Operations and Maintenance Seminar

Operations and Maintenance

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Definitions

Operations and Maintenance:

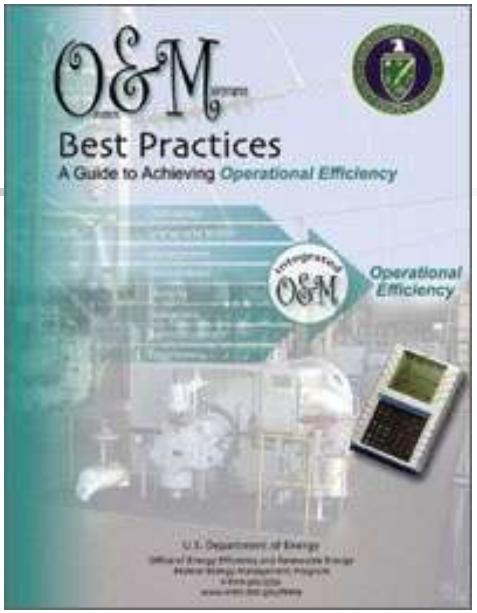
- Actions focused on scheduling, procedures, controls, and optimization.
- Performance of routine, preventative, predictive, scheduled (and unscheduled!) actions to prevent equipment failure and increase efficiency, reliability, and safety.

Operational Efficiency:

- The life-cycle, cost-effective mix, of O&M activities coupled with performance tracking.

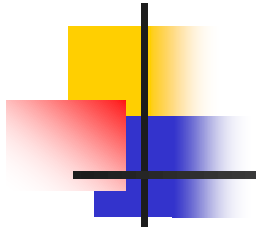
Resources

- FEMP O&M Best Practices
- Cool Choice
- Motor Up
- Utility Programs
- EPACT Grants



COMcheck™
DOE's Building Energy Codes Program

MotorUp
Premium Efficiency Motor Initiative



Utilize Free Resources

O&M Best Practices

www.eere.energy.gov/femp

Free Resource: Energy Star

EPA's Portfolio Manager:

1. Free
2. Easy to use
3. Potential award!
4. Benchmark and baseline for your facility.
5. www.energystar.gov
6. Can make your boss look good!

More Free Resources

COMcheck

www.energycodes.gov/comcheck/ez_download.stm

More Free Resources

Why use COMcheck?

- *Code compliance software*
- *Grant applications*
- *What if scenarios*
- *Incentive applications*

More Free Resources

Motor Master

www1.eere.energy.gov/industry/bestpractices/software.html

More Free Resources

Why use Motor Master?

- *Motors use energy very quietly*
- *Be prepared for burnout*
- *Game plan...inventory!*
- *Great job for intern or student!!!*

More Free Resources

1. *Lighting*

   www.geconsumerandindustrial.com/environmentalinfo/tools

2. *Air Conditioning*

   www.alliantenergy.com/docs/groups/public/documents/pub

3. *Variable Speed Drives*

   www.alliantenergy.com/docs

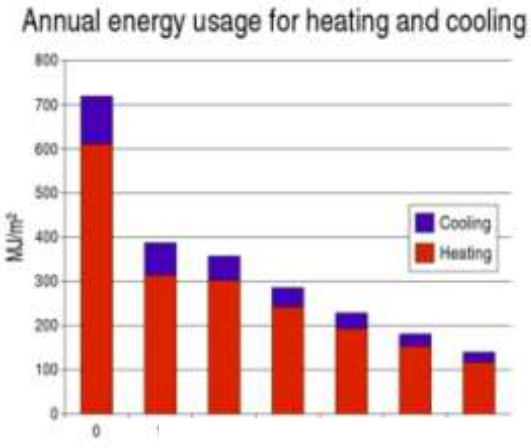
How to Begin? Start Simple!

