Heat Rate Reporting Conflicts

• In preparing the Clean Power Plan (CPP) EPA used a method of calculating annual plant heat rate for coal-fired EGUs using plant data derived from CEMS data (velocity probes) and “F” factors.

• Velocity probes are not normally calibrated for low load conditions or cycling operations and a number of papers have been presented demonstrating potential errors from using this data.

• EPA stated that the annual gross heat rate Btu/kW for 840 plants in their data base for 2002 to 2012 was 9,754
Heat Rate Reporting Conflicts

• DOE/EIA Reports heat rates in two methods, annual and as test based.
  • As tested shows improved heat rates
• EIA data based on coal burned.
• EIA data is based on actual operating conditions
• EIA and EPA data conflict
• July 25, 2017 DOE reported that the heat rate for coal plants “The slight rise in the average operating heat rate in coal-fired generation is attributable to the net result of competing factors. Emissions-control investments, which often create significant station loads, were made to almost 205,000 MW of coal capacity from 2006 to 2015. These emissions-control measures increased the operating heat rates for coal-fired generation”
Heat Rate Impacts

- The plant’s design thermodynamic cycle
- Coal composition and quality - moisture
- Age and size
- Presence of pollution control equipment
- Operating and maintenance practices
- Plant component design
- Geographic location and ambient conditions
- Cooling/Condenser system - Ambient Conditions
- Electric grid dispatch requirements
  - Cycling or base load
## Comparison

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual Gross Heat Rate Btu/kWhr. EPA</th>
<th>Annual Net Heat Rate Btu/kWhr. EIA</th>
<th>Actual Tested Heat Rate Btu/kWhr. EIA</th>
<th>Capacity Factor %</th>
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Heat Rate Comparisons

Annual Gross heat rate Btu/kWhr. EPA
Annual Net Heat Rate Btu/kWhr. EIA
Actual Tested Heat Rate Btu/kWhr.
Units 1, 2, and 3 all have 50% capacity factor although their operation is very different.
Capacity vs. Heat Rate

Source: E.ON UK plc.
Impact of capacity factor on average heat rate versus full load test heat rate

Increase over Full Load HR, BTU/KWh

Capacity Factor

Ann. Avg HR minus Test HR
Linear trend
2007-2012 HR data and generation data from Energy Information Administration
Coal Impact on Heat Rate

Impact of Coal Rank on Heat Rate

- Bituminous ton
- Subbituminous tons
- Gross heat rate Btu/kWhr
- Net Heat Rate Btu/kWhr
Conclusions & Recommendations

• Heat rate measurements are an important factor in plant economics, energy efficiency and calculating emissions.

• Industry needs to have DOE and EPA working on a compatible basis