Energy Assessments for MACT & BACT

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Focus Today

• Introduce key B-MACT provisions affecting LA industry

• Look at how the B-MACT and GHG BACT are related

• Take a quick look at the two provisions with which most major LA sources must comply
Boiler MACT for LA

• No emission limits for most units (Gas 1)
• Work Practice Compliance Due Mar 21, 2014
• Once you are in...
  – Tune-ups annually for Gas 1 boilers ≥10MMBtu/hr
  – Biennially for any boiler / heater <10MMBtu/hr
  – One time energy efficiency assessment

• If you add a new unit – any change to due date?
Boiler MACT and GHG BACT – Related?

- EPA GHG guidance refers to work practices,
- MACT standard includes two:
  - Tune-ups
  - Energy efficiency assessments

- B-MACT specificity may lend itself to BACT
- Will B-MACT “Energy Use System” approach spread?
• EPA BACT guidance: “...the permit could also lay out a requirement to...”
  – Implement an Energy Management System
  – Implement actions that result in net savings
• MACT energy efficiency assessments:
  – Parallel universe
    • Review energy use systems and management
    • Identify cost effective measures
WP 1: Annual Tune-ups

- Inspect the burner
- Check the flame
- Check air-fuel ratio controls
- Minimize carbon monoxide / maximize efficiency
- Maintain results onsite
WP 2: Energy Efficiency Assessment

Overview

• Review management and operating practices

• ID cost effective efficiency opportunities
Energy Efficiency Assessment

- Inventory major energy consuming (use) systems
- Review and evaluate
  - Facility plans
  - Energy use specs
  - Operating maintenance procedures
  - Unusual operating constraints
  - Logs / fuel use records
- Inspect boiler(s) or process heater(s)
Steps in an Assessment cont’d

• Recommend improvements to energy management practices

• List major energy conservation measures

• Describe energy savings potential
  – Cost effective

• Prepare comprehensive report
Who Conducts the Assessment?

- Proposed B-MACT Assessor
  - Certified by DOE*, or
  - Association of Energy Efficiency Engineers

- Final B-MACT Assessor
  - Certified specialists
  - Experienced practitioners
  - Demonstrable capabilities

*5 DOE certifications: steam, process heat, compressed air, fans, pumps and motors
Time and Focus

Tier 1  34.2 MMBtu/hr
  – One day (really?)
  – 50% of energy use output

Tier 2  34.2-114 MMBtu/hr
  – 3 days
  – 33% of energy use output

Tier 3  >114 MMBtu/hr
  – No time limits
  – 20% of energy use output
Tier 1 Example
30 MMBtu/hr Hot Oil Heater

• Determine...
  – The 50%+ energy use system
  – Stack temperature / $O_2$ / CO
  – Temps, flows, pressures - hot oil
  – Temps, flows, pressures – other medium

• Inspect insulation

• Review combustion controls / fuel use records
Tier 1 Example
30 MMBtu/hr Hot Oil Heater

• Evaluate...
  – combustion efficiency
  – Heat exchanger efficiency
  – Heat losses
  – Management / operational controls

• Suggest changes and create estimate of cost effectiveness

• Write final report

• Plant certifies completion to agency
Tiers Revisited

Tier 1  34.2 MMBtu/hr
  – One day (really?)
  – 50% of energy use output

Tier 2  34.2-114 MMBtu/hr
  – 3 days
  – 33% of energy use output

Tier 3  >114 MMBtu/hr
  – No time limits
  – 20% of energy use output
Tier 3 Reality – Major Refinery

- 40 times the heat duty needed for Tier 3
- 46 affected units
- 20% of energy use systems
  - Involves several sources
  - Pre-planning needed for such a site

**Note:** systems consuming onsite-generated electric power are fair game
Geez, Do I Have To?

- Ammonia Plant Assessment
  - saves approximately **$3.5 million** annually
  - Saves 497,000 MMBtu
  - simple payback of 11 months

- Chemical Plant Assessment
  - Saves **$1.9 million** annually
  - Saves 272,000 MMBtu annually
  - simple payback of 1.5 months
EPA Influenced by DOE

- DOE certifications
  - Steam System Specialist
  - Process Heating Specialist
  - Others...

- DOE Tools
  - SSST / SSAT / PHAST

- DOE Programs
  - Industrial Technology Program / Energy STAR EPI / Energy Star Guidelines
Quick Look: DOE Tools

- SSST
- SSAT
- PHAST
- EPIs
# Scoping Tool: Systems Review

## SUMMARY OF STEAM SCOPING TOOL RESULTS

<table>
<thead>
<tr>
<th>Category</th>
<th>Possible Score</th>
<th>Your Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steam System Profiling</td>
<td>90</td>
<td>0</td>
</tr>
<tr>
<td>Steam System Operating Practices</td>
<td>140</td>
<td>72</td>
</tr>
<tr>
<td>Boiler Plant Operating Practices</td>
<td>80</td>
<td>0</td>
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<tr>
<td>Distribution, End Use, Recovery Op. Practices</td>
<td>30</td>
<td>0</td>
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<tr>
<td><strong>Total Scoping Tool Questionaire Score</strong></td>
<td>340</td>
<td>72</td>
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<tr>
<td><strong>Total Scoping Tool Questionaire Score (%)</strong></td>
<td></td>
<td>21.2%</td>
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</tbody>
</table>
SSAT Project Models