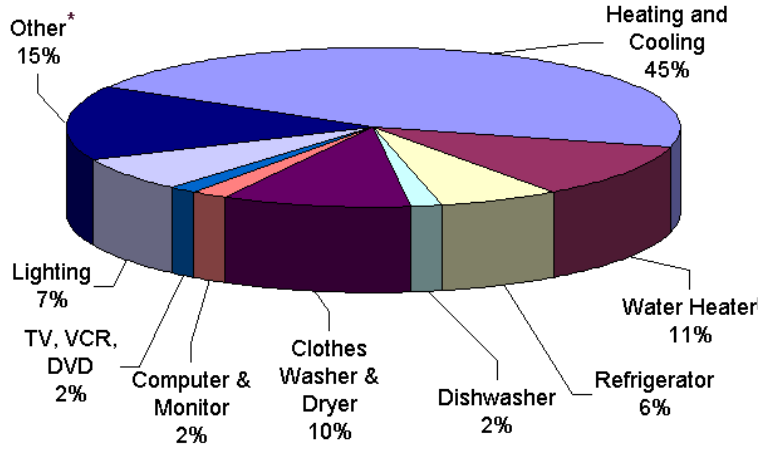
1. Use EPA Energy Star Building Portfolio Manager to establish a baseline score for your facility.
2. Contact your local utility and request billing data for all energy sources and water.
3. Plot Energy and Water usage for the past three years.
4. Establish (or update) an O&M checklist.
5. Pick the low hanging fruit.
6. Tune up your building.
7. Run Energy Star again.

Plot Energy Usage

Contact your local utility and request billing data for all energy sources and water.

Plot Energy and Water usage for the past three years.





The O&M Checklist

- Establish (or update) an O&M checklist.
- Note: In the FEMP Guide, for each equipment type there is an excellent technology specific checklist. www.eere.energy.gov/femp
- www.Schooldude.com is another great resource.

Pick the low hanging fruit

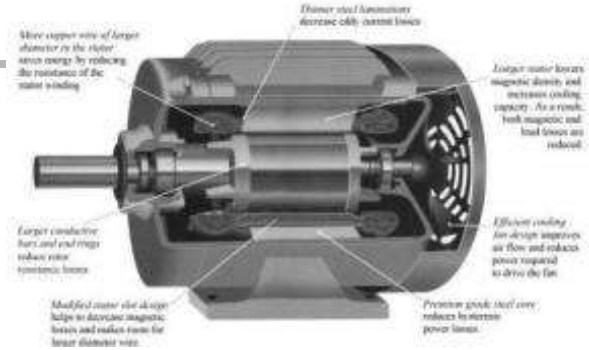
Definition – Easy, inexpensive, great results.

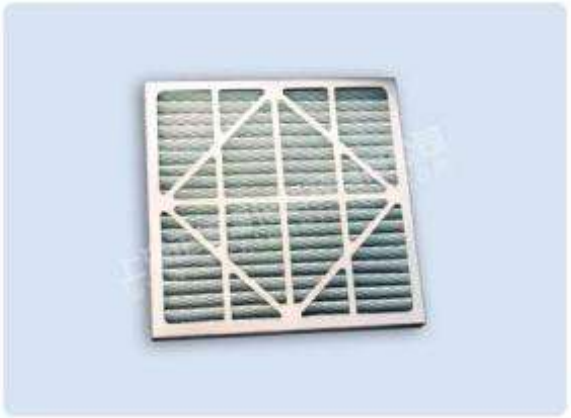
Some examples:

- Clean lighting fixtures
- Install occupancy sensors
- Eliminate all incandescent bulbs
- Eliminate simultaneous heating and cooling
- Change all filters
- Check damper controls
- Install window latches
- Repair major ductwork leaks
- Inspect all fan belts
- Others?

Address the obvious!

