



Memorandum

To: Barbara Sprungl, SRP
From: Colin Campbell
Date: November 17, 2014
Re: Review of “Building Block 1” in Proposed § 111(d) Rule on Behalf of Salt River Project

The interim and final goals proposed by EPA for the State of Arizona are 735 lb/MWh (net) and 702 lb/MWh (net), respectively. 79 *Fed. Reg.* at p. 34,957. The alternative interim and final goals proposed by EPA for the State of Arizona are 779 lb/MWh (net) and 763 lb/MWh (net), respectively. 79 *Fed. Reg.* at p. 34,898. As discussed elsewhere in this memorandum, EPA’s computation of these goals assumes that the entire fleet of twelve coal-fired EGU’s in Arizona will be shut down (i.e., zero MWh of generation and zero tons CO₂) before January 1, 2020.¹ This includes three units owned by SRP - Units 1 and 2 at the Coronado Generating Station and Unit 4 at the Springerville Generating Station – so EPA’s proposal is of particular concern to SRP.

Because EPA’s goal calculation assumes their shutdown, heat rate improvements purportedly achievable at coal-fired EGU’s in Arizona, under “building block 1,” do not affect the goals proposed by EPA. Nonetheless, assuming that EPA corrects its clear errors regarding achievability and reasonableness of CO₂ emission reductions through dispatch changes among affected EGU’s under “building block 2,” SRP requested that RTP prepare this analysis. This memorandum describes EPA’s numerous invalid assumptions and erroneous conclusions regarding heat rate improvements purportedly achievable at coal-fired EGU’s in Arizona.

Background

EPA’s computation of the proposed interim and final goals for the State of Arizona assumes a six percent improvement in heat rate before January 1, 2020, is achievable for the fleet of twelve coal-fired EGU’s in Arizona. (See, docket item EPA-HQ-OAR-2013-0602-0255.xlsx, “Appendix 1,” at cells L5 and AQ5.) Based on these purportedly achievable improvements in heat rate, EPA concludes the generation-weighted average CO₂ emission rate of the fleet of twelve coal-fired EGU’s in Arizona will decrease from 2,268 lb/MWh in 2012 to 2,132 lb/MWh in 2020. (See, docket item EPA-HQ-OAR-2013-0602-0255.xlsx, “Appendix 1,” at cells B5 and L5.)

Similarly, EPA’s computation of the proposed alternative interim and final goals for the State of Arizona assumes a four percent improvement in heat rate before January 1, 2020, is achievable

¹ EPA’s goal computation calculations are based on classification of all EGU’s at Sundt Generating Station, including the coal-fired Unit 4, as oil- or gas-fired units. As discussed elsewhere in this memorandum, EPA’s analysis of heat rate variability includes Unit 4 as a coal-fired EGU.

for the fleet of twelve coal-fired EGU's in Arizona. (See, docket item EPA-HQ-OAR-2013-0602-0255.xlsx, "Appendix 2," at cells L5 and AG5.) Based on these purportedly achievable improvements in heat rate, EPA concludes the generation-weighted average CO₂ emission rate of the fleet of twelve coal-fired EGU's in Arizona will decrease from 2,268 lb/MWh in 2012 to 2,177 lb/MWh in 2020. (See, docket item EPA-HQ-OAR-2013-0602-0255.xlsx, "Appendix 2," at cells B5 and L5.)

EPA's assumptions regarding achievability of four to six percent improvement in heat rate across the fleet of twelve coal-fired EGU's in Arizona are based on underlying assumptions regarding "improvements that could be achieved by reducing heat rate variability ... through adoption of best practices for operation and maintenance" and regarding "improvement[s] that could be achieved through further equipment upgrades." 79 *Fed. Reg.* at p. 34,860. These underlying assumptions are invalid, as discussed in detail below, leaving EPA's assumption regarding the achievable improvement in heat rate across the fleet of twelve coal-fired EGU's in Arizona clearly erroneous and entirely without foundation.

