

Useful Rules of Thumb for Energy Conservation and Waste Minimization

Cost savings numbers are based on the following assumptions:

- The average cost of electricity is \$0.05/kWh
- The average cost of natural gas is \$0.350/ccf.
- There are 2,000 hours per year per shift (based on the assumption that one shift is 8 hours per day, 5 days per week, 50 weeks per year)

RULES OF THUMB FOR ENERGY SYSTEMS

Thumbrule #1. Cost of high pressure steam leaks (125 psig).

The costs of high pressure steam leaks are on the order of:

\$150 to \$500/leak/shift/year

Thumbrule #2. Cost of low pressure steam leaks (15 psig).

The costs of low pressure steam leaks are on the order of:

\$30 to \$110/leak/shift/year

Thumbrule #3. Cost of compressed air leaks (100 psig).

The costs of air leaks are on the order of:

\$30 to \$90/leak/shift/year

Thumbrule #4. Evaporation of water in a cooling tower.

Of the flow through a tower, as much as 1% is lost due to evaporation. Submetering the cooling tower can result in the following savings on sewage treatment bills:

Based on the size of the tower in tons:	\$9/ton/shift/year
Based on the gpm of water through the tower:	\$3/gpm/shift/year

Thumbrule #5. Operating cost of a typical motor.

The cost of operating a motor is:

\$62/hp/shift/year

Thumbrule #6. Savings achieved by reducing pressure of compressed air (100 psig compressed air system).

A 10 psi reduction in compressor discharge pressure results in a 5% reduction in energy consumption.

Thumbrule #7. Cost of heat lost through hot, uninsulated pipes.

Costs associated per 100 feet of uninsulated pipe at a specified steam pressure:

25 psig steam:	\$375/100 ft/shift/year
50 psig steam:	\$430/100 ft/shift/year
75 psig steam:	\$480/100 ft/shift/year
100 psig steam:	\$515/100 ft/shift/year

Thumbrule #8.

90% of the heat loss from a hot, uninsulated surface can be economically eliminated by installing insulation.

Thumbrule #9. Costs for comfort heating:

Michigan:	\$0.26/ft ² /yr
Tennessee:	\$0.35/ft ² /yr
Texas	\$0.24/ft ² /yr

Thumbrule #10. Costs for cooling office spaces:

Michigan:	\$0.12/ft ² /yr
Tennessee:	\$0.30/ft ² /yr
Texas	\$0.52/ft ² /yr

Thumbrule #11.

A typical boiler or furnace has a combustion efficiency of 80%.

Thumbrule #12. Typical Performance Efficiencies for Motors

Upgrading to an energy efficient efficiency motor can result in savings of about 5% over the operating costs of a standard motor. A typical standard motor has an efficiency of 90%.

Thumbrule #13. Benefit of Fuel Switching.

Switching from electric heat to natural gas or #2 fuel oil can reduce heating costs by 78%.

Thumbrule #14. Average Cost of Lighting.

The following table gives operating costs and light output data for various lighting types. The tabulated bulb wattages include ballast contributions.

Lighting Type	Annual Cost (\$/bulb/shift/year)	Bulb Wattage	Light Output (Lumens/Watt)
4-ft Std. Fluorescent (T12) w/ Std. Magnetic Ballast	4.6	46	58
4-ft E.E. Fluorescent (T8) w/ Electronic Ballast	3.1	31	83
8-ft Std. Fluorescent (T12) w/ Std. Magnetic Ballast	8.8	88	70
8-ft E.E. Fluorescent (T8) w/ Electronic Ballast	5.3	53	102
8-ft High Output Fluorescent (T12) w/ Std. Magnetic Ballast	12.9	129	65
8-ft High Output E.E. Fluorescent (T8) w/ Electronic Ballast	8.0	80	100
400W High Press. Sodium	46.5	465	97
400W Metal Halide	45.5	455	63
400W Mercury Vapor	45.0	450	40

Thumbrule #15. Cost Savings for Demand Reduction (or “Load Shifting”).

By shifting an operation to off-peak times, the following savings are achieved:
\$75/hp/year

The benefit of shifting other electric equipment to off-peak hours is:
\$120/kW/year

RULES OF THUMB FOR WASTE MINIMIZATION

Thumbrule #16. Cost per Cubic Yard of Solid Waste.

On average, it costs \$30 per cubic yard for municipal solid waste removal. This cost includes dumpster rental, transportation or "pull" fees, and landfill tipping fees.

Considered separately, typical landfill tipping fees are \$45 to \$65 per ton.

Thumbrule #17. Disposal Costs for various substances, per 55 gal. drum.

Disposal Substance	Disposal Cost (\$ / 55 gal. drum)
Incineration (liquid)	165
Landfill (Non-hazardous)	100
Landfill (Hazardous)	250
Incineration (Sludges, Greases, Debris and Solids)	550
Rags and Debris (Uncompacted)	250
Corrosives	550

Thumbrule #18. Typical Water Costs

Total Cost = \$4.00 to \$5.00 / ccf

Water Consumption = \$2.50 / ccf

Sewer Charge = \$2.00 / ccf

(Note: 1 ccf = 100 cubic feet)

Thumbrule #19. Minimum Ventilation Requirements.

Prescribed ventilation rates in a building are defined as:

By size - 0.1 to 0.25 cfm per square foot of the building

By person - 5 to 15 cfm per person

Thumbrule #20. Paint Transfer Efficiencies

Most paint application wastes are caused by either paint overspray or the paint not reaching the target. The amount of overspray results from the design and operation of the system used. The efficiency of some of the systems are as follows:

Painting Method	Transfer Efficiency (%)
Conventional air atomized spray	30 - 60
Conventional pressure atomized spray	65 - 70
Electrostatic air atomized spray	65 - 85
Electrostatic centrifugal atomized spray	85 - 95
Powder Coating	90 - 99
Roller / Flow coating	90 - 98