- Train your building operators!
- P&P a PM System
- Throw away incandescent bulbs.
- Know thy utility reps!
- Change your filters
- Electric motor game plan
- Plan to group relamp





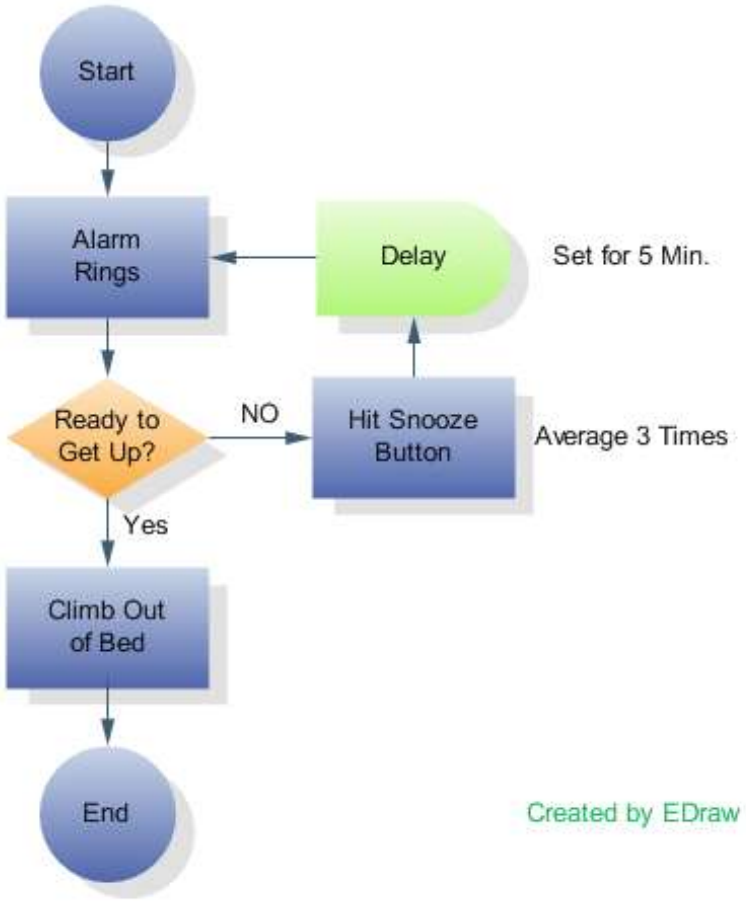
Building Tune Up

Tune up your building! Here are some of the most common actions:

1. Adjust temperature settings
2. Adjust sequencing of boilers, A.H.’s, and chillers
3. Repair dampers and economizers
4. Modify control strategies of all HVAC equipment
5. Balance air supply and return
6. Check weekend and “off” hour controls
7. Turn off lights!

O&M Management

- The Team Approach – make friends with the purchasing agent
- Management support is critical!
- Time for a PM System?
- Implement the Program
- Measurement, Verification, and Report Back.

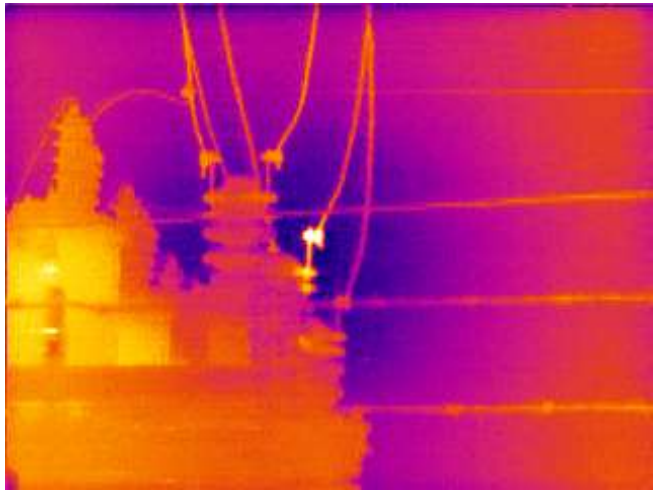


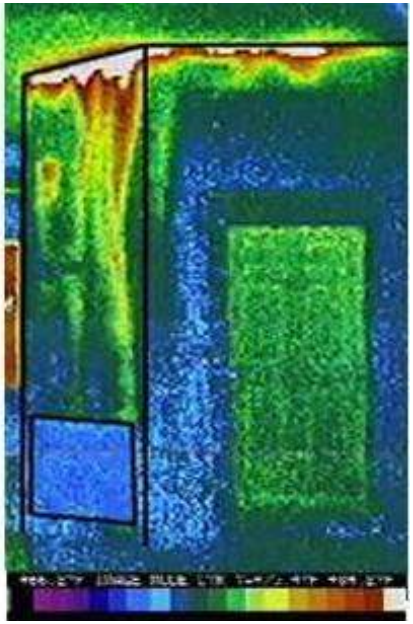
Computerized O&M?