These errors are so fundamental to EPA's entire rationale for its "system," that EPA's proposal is legally flawed because EPA has not substantiated that a heat rate improvement "has been adequately demonstrated" at the levels claimed. As discussed further below, RTP disagrees with EPA's legal interpretation that it has authority to specify the level of emissions reductions achievable through the "best system," but even if EPA's interpretation were proper, before EPA could require States to consider any specific level of heat rate improvement in their plan submissions, EPA must provide an opportunity for public comment on a corrected analysis of the emissions reductions achievable through heat rate improvements.

Analysis of EPA's Assumptions Regarding Reduction in Heat Rate Variability

EPA claims to have analyzed independently the improvements in gross heat rate that could be achieved by reducing variability in gross heat rate through adoption of best practices for operation and maintenance at each of the twelve coal-fired EGU's in Arizona (See, docket item EPA-HQ-OAR-2013-0602-0255.xlsx, "GHG Abatement Measures Units," at cells J46, J56, J193, J476, J545, J546, J551, J634, J794, J867, J973, and J1043.) Remarkably, however, EPA did not take these unit-specific analyses into account in reaching a conclusion regarding the improvements in gross heat rate that could be achieved by reducing variability in gross heat rate through adoption of best practices for operation and maintenance at the fleet of twelve coal-fired EGU's in Arizona. Instead, EPA based its assumption of what is purportedly achievable for the fleet of twelve coal-fired EGU's in Arizona on the results of its analysis for a larger "study population" of 884 coal- and petroleum coke-fired EGU's. (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at p. 2-16.) Thus, even if EPA's analysis were not fundamentally flawed, its results would be indicative only of the improvements in gross heat rate which may be achievable for the "study population" as a whole, not of the improvements achievable at the coal-fired EGU's in Arizona.

In fact, EPA's analysis is riddled with fatal errors, a few of which we discuss below.

First, EPA improperly interpreted differences in reported hourly heat input as reflecting differences in heat rate. EPA attempts to hide this flaw by flagrantly mischaracterizing the analysis that it performed. In the preamble to the proposed rule, EPA describes its analysis as follows.

We used the hourly data to assess variability in the hourly gross heat rates of approximately 900 individual coal-fired steam EGUs over the period from 2002 to 2012. Specifically, the EPA evaluated the consistency with which individual EGUs maintained their hourly heat rates over time. 79 Fed. Reg. at p. 34,860.

Elsewhere in the docket, in a general description of its “heat rate improvement assessment,” EPA describes its analysis as follows.

The EPA developed unit-level statistics from over 60 million rows of hourly data. We evaluate each unit on its individual performance using heat rate variability as an indicator of the application of best practices and potential for improvement. (See, docket item EPA-HQ-OAR-2013-0602-17180, “GHG Abatement Measures,” at p. 2-16.)

Both of these characterizations are demonstrably false: EPA’s based its analysis on variability in hourly heat input NOT on variability in hourly gross heat rate. Variability in heat input is not a measure of efficiency at all.

For example, in EPA’s data set for Unit 1 at the Coronado Generating Station, there are 87 hourly records in the bin for 20 to 29 percent capacity factor and 50 to 59 °F. The p10 hour identified by EPA is 5/20/2002 at hour 1. The heat input, gross load, capacity factor, and gross heat rate for this hour are 880.3 MMBtu/hr, 95 MW, 21 percent, and 9,266 lb/MWh, respectively. EPA uses this hour as the point of comparison and the basis for hypothetical improvements (*i.e.*, reductions) in heat input for hours in the same bin but having greater heat input. For example, one of the hours for which EPA calculates an improvement is 5/28/2002 at hour 7. The heat input, gross load, capacity factor, and gross heat rate for this hour are 1,051.5 MMBtu/hr, 114 MW, 25 percent, and 9,224 lb/MWh, respectively. Notably, relative to the p10 hour, the gross load for the second hour is higher by 20 percent and the gross heat rate is lower (*i.e.*, better) by 0.5 percent. However, because the heat input during this hour is higher than the heat input during the p10 hour by 19 percent, EPA calculates an improved heat input for this hour of 1,000.1 MMBtu/hr. EPA assumes that the heat input during this hour should be decreased by 4.9 percent while maintaining gross load, improving the gross heat rate to 8,773.2 MMBtu/hr. Astoundingly, EPA’s sole basis for assuming this improvement in gross heat rate is achievable using “best practices” is the fact that the unit had previously operated for an hour at substantially lower load and with a slightly higher heat rate. Even without correcting for all other errors, simply performing the analysis in a manner that quantifies variability in gross heat rate, as EPA purported to do, rather than variability in heat input, as EPA actually did, would yield a much lower calculated value for the achievable reduction in CO₂ emission rate for the “study population” as a whole.