Steam System Assessment Tool

SSAT Default 3 Header Model

Model Status: OK

Economic Summary based on 2760T $700k/yr

Power Balance
- Generation: 7,854 kW
- Demand: 7,954 kW
- Unit Cost: $0.0600/kWh

Fuel Balance
- Boiler: 29,712 gal/h
- Unit Cost: $0.30/gal

Make-Up Water
- Flow: 10,015 gal/h
- Unit Cost: $0.0325/gal

Total Operating Cost: $22,485
## SSAT Project Evaluations

<table>
<thead>
<tr>
<th>Cost Summary</th>
<th>Current Operation</th>
<th>After Projects</th>
<th>Reduction</th>
<th>Reduction %</th>
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<tbody>
<tr>
<td>Power Cost</td>
<td>2,190</td>
<td>2,192</td>
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<td>-0.1%</td>
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<tr>
<td>Fuel Cost</td>
<td>21,342</td>
<td>19,063</td>
<td>2,279</td>
<td>10.7%</td>
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<tr>
<td>Make-Up Water Cost</td>
<td>434</td>
<td>401</td>
<td>33</td>
<td>7.7%</td>
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<tr>
<td>Total Cost (in $ '000s/yr)</td>
<td>23,966</td>
<td>21,656</td>
<td><strong>2,311</strong></td>
<td><strong>9.6%</strong></td>
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</tbody>
</table>
DOE’s PHAST Program

- Heaters and Boilers only
- Before and after analysis
- Multi-unit capacity
PHAST Results – Single Unit

U.S. Department of Energy
Energy Efficiency and Renewable Energy
Bringing you a prosperous future where energy is clean, abundant, reliable and affordable

Plant Name: Test Petroleum plant - US
Furnace Name: New Heater no. 2

Furnace heat input

Gross fuel heat input
21,610,578 Btu/hr
15,374,087 Btu/hr

Available heat
14,654,133 Btu/hr
12,002,550 Btu/hr

Flue gas losses
6,956,445 Btu/hr
3,715,537 Btu/hr

Other losses
52,372 Btu/hr
12,933 Btu/hr

Wall losses
399,608 Btu/hr
225,603 Btu/hr

Opening losses
497,749 Btu/hr
39,550 Btu/hr

Useful output (heat to load)
13,203,680 Btu/hr
11,163,680 Btu/hr

Atmosphere losses
0 Btu/hr
0 Btu/hr

Water cooling losses
500,724 Btu/hr
500,724 Btu/hr

Fixture/conveyor losses
0 Btu/hr
0 Btu/hr

Legend:
- Current
- Modified
# PHAST Plant Summary

## Example Output

<table>
<thead>
<tr>
<th>Heating Equipment</th>
<th>Fuel Energy Use (Million Btu/Year)</th>
<th>Annual Cost (USD/Year)</th>
<th>Electric Energy Use (Thousand kWh/Year)</th>
<th>Annual Cost (USD/Year)</th>
<th>Steam Energy Use (Million Btu/Year)</th>
<th>Annual Cost (USD/Year)</th>
<th>Annual Total Cost (USD/Year)</th>
<th>% of Total Cost</th>
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</thead>
<tbody>
<tr>
<td>Steam Boiler</td>
<td>188,698</td>
<td>943,488</td>
<td>920</td>
<td>73,592</td>
<td>2,376,192</td>
<td>23,761,920</td>
<td>24,779,000</td>
<td>45.72</td>
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<tr>
<td>HP Boiler</td>
<td>209,664</td>
<td>419,328</td>
<td>0</td>
<td>0</td>
<td>2,358,720</td>
<td>23,587,200</td>
<td>24,006,528</td>
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<td>New Heater no. 2</td>
<td>268,800</td>
<td>1,344,000</td>
<td>917</td>
<td>0</td>
<td>126,706</td>
<td>1,257,056</td>
<td>2,611,056</td>
<td>4.82</td>
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<td>Heater 3</td>
<td>403,200</td>
<td>2,016,000</td>
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<td>2,016,000</td>
<td>3.72</td>
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<td>Distillation unit</td>
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<td>0</td>
<td>192</td>
<td>15,360</td>
<td>75,492</td>
<td>754,915</td>
<td>770,275</td>
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<td>Cat Cracker</td>
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<td>413</td>
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<td>SynGas heater</td>
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<td><strong>Total</strong></td>
<td><strong>1,070,362</strong></td>
<td><strong>4,722,816</strong></td>
<td><strong>10,722</strong></td>
<td><strong>109,092</strong></td>
<td><strong>4,937,109</strong></td>
<td><strong>49,371,091</strong></td>
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<td>• Glass Manufacturing</td>
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<td>• Pulp and Paper Manufacturing</td>
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Some Resources

• http://www1.eere.energy.gov/industry/saveenergy/energynow/index.html
  – Best Practices: Steam
  – Steam Tip Sheets
  – Improving Steam System Performance: A Source Book for Industry

• http://www.energystar.gov

• http://www.energystar.gov/index.cfm?c=in_focus.bus_industries_focus
Wrap Up

• B-MACT energy efficiency assessments:
  – Structured framework could influence GHG BACT thinking
  – Can be reviewed by DEQ at any time

• If NSPS is BACT floor, then what of the B-MACT?