- Work order tracking and generation
- Historical information
- Scheduling function
- Technical documentation
- Calendar
- Parts inventory
- Capitol and **labor cost** tracking

Predictive Maintenance

Thermography: Expensive but very effective



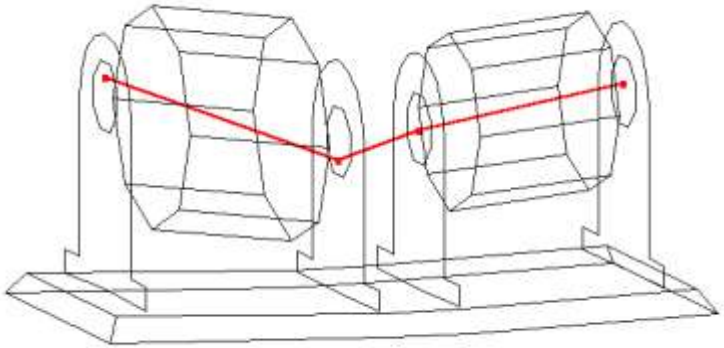


Predictive Maintenance

Oil Analysis: Turbines, Pumps, Gearboxes, your car!

Predictive Maintenance

Vibration Analysis: Fans, large motors, pumps



Commissioning

- New Buildings

  Get what you pay for!

- Recommissioning

  Building tune up

- Continuous Commissioning

  A part of an O&M Program

Major Equipment O&M: Boilers

- Reduce Excess Air
- Waste Heat Recovery
- Reduce Scale and Soot
- Reduce Blowdown – Recover Heat
- Co generate (or Tri-Gen)
- Preheat combustion air
- Analyze combustion gases
- Checklist on 9.2.9

Boilers – Repair or Replace

Case Study #1:

Benefits – 25% fuel savings (14,800 therms), reduced maintenance, less smoke

Considerations – Cost! ($160,000 +/-)

Help? – No.

Savings in fuel - $29,466 at $2 per therm

Payback – 5.4 years

Major Equipment O&M: Chillers

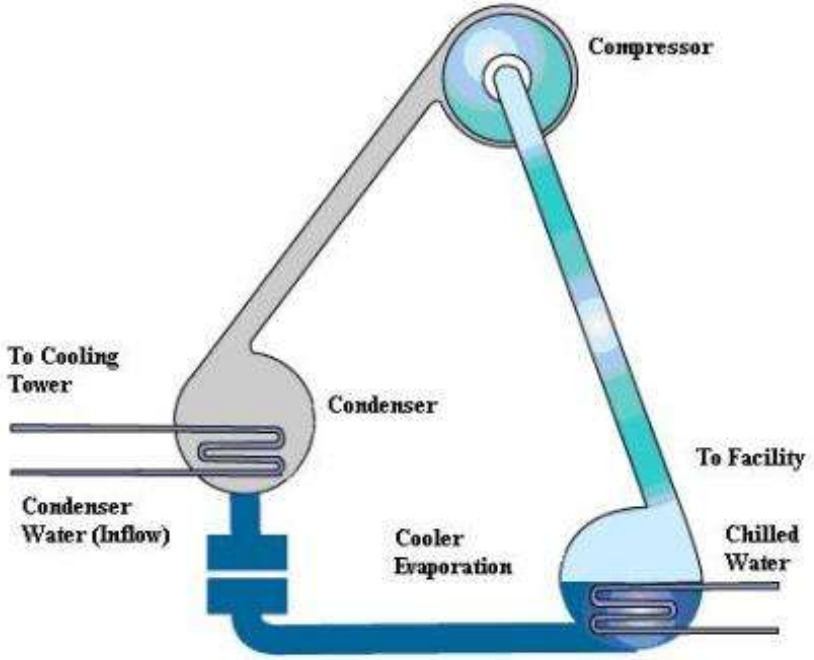
- Three types: Reciprocating, Centrifugal, and Screw