Second, EPA miscalculates the data distribution for certain units and certain load/temperature bins, yielding incorrectly identified p10 values and resulting in substantial overestimation of the variability in heat input. For example, in EPA’s data set for Unit 1 at the Coronado Generating Station, there are 256 hourly records in the bin for 50 to 59 percent capacity factor and 30 to 39 °F. The p10 hour identified by EPA is 11/3/2002 at hour 17. The heat input for this hour is 1,988.2 MMBtu/hr. Using this hour as the point of comparison and the basis for hypothetical improvements (*i.e.*, reductions) in heat input for hours in the same bin but having greater heat input, EPA calculates an overall 5.7 percent reduction in CO₂ emission rate for the hourly records in this bin. However, the hourly record identified by EPA is the 12th highest heat input among the 256 hourly records in this bin, which does not represent the 10th percentile. The hourly record that should have been used is the 25th highest heat input among the 256 hourly

records in this bin, which is 2/3/2003 at hour 0. The heat input for this hour is 2,115.6 MMBtu/hr. Using the correct hour as the point of comparison, without correcting for any other errors in EPA's analysis, yields an overall 4.3 percent reduction in CO₂ emission rate for the hourly records in this bin. If the analysis is performed using distribution and variability of gross heat rate hourly records rather than heat input hourly records, as discussed above, the calculation yields an overall 3.3 percent reduction in CO₂ emission rate for the hourly records in this bin.

Third, EPA's analysis, which corrects for ambient temperature and gross load, does not correct for a sufficient number of factors in order to reflect variability which might reasonably reflect an opportunity to improve heat rate through improved operating practices. For example, Unit 1 at the Coronado Generating Station switched to PRB coal in 2007. In EPA's data set for this unit, there are 256 hourly records in the bin for 50 to 59 percent capacity factor and 30 to 39 °F. These include 166 hourly records in calendar years 2002 through 2006, with average heat input of 2,356 MMBtu/hr, and 82 hourly records in calendar years 2008 through 2012, with average heat input of 2,633 MMBtu/hr. EPA's assumption that variability in heat input or gross heat rate at this coal-fired EGU over this 11-year period is indicative of the level of achievable reduction in CO₂ emission rate through application of "best practices," with no attempt to correct for the step change in heat rate occurring in conjunction with the commencement of PRB coal firing in 2007, is invalid. The analysis described above, using distribution and variability of gross heat rate hourly records rather than heat input hourly records, but using only the 82 hourly records in this bin for calendar years 2008 through 2012, yields an overall 1.5 percent reduction in CO₂ emission rate.

With respect to this coal-fired EGU and this bin, as shown by the discussion above, the three significant flaws in EPA's analysis that can be readily corrected led EPA to overstate the achievable reduction in CO₂ emission rate by a factor of four.

Fourth, EPA erroneously labels any differences in hourly heat input which are observed in the data set for a particular EGU and which cannot be explained by differences in capacity factor or ambient temperature as "heat rate variability." EPA assumes that this heat rate variability is "attributed to operation and maintenance practices" and is indicative of a "potential for heat rate improvement." (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at pp. 2-15 and 2-27.) In other words, EPA assumed that each operating hour for which a particular EGU's heat input is greater than the heat input during other operating hours for that EGU with similar ambient temperature and capacity factor, represents an opportunity to improve upon the EGU's performance during that hour. This assumption is not valid, as EPA's analysis did not attempt to take measurement error, and the potentially significant effects of this error, into account. For example, reported hourly heat input data upon which EPA relies are based on both diluent concentration monitoring data and exhaust gas volumetric flow monitoring data collected pursuant to 40 CFR part 75. The relative accuracy requirements under appendix A to part 75 are 10 percent for diluent concentration monitors and 10 percent for exhaust gas volumetric flow monitors. Measurement error in either or both of these parameters has a significant effect on the hourly heat input data relied upon by EPA, as illustrated by the following example: Assume, at a particular EGU, there are two operating hours with precisely the same actual heat input, gross electrical generation, heat rate, exhaust gas oxygen concentration, and exhaust gas volumetric flow. The actual values are as follows:

Exhaust gas flow	45.00 million scfh
Exhaust O ₂ concentration	2.00 percent
Heat input	3,800 MMBtu/hr
Gross generation	400 MW
Heat rate	9,500 Btu/kWh

The monitored exhaust gas flow and O₂ concentration, reported heat input and gross generation, and calculated heat rate for the two operating hours are as follows:

Hour 1

Exhaust gas flow	42.75 million scfh
Exhaust O ₂ concentration	2.10 percent
Heat input	3,591 MMBtu/hr
Gross generation	400 MW
Heat rate	8,980 Btu/kWh

Hour 2

Exhaust gas flow	47.25 million scfh
Exhaust O ₂ concentration	1.90 percent
Heat input	4,011 MMBtu/hr
Gross generation	400 MW
Heat rate	10,030 Btu/kWh

Each of these hypothetical data sets is entirely plausible and is representative of real-world conditions. In the first hour, the monitored exhaust gas flow rate and exhaust gas oxygen concentration are high by 5 percent and low by 5 percent, respectively; in the second hour, the monitored exhaust gas flow rate and exhaust gas oxygen concentration are low by 5 percent and high by 5 percent, respectively. Each of the measurement error levels reflected in these examples is well within the 10 percent relative accuracy permissible under the regulations. The apparent “heat rate variability” is a difference of 1,050 Btu/kWh (gross), or approximately 11 percent. EPA’s methodology would assume this variability represents an opportunity for heat rate improvement, while in fact it represents nothing more than measurement error, permissible under EPA’s regulations. Although it completely ignores the effect of measurement error on variability in reported heat input and gross heat rate for purposes of this analysis, EPA recognizes the significance of measurement error elsewhere in the docket for the proposed rule. For example:

During Relative Accuracy Testing Audits (RATA) testing for stack gas flow meters, Part 75 allows units to use either the standard Reference Method 2 or an optional method in order to increase the accuracy of and to minimize over reporting of CEMS stack gas volumetric flow data.... 40 CFR Part 75 specifies that these alternative methodologies are optional. Therefore, there may be inconsistencies between emissions or heat input values when a unit changes the reference method used during flow RATAs, which could impact comparisons between emissions and heat input between time periods under which different reference methods are used. (See, docket item EPA-HQ-OAR-2013-0602-0461, “Technical Support Document: Part 75 Monitoring and Reporting Considerations,” at p. 7.)

Fifth, EPA's data set is inappropriate, as it includes units that are not subject to the proposed rule, such as the units at Navajo Generating Station and Unit 4 at the Sundt Generating Station (ORIS code 126). Variability in hourly heat input or gross heat rate at units that will not be subject to the proposed rule is not indicative of an opportunity for heat rate improvement at the coal-fired EGU's which would be subject to the rule.

Sixth, EPA's inferences with respect to a causal relationship between high variability in calculated hourly gross heat rate data and poor heat rate performance are without foundation. EPA observes a positive statistical correlation between the level of variability in calculated hourly gross heat rate data and annual gross heat rate (*i.e.*, a negative correlation between variability and efficiency). From this observation, EPA draws a critical inference regarding causal relationship:

These results indicate that, other factors held equal, if an EGU reduces heat rate variability, generally heat rate performance will improve. (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at p. 2-28.)

However, as discussed previously, the "heat rate variability" on which EPA relies so heavily is not necessarily an indicator of actual changes in heat rate performance. To at least an extent, this observed correlation is an indicator that units with better heat rate performance have more accurate part 75 monitoring systems. While a laudable goal, improving the performance of part 75 monitoring systems is not a viable method of reducing CO₂ emissions.

