

Energy Efficiency as a Regulatory Requirement

Extended Abstract # 61

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INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has included energy assessments as requirements in the recently-finalized Title 40 Part 63 Subparts DDDDD and JJJJJ, or Boiler MACT, rulemakings. In issuing these rules, EPA noted that energy efficiency was chosen over fuel switching as a “beyond the floor” option. The Department of Energy has found that by using best practices, fuel/energy use can oftentimes be decreased by as much as 10-15%. The scope of the audit varies from a single day, focused primarily on the boiler system, to up to a week, focusing on facility-wide efficiency, depending on the facility designation. Assessments are to be performed by third-party auditors with highly specialized qualifications.

EPA has also issued technical guidance including energy efficiency as an approach to Best Available Control Technology (BACT) for greenhouse gases (GHG) as related to Prevention of Significant Deterioration (PSD) permitting under the Tailoring Rule.¹ The guidance document posits that a BACT analysis for a new combustion source should include the consideration of methods that increase the overall energy efficiency of the source. In general, a more energy efficient technology burns less fuel than a less energy efficient technology on a “per unit of output” basis.

The first GHG PSD permit was issued by the Louisiana Department of Environmental Quality in January 2011, and included installation of energy efficient equipment as the GHG BACT for the NUCOR Steel facility. Although the Calpine Russell City PSD permit was issued in 2010 (before the Tailoring Rule was finalized), it also includes a GHG BACT analysis and GHG permit limits.

BOILER MACT

The Boiler MACT rulemakings finalized in February 2011 include four related rules:

- 40 CFR 63 Subpart DDDDD – Major Source Boilers
- 40 CFR 63 Subpart JJJJJ – Area Source Boilers
- 40 CFR 60 Subpart CCCC – Performance Standards for CISWI Units
- 40 CFR 60 Subpart DDDD – Emissions Guidelines for CISWI Units

While the Area Source Boilers rule remains in effect, the other three rules have been temporarily stayed pending further review of emission data. At the time of this writing, EPA has announced that the stayed rules will be proposed again by the end of October 2011, with final rules in place by the end of April 2012.

In addition to potentially being subject to numeric emission limits, as the rules are currently written, a one-time energy assessment is required by both Major Source Boilers / Process

Heaters AND Area Source Boilers. Depending on size/fuel/etc., the subject boilers may also require annual or biennial boiler “tune ups.”

Energy Assessment Scope

In accordance with the current versions of the Boiler MACT regulations, *energy assessment* means “an in-depth assessment of a facility to identify immediate and long-term opportunities to save energy, focusing on the steam and process heating systems which involves a thorough examination of potential savings from energy efficiency improvements, waste minimization and pollution prevention, and productivity improvement.”

Major sources – facilities with emissions that exceed the major source thresholds for hazardous air pollutants (HAP) – would be subject to facility-wide energy assessments. Meanwhile, area sources of HAP would be required to conduct an energy assessment on the boiler system alone. EPA estimates the cost at \$2,500 to \$55,000.

The purpose of the assessment would be to identify energy conservation measures, such as efficiency improvements, pollution prevention, and productivity improvements. The assessment could also include process changes and other efficiency modifications to identify cost-effective energy conservation measures (payback period of less than or equal to two years). The final assessment report, along with a signed certification by a responsible official, would be submitted to EPA.

The scope of the audit would include a boiler system inspection. For facility-wide audits, the scope would include establishing operating characteristics of the facility, the energy system specifications, existing operating and maintenance procedures, and unusual operating constraints. The assessment would identify major energy consuming systems, and review available architectural and engineering plans; review facility operation and maintenance procedures and logs, and review fuel usage. The assessment report should include a list of major energy conservation measures, the energy savings potential of the energy conservation measures identified, and a comprehensive report detailing the ways to improve efficiency, the cost of specific improvements, benefits, and the time frame for recouping those investments. Finally, major sources would be required to develop a facility energy management program according to the ENERGY STAR guideline for energy management (Major sources only).

Auditor Qualifications

Third party auditors performing the energy assessments must be considered “qualified energy assessors.” According to the stayed rules, this individual must have “demonstrated capabilities to evaluate a set of the typical energy savings opportunities available in opportunity areas for steam generation and major energy using systems.”

Although the current version of the rule does not require it, the previously proposed rule distinctly identified two categories of qualified auditors: Department of Energy (DOE) Qualified Specialists, and Association of Energy Engineers Certified Energy Manager (AEE CEM).

