions

Waste Recovery

- Lack of heat recovery in hot exhaust air streams

Improve Efficiency

Replace existing

- Chillers
- Light bulbs
- Motors

System upgrade

- Central monitoring and control system
- Air conditioning system

How to Find Waste & Inefficiency?

- Compare facility use (may not know)
  - With earlier years
  - With similar facilities
  - Compare with computer model results
- Site survey for improper conditions
  - Too warm stack temperature
  - Excessive make-up water
  - Buildings too warm
  - Cold drafts entering building
  - Equipment cycling on/off
  - Systems operating during unoccupied hours

How to Find Waste & Inefficiency?

Review building drawings
- Identify spaces with changed function
- Find energy intensive systems
- Understand operating settings

Check equipment nameplate Data
- Efficiency
- Age

- Review equipment logs
  - Compare with weather data
  - Note unusual occurrences – peaks, drops

How to Find Waste & Inefficiency?

Talk to building occupants

- Uncomfortable spaces
- Noisy spaces
- Poorly performing controls
- Operation inefficiencies
- Causes of rework and poor quality

Energy Assessment Audit Phases

- Level 0 – Initial site contact and audit planning
- Level 1 – Identification of potential ECM's in selected buildings – order of magnitude calculations to prioritize selection
- Level 2 – Detailed analysis of selected ECM's from level 1 analysis
- Level 3 – Engineering design, project implementation followed by performance verification

Site Surveying Tools

Level 1 Audit

- Thermometers
  - Infrared
  - Immersion
  - Wet bulb
- Measuring tape or ultrasonic measurement device
- Light meter
- Flashlight, screw driver

Site Surveying Tools, Continued

Level 2 Audit

- Electrical volt, ohm, amp meter
- Air flow measurement equipment
- Combustion test kit
- Vibration sensor
- Noise meter
- Infrared Thermography
- Blower-door tests

Estimating System Air Flows

- 500 fpm through air handling unit at coils or filters
- 1000 CFM per Hp with extensive duct system
- 2000 CFM per Hp no cooling & moderate duct system