Seventh, EPA's assumptions regarding the magnitude of improvements in gross heat rate achievable through adoption of best practices for operation and maintenance are invalid. Having incorrectly labeled all differences in hourly heat input or calculated hourly gross heat rate which are observed in the data set for a particular EGU and which cannot be explained by differences in capacity factor or ambient temperature as opportunities for potential improvement in gross heat rate, EPA assumes, without explanation, that these improvements are achievable through "practices such as turning off unneeded pumps at reduced loads, installation of digital control systems, more frequent tuning of existing control systems, or earlier like-kind replacement of worn existing components." 79 *Fed. Reg.* at p. 34,860. Although it is incontrovertible that these practices are potential methods for improving heat rate performance at a given EGU at which they have not already been implemented, EPA has provided no data or information whatsoever connecting these practices to its assumptions regarding achievability, costs, and overall reasonableness of improvements in gross heat rate. Instead, EPA's estimate of a four percent across-the-board improvement reflects nothing more than a completely arbitrary fraction of the variability in hourly heat input which EPA erroneously believes it has observed in the data set for its "study population:"

Assuming that between 10 percent and 50 percent of the deviation from top decile performance in each subset of hourly heat rate observations within defined ranges of temperature and load could be eliminated through adoption of best practices, the result is a corresponding estimated range of 1.3 percent to 6.7 percent technical potential for improvement in the average heat rate of the entire fleet of coal-fired EGUs. Based on this analysis, we believe a reasonable estimate for purposes of developing state-specific goals is that affected coal-fired steam EGUs on average could achieve a four percent improvement in heat rate through adoption of best practices to reduce hourly heat rate variability. This estimate corresponds to the elimination, on average across the fleet of affected EGUs, of 30 percent of the deviation from top-decile performance in the hourly

heat rate for each EGU not attributable to hourly temperature and load variation. 79 Fed. Reg. at p. 34,860. (Internal footnote omitted.)

In addition to the analysis of hourly data discussed above, EPA offers another explanation for its arbitrary assumption that four percent improvement in gross heat rate is achievable, based on a more simplistic analysis of data for the same “study population:”

[I]f each unit achieved heat rate performance equal to its best three-year moving average, the study population as a whole would post a 3.9% heat rate improvement. (See, docket item EPA-HQ-OAR-2013-0602-0437, “GHG Abatement Measures,” at p. 2-34.)

This explanation is similar to, and even less technically supportable than, the first. The following example, involving a unit at which a change in coal source was implemented, will illustrate the utter lack of reason underlying EPA’s conclusion. At Coronado Unit 2, owned and operated by SRP, the average gross heat rate from 2004 through 2006 was 9,257 Btu/kWh, the best three-year average for this EGU during EPA’s study period. Following a switch to PRB coal, the average gross heat rate from 2007 through 2011 was 9,827 Btu/kWh. This represents an increase in gross heat rate of approximately six percent, at least in part due to the higher moisture content of PRB coal. The only sensible conclusions that can be drawn from these data with respect to “building block 1” are that switching to a high-moisture coal, such as PRB coal, causes an increase in heat rate which can be reversed by switching to a low-moisture coal. EPA incorrectly characterizes this change as “heat rate variability” which can be reversed through “practices such as turning off unneeded pumps at reduced loads, installation of digital control systems, more frequent tuning of existing control systems, or earlier like-kind replacement of worn existing components.” 79 Fed. Reg. at p. 34,860. Having failed to identify the cause of the increase in heat rate (*i.e.*, switching to PRB coal) and the potentially available method of reversing it (*i.e.*, switching to low-moisture coal), EPA completely fails to assess the economic and non-GHG environmental impacts of this technique for improving heat rate.

The flawed analysis described above is critical to EPA’s conclusions with respect to reductions in CO₂ emissions achievable in Arizona under “building block 1.” The goal computation for the State of Arizona must be corrected to remove the effect of unfounded assumptions regarding improved heat rate performance achievable through implementation of best practices for operation and maintenance of coal-fired EGU’s.

