**EPA v.5.13 Base Case Documentation Appendix: Heat Rate Improvement Option**

A new feature of EPA's Base Case v.5.13 is the capability to offer coal steam model plants a heat rate improvement option that is fully integrated into the modeling framework. This capability would enable IPM to solve for the optimal deployment of heat rate improvement technologies on a plant-by-plant basis in a manner that both impacts and responds to the full suite of power sector modeling projections.

EPA understands that a variety of technical approaches have been applied at existing steam-electric units to reduce auxiliary power consumption and fuel consumption so as to increase net electrical output per unit of heat input. Several recent studies have examined opportunities for efficiency improvements as a means of reducing heat rate and emissions from coal-fired power plants; see a partial list below.

Some of the studies listed below provide estimates of potential heat rate reduction by existing U.S. coal-fired units, ranging from less than 5% to greater than 15%. EPA recognizes that the cost of and fleet-wide potential for adopting heat rate improvements is influenced by a diverse set of factors, many of which are site-specific. Absent detailed information on the unit-level, fine-grained drivers of net generating efficiency, EPA believes a reasonable approach for power sector modeling purposes is to apply a uniform heat rate improvement option (percentage reduction in net heat rate) to all eligible model plants that is representative of what might be reasonably achievable on a national average basis, at a representative national average $/kW cost.. To fully define such an option, the basic parameters that must be specified include:

- Specific suite of technologies and best practices
- Assumed performance (e.g., percent reduction in net heat rate)
- Applicability to the coal steam fleet (i.e., if and how the application of the heat rate improvement option may vary based on model plant characteristics)
- Cost (capital, operations and maintenance)
- Financial parameters necessary to construct a capital charge rate/capital recovery factor (capital structure, book life, etc.)[1]

EPA welcomes input on all aspects of how to specify this heat rate improvement capability for power sector modeling purposes.

Partial list of recent heat rate improvement studies:

"Coal-fired Power Plant Heat Rate Reductions", Sargent & Lundy SL-009597 Final Report (Project 12301-001), (January 2009), available at http://www.epa.gov/airmarkets/resource/docs/coalfired.pdf

"Reducing CO2 Emissions by Improving the Efficiency of the Existing Coal-fired Power Plant Fleet", DOE/NETL-2008/1329, (July 2008), available at http://www.netl.doe.gov/energy-analyses/pubs/CFPP%20Efficiency-FINAL.pdf

"Power Plant Performance Reporting and Improvement under the Provision of the Indian Energy Conservation Act – Output 1.1", Evonik/VGB (2008), available at http://www.emt-india.net/PowerPlantComponent/Output1.1/Output1.1.pdf

[1] See Chapter 8 for additional detail on the components of a capital charge rate and how financial assumptions impact overall cost

"Opportunities to Improve the Efficiency of Existing Coal-fired Power Plants, Workshop Report", NETL (July 2009), available at http://www.netl.doe.gov/energy-analyses/pubs/NETL%20Power%20Plant%20Efficiency%20Workshop%20Report%20Final.pdf

"Improving the Efficiency of Coal-fired Power Plants for Near Term Greenhouse Gas Emission Reductions", DOE/NETL-2010/1411 (April 2010), available at http://www.netl.doe.gov/energy-analyses/pubs/ImpCFPPGHGRdctns_0410.pdf

"Power Generation from Coal - Measuring and Reporting Efficiency Performance and CO2 Emissions", OECD/IEA-CIAB (2010), available at http://www.iea.org/ciab/papers/power_generation_from_coal.pdf

"Opportunities to Enhance Electric Energy Efficiency in the Production and Delivery of Electricity", EPRI Technical Report 1024651 (November 2011), available at http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CCsQFjAA&url=http%3A%2F%2Fwww.pserc.wisc.edu%2Fdocuments%2Fpublications%2Fspecial_interest_publications%2FEPRI_Electricity_Use_Report_Final_1024651.pdf&ei=Qo9yUvmwMYXb4AOZz4GYAw&usg=AFQjCNElzekbtoSNCR5SKFwkfbKx83p0Uw&bvm=bv.55819444,d.dmg

"Closing the Power Plant Carbon Pollution Loophole: Smart Ways the Clean Air Act Can Clean Up America's Biggest Climate Polluters", NRDC (March 2013), available at http://www.nrdc.org/air/pollution-standards/files/pollution-standards-report.pdf