- Improve Chiller Performance via:
  - Raise CW temperatures or reduce condenser water temp.
    For each degree, a 1% gain in efficiency.
  - Clean filters and maintain water flow
  - NEMA premium efficiency motors
  - VSDs on centrifugal chillers
  - Match loads…do not oversize!
  - Free cooling
  - Heat recovery
  - Absorption chillers
  - Thermal (ice or slush) storage

Major Equipment O&M: Chillers

Maintenance of Chillers:

1. Inspect as recommended by manufacturer (quarterly)
2. Check for leaks (monthly)
3. Check compressor operating pressures, oil levels, etc
4. Verify temperatures and electrical operations
5. Using temperature readings, calculate chillers efficiency (quarterly)
6. Checklist 9.4.8



Chillers – Repair or Replace?

Case Study #2:

Benefits – Reliability! Electric savings (186,000 kwhrs), Maintenance

Considerations – Cost! ($376,000)

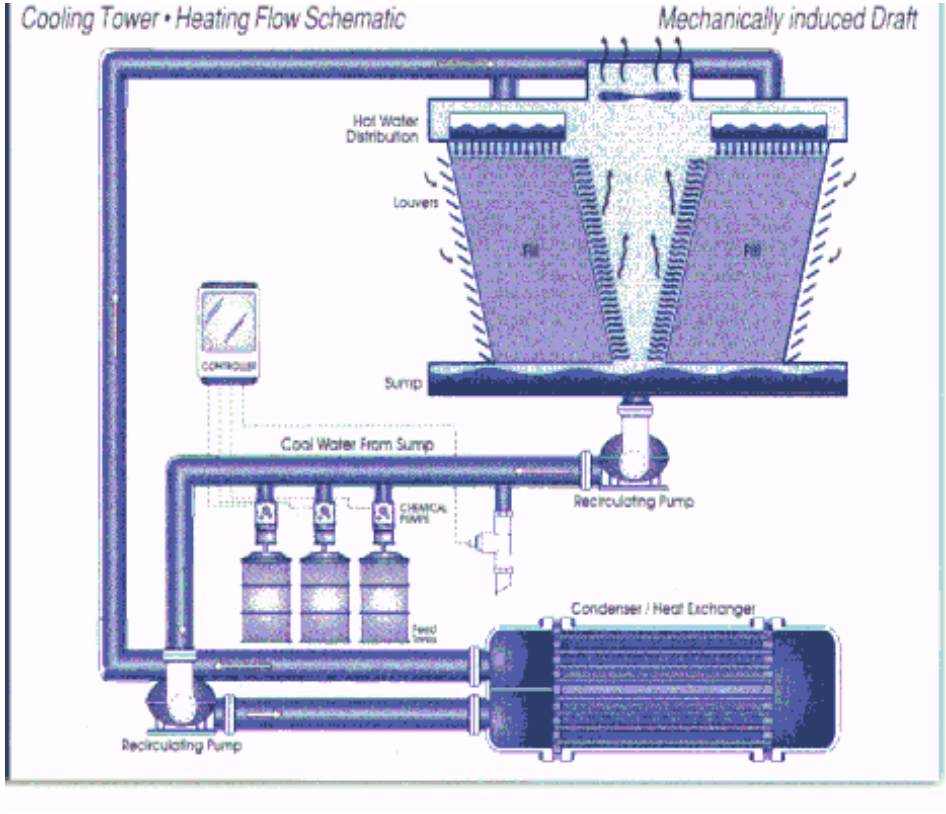
Help? – No.