Additional Analysis of EPA’s Assumptions Regarding “Best Practices”

In addition to its analysis of variability in hourly heat input rate and gross generation data for the “study population,” EPA also asserts that the 2009 Sargent & Lundy study supports its conclusion regarding the achievability of improvements in heat rate at coal-fired EGU’s at no cost or low cost. (See, docket item EPA-HQ-OAR-2013-0602-17180, “GHG Abatement Measures,” at p. 2-33.) EPA specifically cites the following nine practices discussed in the study:

- Condenser Cleaning
- Intelligent Soot Blowers
- ESP Modification
- Boiler Feed Pump Rebuild
- Air Heater and Duct Leakage Control
- Neural Network

- SCR System Modification
- FGD System Modification
- Cooling Tower Advanced Packing

SRP commissioned Sargent & Lundy to evaluate the opportunities for heat rate improvements, through these and other techniques, at the two coal-fired EGU's at its Coronado Generating Station. Contrary to EPA's assumptions, the results of this study indicate there is no opportunity for heat rate improvements as a result of implementing these practices at either of these units. *Unit Heat Rate Improvement Study at Coronado Generating Station (SL-012487)*, November 13, 2014. Sargent & Lundy.

Analysis of EPA's Assumptions Regarding Equipment Upgrades

In the preamble to the proposed rule, EPA identifies only one source of information as the basis for its conclusions regarding heat rate improvements through equipment upgrades:

For the equipment upgrade analysis, we evaluated potential opportunities to improve heat rates at affected EGUs through specific upgrades identified in the 2009 Sargent & Lundy study. In that study, Sargent & Lundy estimated ranges of potential heat rate improvement achievable through a variety of equipment upgrades.... We screened the upgrades from the study to identify what we consider to be a reasonable subset of equipment upgrades that would generally be beyond the scope of investments we would expect to be made for purposes of achieving the best-practices heat rate improvements discussed above. Based on the average of the study's ranges of potential heat rate improvements from the various upgrades in this subset, implementation of the full subset of appropriate opportunities at a single EGU could be expected to result in an aggregate heat rate improvement of approximately four percent (incremental to the improvement achievable from adoption of best practices). *79 Fed. Reg.* at p. 34,860.

The inferences drawn by EPA from the 2009 Sargent & Lundy study regarding aggregate heat rate improvement are inappropriate, for at least two reasons. First, the numbers presented in the study did not reflect any analysis of improvements actually achieved or determined to be achievable at any particular EGU:

Heat rate improvements described in the 2009 Report case studies were estimated at a conceptual level, and were not based on any site-specific detailed analysis. In addition, verification of actual heat rate improvements was not made to determine whether any of the modifications were implemented and what actual heat rate improvements were realized based on detailed design. *Unit Heat Rate Improvement Study at Coronado Generating Station (SL-012487)*, November 13, 2014. Sargent & Lundy.

Second, EPA initially assumes that the heat rate improvements which may be achievable at a hypothetical EGU at which those improvements have not already been made are informative as to the achievable improvements in heat rate for the fleet of twelve coal-fired EGU's in Arizona. EPA recognizes and acknowledges that this assumption has no basis "because the EPA expects that a significant fraction of the coal fleet has already applied some or many of the available [heat rate improvement] methods." (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at p. 2-36.)

Pursuant to 42 U.S.C. 7414(a), EPA has broad authority to gather information for the purpose of carrying out its responsibilities under the Clean Air Act, and frequently exercises that authority for purposes of collecting information from entities potentially subject to a new regulation. (See,

for example, "Supporting Statement for EPA Information Collection Request No. 2411.01," March 23, 2011, available at <http://www.reginfo.gov/public/do/DownloadDocument?documentID=227374&version=2>, providing EPA's estimated cost burden of 66,000 hours and \$29 million to be imposed on regulated entities for responding to the information request and citing as justification EPA's conclusion "that obtaining updated information will be crucial to informing its decisions [regarding emission standards under Clean Air Act § 111 and § 112] for petroleum refineries.") However, recognizing that exercising this information-gathering authority in this instance would be inconvenient and might interfere with its agenda-driven timeline for establishing emissions guidelines, EPA simply throws up its hands regarding the lack of pertinent, readily available data:

The EPA has found no comprehensive data set on the extent to which specific [heat rate improvement] methods have already been applied at individual EGUs. The EPA believes that many EGU owners consider such information to be confidential. (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at p. 2-36.)

