Boiler MACT Energy Audits

The Purpose, The Process, and The Profit
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- 8 years in U.S. Navy Nuclear program
- Previous co-gen plant Operations Manager
- Mechanical Design, Project Management, and Construction Management
- Certified Energy Manager
Who Needs An Energy Audit?

→ Must have a one-time energy assessment performed by a qualified energy assessor:

- Existing Biomass, Coal, and Oil-Fired Boilers
  - >10 MMBtu/hr (Area Sources)
- Existing boiler or process heater located at Major Source facility

Audit Requirements:

1. A visual inspection of the boiler system.
2. An evaluation of operating characteristics of the boiler, specifications of energy use systems, and operating and maintenance procedures.
3. An inventory of major energy use systems that consume energy from the affected boiler.
5. A list of major energy conservation measures.
6. A list of energy savings potential of the identified ECMs.
7. A comprehensive report detailing the ECMs, the cost-benefit of the improvements, and payback time.
“The Purpose”
Why Perform an Energy Audit?

• Overall goal of Boiler MACT is to reduce emissions

• Energy audits are designed to show ways to improve plant efficiency

• Increased efficiency:
  → lower fuel usage
  → lower emissions
  → lower permit fees
  → lower fuel bill

😊 Regulators
😊 Plant owners
😊 Plant managers
Close the window you’re letting the cold in.

THERMODYNAMICS II: The heat goes out!!!
What Systems Will Be Assessed?

Energy Use Systems:
→ Systems located on site of affected boiler that use energy provided by boiler.

Types of Systems:
• Process heating / cooling
• Compressed air
• Motors, pumps, fans
• HVAC
• Hot water
• Building envelope & lighting
• Steam, electricity, or process energy produced by the boiler
Typical Problem Areas

- Steam leaks
- Insulation deficiencies
- Air leaks
- Old inefficient motors
- Single speed motors (non-VFD)
- Incandescent or old fluorescent lighting
- Steam traps leaking by
- Blowdown or cooling tower water loss
- Tramp air
The Most Important Part of an Energy Audit: The Report

1. Comprehensive assessment of your facility.

2. A detailed list of energy conservation measures, ranked by priority, and energy savings potential of each item.

3. Give estimated cost to implement each measure, benefit, and payback.
“The Profit”
Why Go Beyond Just “Checking the Box”?

- From your report: Examine the ECMs, their cost-benefit, and payback.
  - The ECM’s are listed by priority and payback period
  - Look for “low hanging fruit” for your facility (payback < 1 year)

- There are often incentives available to implementing ECMs.
  - Cash offset and/or tax credits
  - Sources: DOE, local PUDs, the Energy Trust (Oregon), larger utilities (BPA)

- The information gained from your energy audit can lead to real money savings for your plant.
Efficiency by the Numbers:

Cost of Compressed Air Leak

- 80 psi mill air, ⅛” dia. leak:
  - 21.4 CFM loss
  - $\1777 \text{/yr}

- 80 psi mill air, ¼” dia. leak:
  - 85.7 CFM loss
  - $\7106 \text{/yr}

High Efficiency Motor Savings

- 100 HP motor, 80% efficient:
  - 792,625 kW/yr
  - $\39,631 \text{/yr}

- 100 HP motor, 90% efficient:
  - 704,556 kW/yr
  - $\35,228 \text{/yr} = $4400/yr savings per motor

- Most HE motors pay back in 1 yr or less.
Case #1

Optimizing Steam-Driven FWP

- Replaced old steam-driven FWP HP turbine with new MP (80 psig) turbine.
  - Old steam supply was from drum prior to SH – additional boiler load w/ no increase in T/G output.
  - New MP source is process steam – 18,300 pph increase in boiler baseload.
- Installed additional air heat HX for 5 psig exhaust steam heat and condensate recovery.
- Replaced existing demineralizers with new larger RO unit.
- Placed continually operating 450HP electric FWP in standby.
- Applied for green energy incentives and received enough to fund 70% of the project.

  - Plant parasitic load reduction = 239 kW/day
    $287 /day
    $100,000 /yr
  - Increased electrical generation = 0.45 MW
    $275 /day
    $96,000 /yr
  - Project capital cost = $450,000
  - Project cost after incentives = $135,000
  - Payback = 240 days
Case #2

Reducing Continuous Blowdown by 1%

- Evaporation = 2,400,000 lb/day
- B/D Reduction = 24,000 lb/day
- ΔEnthalpy of FW = 447 Btu/lb
- Heat Reduction = 10,728,000 Btu/day
- Hog Fuel (45% MC) = 4500 Btu/lb
  @ 70% efficiency = 3150 Btu/lb
- Fuel Reduction = 3405 lb/day
- Annual Reduction (350 d/y) = 1,191,750 lb/yr (596 tons)

- Annual Fuel Savings @ $50/T = $29,800

- Hog Fuel Boiler
  o 100,000 pph
  o 600 psig
  o FW$_{in}$ = 60 F
  o FW$_{out}$ = 240 F

- Current B/D rate = 6% (144,000 lb/day FW)
- New B/D rate = 5% (120,000 lb/day FW)
In Summary...

Turn a Boiler MACT Energy Audit from something you have to do into something you want to do.

- An excellent way to take the temperature of your facility.
- Helps you identify areas of opportunity.
- Performing plant efficiency improvements can help your boiler run better.

ENERGY SAVINGS = COST SAVINGS
Thank You!

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