Savings in electric - $16,600 annually at $.07/kwhr

Payback – 22.6 years

Major Equipment O&M: Cooling Towers

- Heat exchanger utilizing evaporation
- Legionella warning!
- Maintenance – keep clean and free of clogs
- Single stage – install VSD *now!*
- Checklist 9.5.9



Major Equipment O&M: Air Compressors

- Two types: Reciprocating and Rotary Screw
- 7HP of electricity to yield 1HP of air force. *Don't waste compressed air!*
- Fix leaks! (roughly 25%)
- Recover waste heat
- Follow manufacturers maintenance schedule
- Checklist 9.10.9

Major Equipment O&M: Air Compressors

A few notes from Jeff Wright (www.compressorenergy.com):

1. Audible leaks - $500 to $1,500
2. Open blow- $5,000
3. Add VSD and expansion tank – save 30 to 50% of energy
4. Roughly $1,000 per HP

Major Equipment O&M: Lighting

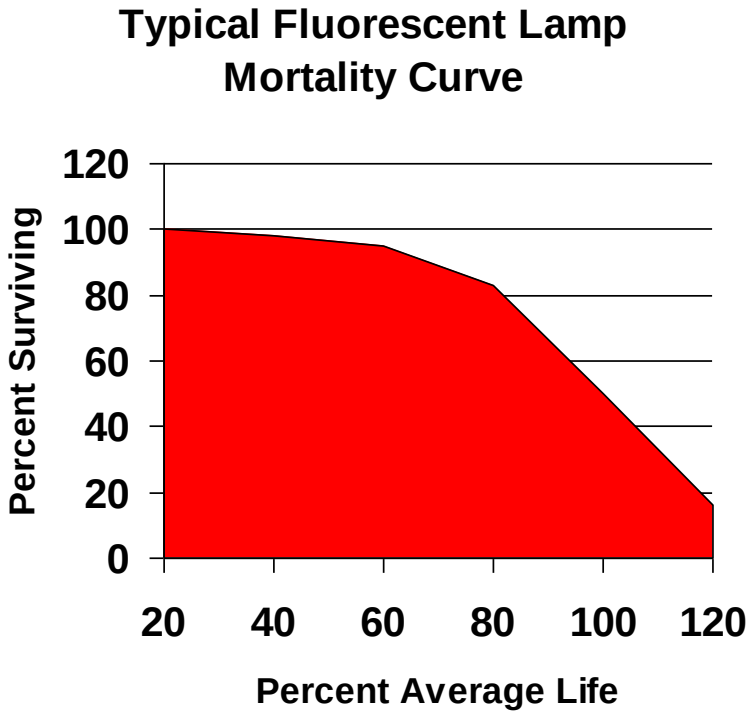
Industrial Lighting:

- Replace HID with T5 or HPT8
- Lumen depreciation
- Pulse start Metal Halide
- Control with Sensors
- Eliminate all Incandescent Bulbs with CFLs
- LED technology

Major Equipment O&M: Lighting

Industrial Lighting:

- Clean all fixtures!
- Use ComCheck for code compliance
- Daylight dimming
- “Bruno-proof” lamps
- Group relamping
- *Call your electric utility!*



Major Equipment O&M: Lighting

Commercial Lighting:

- HPT8 direct/indirect
- Control with Sensors
- Eliminate all Incandescent Bulbs with CFLs
- CFLs can be dimmed
- LED “cans” and exits

Major Equipment O&M: Lighting

Remember to check IESNA at www.iesna.org/ for light levels

Major Equipment O&M: Filters

Filters:

- Don’t buy the cheapest!
- Locate and change them
- NAFA - National Air Filtration Association
- Fiberglass filter MERV < 1
- Pleated filter MERV > 6

Major Equipment O&M: Motors

Motors:

- Don’t buy the cheapest!
- NEMA Premium Efficiency
- www.MotorUp.com
- *Call your electric utility!*

Major Equipment O&M: Motors

Cost of Running VOC Pump / Motor:

1. 8,000 hours run time
2. 60 HP
3. 1 HP = 0.756 KW
4. Annual kwhrs = 8000 x 60 x .756 = 362,880 kwhrs
5. Cost per kwhr = $0.20
6. Cost of pollution = $72,500 every year!