Reflecting an apparent assumption that it is not necessary to gather and analyze the data which would allow an assessment of the achievable heat rate improvements at the specific EGU's which would be subject to the standards of performance which EPA is proposing should be established, EPA proceeds to establish emission guidelines for Arizona and other states, believing that this fatal flaw can be fixed by cutting in half the entirely unrepresentative estimate it generated based on inadequate, generic data:

[W]e recognize that this total may overstate the average equipment upgrade opportunity across all EGUs because some EGUs may have already implemented some of these upgrades. We therefore propose to use as a data input for purposes of developing state goals an estimate that, on average across the fleet of affected EGUs, only half of the full equipment upgrade opportunity just described remains—*i.e.*, that for the fleet of affected EGUs as a whole, the technical potential for heat rate improvements from equipment upgrades incremental to the best-practices opportunity is on average two percent rather than four percent. 79 *Fed. Reg.* at p. 34,860.

A review of pertinent data for Units 1 and 2 at SRP's Coronado Generating Station illustrates the type of information that EPA would have collected if it had undertaken the data-gathering that is crucial for reasoned decision-making. First, EPA would have seen that SRP already performed several of the equipment upgrades identified in the 2009 Sargent & Lundy study for these units before 2012, eliminating opportunities for heat improvements relative to a 2012 baseline. As detailed in a recent study performed by Sargent & Lundy, rather than an opportunity for an aggregate heat rate improvement of four percent as suggested by EPA, the achievable improvement in net heat rate through equipment upgrades at each of the two coal-fired EGU's at its Coronado Generating Station is at most one percent. *Unit Heat Rate Improvement Study at Coronado Generating Station* (SL-012487), November 13, 2014. Sargent & Lundy. Second, EPA would have seen that, rather than opportunities for improvement in net heat rate relative to a 2012 baseline, SRP is required to undertake costly capital projects merely to avoid significant increases in net heat rate due to the ill-advised air pollution control requirements imposed by EPA. In particular, the requirement for SCR at Coronado Unit 1 under the Federal Implementation Plan promulgated in 2012 (77 *Fed. Reg.* 72,512) is expected to increase net heat rate by at least one percent, completely offsetting the potentially achievable improvement in heat rate through an \$11.3 million turbine upgrade at this coal-fired EGU. Thus, there is no opportunity for heat rate improvement as this unit.

Even more remarkable than EPA's erroneous assumptions regarding achievable improvements in net heat rate at coal-fired EGU's constructed in or before the 1970's, such as those at SRP's Coronado Generating Station, is the fact that EPA made the same assumptions for state-of-the-art coal-fired EGU's such as the SRP-owned Unit 4 at Springerville Generating Station. This unit commenced operation in 2009 and, based on the part 75 monitoring data which was the basis for EPA's analysis of heat rate variability, has a gross heat rate of approximately 8,800 Btu/kWh. This is approximately 10 percent less than the average for EPA's "study population," reflecting the fact that the initial design of this and other state-of-the-art units includes the technological upgrades upon which EPA based its assumptions regarding achievable improvements in net heat rate at coal-fired EGU's. Because the goal computations performed by EPA omit any consideration whatsoever of the improvements achievable through equipment upgrades at coal-fired EGU's which commenced operation in or after 2009, these units must be excluded from coverage under the proposed regulation.

Although EPA is clear that the 2009 Sargent & Lundy study is the sole basis for its assumption regarding the achievability of heat rate improvements through equipment upgrades, EPA also summarily discusses other sources of purportedly pertinent data that it considered. One of those is a subset of the "study population" of 884 EGU's discussed previously:

The EPA inspected the study population to find examples of EGUs that made significant year-to-year improvements in heat rate. After filtering out those cases that may have been the result of changes in capacity factor, reporting method, or other events, we identified 16 EGUs that reported a single year-to-year heat rate improvement of 3-8%. In two of these cases we were able to identify equipment upgrades responsible for 2-3% heat rate improvement using the applicable estimates from the Sargent & Lundy 2009 study. Similarly, in the other cases, while our research was unable to confirm specific equipment upgrades, based on the elimination of other possible explanations we believe that equipment upgrades were the most likely cause of some of the observed heat rate improvements. (See, docket item EPA-HQ-OAR-2013-0602-17180, "GHG Abatement Measures," at pp. 2-32 through 2-33.)