DOE Qualified Specialists must have completed the DOE Qualified Specialist Program for all systems. The program generally consists of training, a hands-on exam, and a written exam. The systems for which DOE offers the program include:

- Steam systems
- Fan systems
- Process heater systems
- Compressed air systems
- Pump systems

The AEE CEM certification requires at least three years of experience in energy engineering or energy management (dependent upon degree) plus attendance at an AEE CEM seminar and successful exam results.

TAILORING RULE

The Tailoring Rule, addressing title V and PSD permitting for greenhouse gases, became effective on January 2, 2011.

BACT Guidance

The U.S. EPA has subsequently issued guidance to assist facilities in conducting the BACT analysis under the Tailoring Rule. The BACT steps are as follows:

1. Identify all available control technologies;
2. Eliminate technically infeasible options;
3. Evaluate and rank remaining control technologies;
4. Evaluate cost effectiveness of controls and energy and other environmental impacts; and
5. Select BACT.

Both on-site and off-site energy efficiency options are discussed in the guidance document. For on-site efficiency, the facility may consider energy efficient technologies at the source. This may include individual emissions unit (i.e., supercritical boiler). For a greenfield site, facility wide energy efficiency may be considered, with a focus on equipment that consumes the largest amount of energy and as an overall category to compare to benchmarks. Onsite efficiency should be considered in Step 1 (identify available technologies). Additionally, the rule does not require “redefining the source.” That is, a natural gas fired boiler would not necessarily be required to consider fuel switching.

Off-site energy efficiency (also known as secondary GHG emissions) might include reductions in the facility’s demand for energy that do not affect emissions within the boundary of the facility. These types of efficiencies should be considered in Step 4 (evaluate cost effectiveness of controls and energy and other environmental impacts).

The guidance document also suggests multiple sources to assist with the BACT analysis, including:

- Benchmarking
- ENERGY STAR sector-specific tools
- Energy Performance Indicators (EPIs)

- GHG Control Measures Whitepapers²
 - Combustion control optimization
 - Cooling system heat loss recovery
 - Flue gas heat recovery
 - Low-rank coal drying
 - Sootblower optimization
 - Steam turbine design

BACT Determinations

One of the first PSD permits issued which addressed GHG emissions was that of Calpine Russell City. This PSD Permit was issued in February of 2010, well before the Tailoring Rule came into effect. The permit included GHG BACT analysis and GHG permit limits. The BACT analysis determined that thermal efficiency (a turbine heat rate limit of 7,730 Btu/kWhr), operating limitations on the fire pump engine (limiting operations to testing and emergencies only), and a circuit breaker SF₆ leak detection system were BACT for the facility.³ Also considered in the BACT analysis was carbon capture and storage, which was ruled out due to storage not being considered commercially available and since no carbon sequestration has been demonstrated to be feasible in the vicinity of the facility. The permitting process considered combined cycle gas turbine efficiency and cited EPA guidance that the BACT limits should be set such that the facility could consistently achieve compliance under all anticipated operating conditions. Therefore, the anticipated efficiency takes into account such conditions as operating at less than full load, start up and shutdowns, and varying ambient conditions. The resulting CO₂e limits for turbine/HRSs were established at 242 MTCO₂e per hour. In the BACT evaluation, it was shown that the Siemens F-class turbines with FD3 upgrades were able to achieve a facility wide efficiency of 56.45% (LHV, gross, without duct firing). Although G-class turbines were also considered, the applicants noted that utilizing a smaller steam turbine actually resulted in a slightly lower facility wide efficiency.

The first PSD permit issued after the effective date of the Tailoring Rule was the Nucor Steel permit, issued by the Louisiana Department of Environmental Quality (LDEQ). The proposed permit established “good combustion practices” as BACT for GHG for the package boiler and the reformer/main gas flue stack, and an acid gas separation unit for the acid gas absorption vent. Additionally, the proposed permit established a natural gas fuel limit of 13 MMBTU per tonne of direct reduced iron (DRI) produced. In January 2011, the U.S. EPA commented on the draft permit and identified areas of concern, notably including failure to consider CCS technologies. EPA also commented on the lack of numeric emission limits on GHG, the lack of establishing baseline emissions levels and reductions, and noted that the fuel limitation was not practically enforceable.⁴ However, the LDEQ subsequently issued the permit without any revisions.

REFERENCES

1. *PSD and Title V Permitting Guidance for Greenhouse Gases* – Office of Air and Radiation – United States Environmental Protection Agency – March 2011
2. <http://www.epa.gov/nsr/ghgpermitting.html> (accessed February 2011).

3. BAAQMD Response to Comments related to Calpine Russell City. February 2010.
4. <http://www.epa.gov/region07/air/nsr/nsrmemos/nucor.pdf> (accessed August 2011).