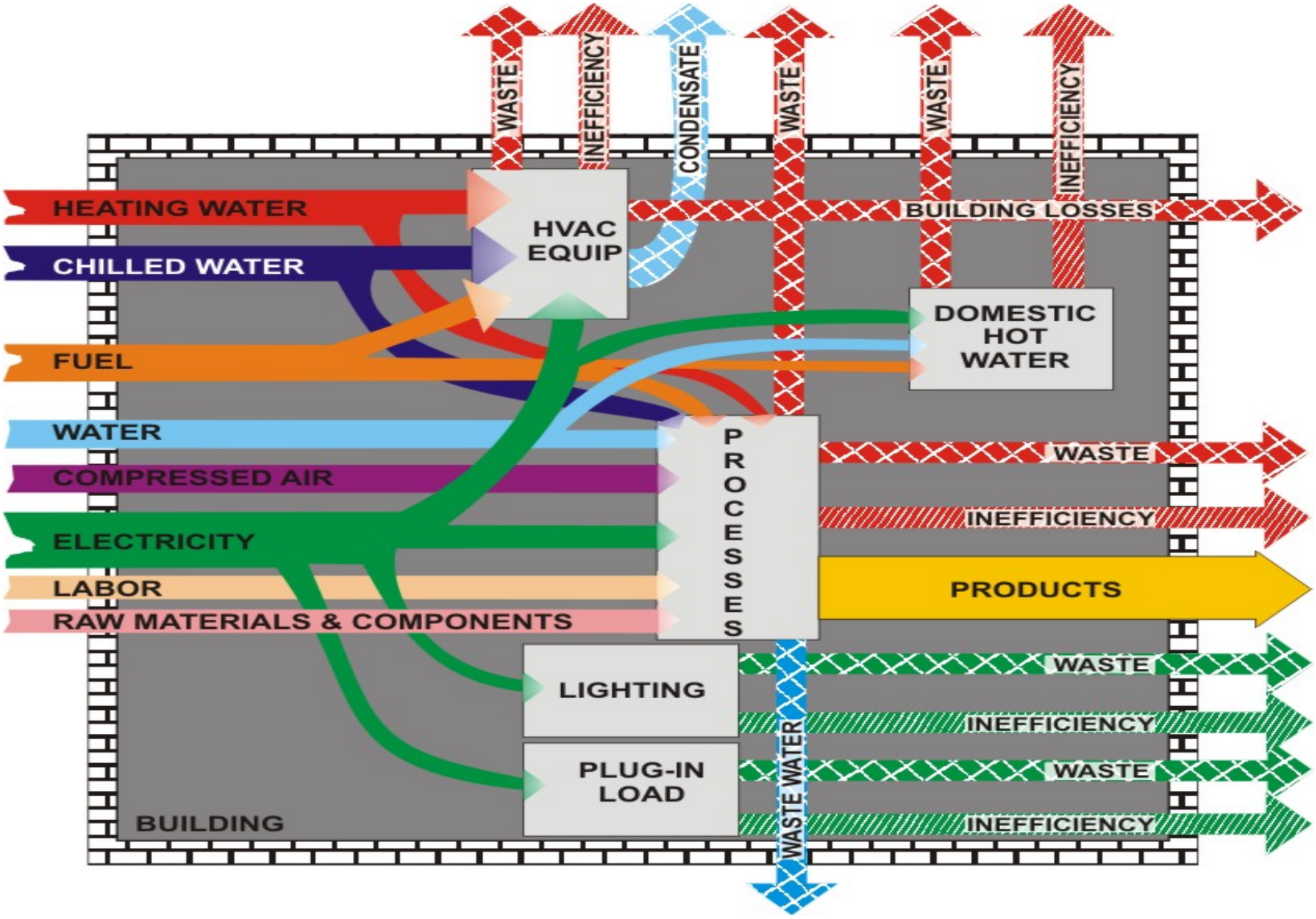
Calculating Energy Savings

- Use computer model results
- Use heat transfer or fluid flow formula
  - Q = U x A x delta T x hrs.
  - Q = 1.08 CFM x delta T x hrs.
  - Q = gpm/500 x delta T x hrs.
- Equipment efficiency curves – chiller, air compressor, etc.
- Change in component energy use
  - no. old lamps x watts – no. new lamps x watts
- Use a nomograph designed for the ECM

Other Cost Savings

- Maintenance & operating cost reduction
- Also consider labor cost reduction and increased production output
  - 1 million Btu saved = $5 to $15
  - 1 million watt hours = $5 to $10
  - 1 man hour = $ 40 to $80
  - 1% production output improvement = less overtime, smaller fleet of equipment, better utilization of space

BUILDING OPTIMIZATION



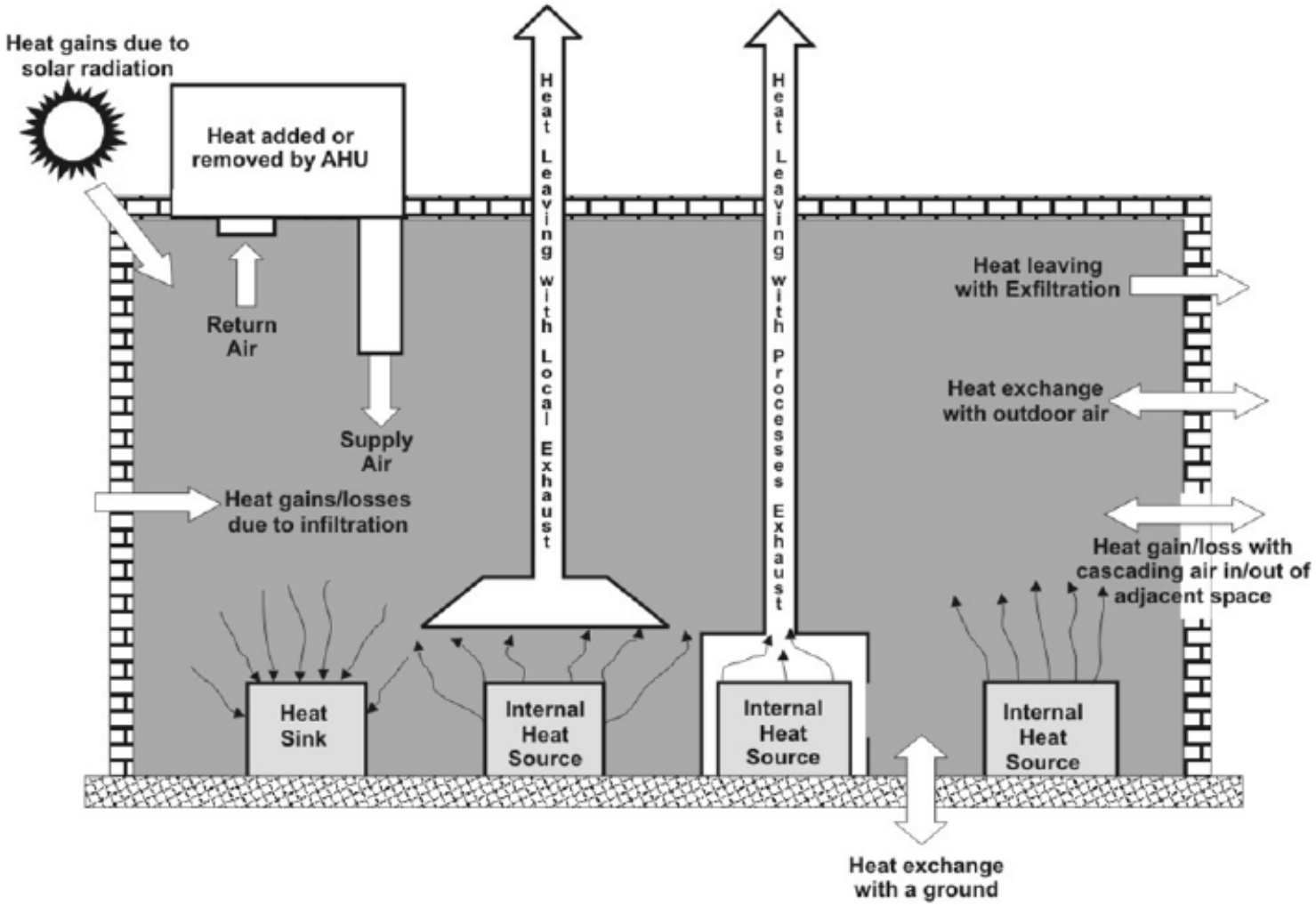
Building Waste

- Wet insulation
- Holes in air barrier
- Worn seals in windows and doors
- Air leaks around window and door frames
- Broken windows
- Windows and doors that don’t close
- Lack of vestibules in cold climates
- Abandoned exhaust stacks

Building Inefficiency

- Dark roof color
- Inadequate insulation in walls, roof or floor
- Single pane windows with no thermal breaks

HVAC Systems



HVAC System Waste

- Lack of insulation on ducts and pipes
- Duct and pipe leaks
- Loose fan belts
- Equipment operating when not required
- Use of excessive dampers or valves to achieve system balance
- Heating or cooling unused spaces
- Overheating or overcooling

HVAC System Inefficiency

- Use of motors that are not premium efficiency
- Use of dilution ventilation
- Use of canopy hoods
- Excessive air flow
- Use of oversized equipment
- Use of uncalibrated controls
- Simultaneous heating and cooling

Central Heating Systems Waste

- Leaks
- Poor water treatment
- Dirty burners
- Failure to return steam condensate
- Excess boiler blowdown
- Heating unoccupied areas
- Sending water greater than 140 F to drain

Central Heating Systems Inefficiency

- Use of uncalibrated controls
- Use of on/off inefficient burner controls
- Heating with oversized boilers
- Inadequate insulation
- Failure to have booster pump in high pressure systems
- Dirty heat exchangers

Central Cooling Systems Waste

- Leaks
- Poor water treatment
- Water flow through shutdown equipment
- Cooling unoccupied areas
- Excessive cooling tower blowdown

Central Cooling Systems Inefficiency

- Use of uncalibrated controls
- Use of old inefficient equipment
- Cooling with oversized chillers
- Inadequate insulation
- Failure to use variable speed pumps in primary/secondary piping systems
- Failure to vary chilled and condenser water temperatures
- Dirty heat exchangers

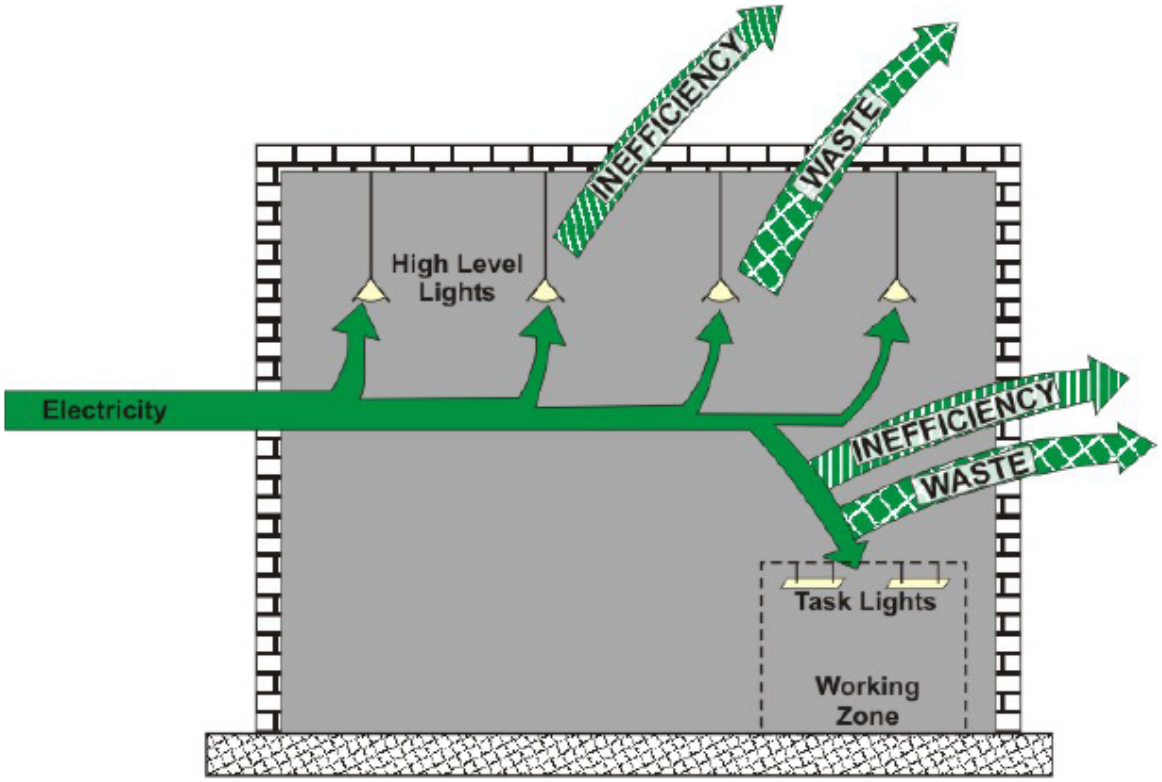
Compressed Air System Waste

- Air leaks
- Running standby compressor or dryer
- Dirty heat exchangers
- Dirty filters
- Excessive air pressures
- Providing compressed air to areas not requiring it

Compressed Air System Inefficiency

- Using room as air source
- Use of uncalibrated controls
- Use of oversize equipment
- Use of compressed air for cooling, drying & agitation

Lighting Systems

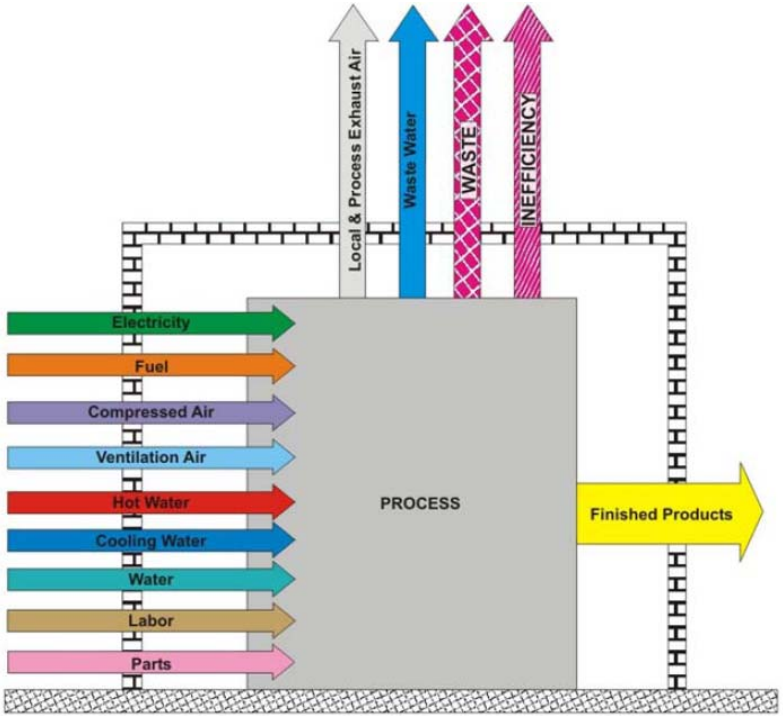


Lighting System Waste

- Leaving lights in unoccupied spaces
- Outdoor lights on in daytime
- Keeping electrical lights on in spaces having day lighting
- Lack of task lighting

Lighting System Inefficiency

- Using incandescent lamps
- Using T 12 florescent lamps
- Using mercury vapor lamps
- Use of lighting fixtures that trap light
- Failure to use LED exit lighting


Local & Process Exhaust Air
Waste Water
WASTE
INEFFICIENCY
Electricity
Fuel
Compressed Air
Ventilation Air
Hot Water
Cooling Water
Water
Labor
Parts
PROCESS
Finished Products

Process Waste

- Compressed air leaks
- Painting objects that are too cold
- Operating ventilation equipment when process shut down
- Exhaust air greater than 200 F
- Lack of the use of task lighting
- Firing furnaces when not needed

Process Inefficiency

- Using excessive compressed air pressure for paint guns
- Failure to use booths and enclosures for hazardous operations
- High air movement near exhaust hoods
- Use of inefficient burners in furnaces
- Use of oversized furnaces and tanks

Questions?