As with the earlier discussion of hour-to-hour variability, the inferences drawn by EPA based on apparent year-to-year improvements in gross heat rate shown by the "study population" data set are not appropriate. There are at least two fatal flaws in EPA's logic with respect to this data set. First, as discussed previously, fluctuations in reported heat input rate are more likely the result of measurement error or factors other than actual improvements in EGU efficiency. Here, having admitted that it had no basis for presuming that the observed fluctuation in gross heat rate at fourteen of the sixteen referenced EGU's was attributable to an equipment upgrade, EPA did not even attempt to determine whether the purported improvements in heat rate were sustained. Second, in 2012, at the conclusion of EPA's study period, of the sixteen referenced EGU's at which EPA touts the efficiency gains purportedly achieved through equipment upgrades, eight had a gross heat rate higher than the 9,753 Btu/kWh which EPA claims is the average for the "study population" as a whole. In other words, EPA's presumption, even if it were true, would show only that equipment upgrades can be used to achieve the 2012 baseline level; it would not be informative as to whether widespread equipment upgrades can be used to achieve heat rate improvements beyond that level, which is what EPA's proposal would require.

More robust analyses of the potential improvements in heat rate of coal-fired EGU's have been performed by agencies within the federal government which, in contrast with EPA, have

particular expertise in efficiency and reliability of fossil fuel-fired EGU's. The results of these analyses include key findings overlooked by EPA:

As these results show, the potential reduction in emissions (in percent terms) is greatest when the base plant (before retrofit) is less efficient. This is a recurring theme throughout the analysis, and is intuitive: **when efficiency improvements are performed at an existing coal unit, there is greater potential for improvement at a unit that operates less efficiently to begin with, than at a newer unit with an already-low heat rate.**

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These results illustrate that a “one-size fits all” solution does not exist when it comes to power plant retrofits, and that some retrofits may not make sense for certain plants, such as pulverizer upgrade for Plant B. Instead, utilities are likely to weigh their options based on the expected plant life, anticipated fuel costs, and other such factors – such as familiarity with a technology – before making the decision to invest in capital improvements. (Emphasis in original.) (*Options for Improving the Efficiency of Existing Coal-Fired Power Plants*, DOE/NETL-2013/1611. U.S. Department of Energy, National Energy Technology Laboratory. April 1, 2014.)

EPA's Failure to Address NSR Implications

EPA's assumptions regarding the achievable improvement in heat rate across the fleet of twelve coal-fired EGU's in Arizona, both through adoption of best practices for operation and maintenance and through equipment upgrades, are based in part on a complete failure to take account the chilling effects and the significant costs of the New Source Review (“NSR”) programs under the Clean Air Act, 42 U.S.C. §§ 7475 and 7502(c)(5). EPA's assumptions regarding achievability of increased capacity factor at NGCC EGU's similarly fails to take these effects into account. The NSR programs are addressed by EPA only summarily, through hand-waving rather than through any substantive analysis, in the preamble to the proposed rule. EPA's unsupported conclusion with respect to the NSR program is as follows:

As a result of such flexibility and anticipated state involvement, we expect that a limited number of affected sources would trigger NSR when states implement their plans.
79 *Fed. Reg.* at p. 34,929.

EPA's analysis of economic impacts of the proposed rule does not address any costs for even the “limited number” of NSR-triggering projects that it acknowledges would occur.

More importantly, EPA also fails to recognize the fact that the predominant costs of compliance with the NSR programs are incurred not in the context of obtaining NSR permits but in efforts to avoid triggering preconstruction NSR permitting. EPA's speculation regarding the number of stationary sources which would actually trigger preconstruction NSR permitting is therefore not informative as to the total costs which, if it were possible to achieve the heat rate improvements and increased capacity factor required by the proposed rule, would be incurred by owners and operators of affected EGU's in order to comply with NSR program requirements. Although EPA took the more convenient and expedient approach in the impacts analysis for this proposed rule, completely ignoring the “NSR permit avoidance” compliance option available to owners of affected EGU's and overlooking the costs of this compliance mechanism, it is not because EPA is unaware that this compliance mechanism is frequently used. For example, in both internal and external correspondence regarding the project proposed by the Wisconsin Electric Power Company (“WEPCO”), which ultimately led to the landmark WEPCO court decision, U.S. EPA

officials specifically recognized the possibility that WEPCO would implement emissions-reducing measures in order to avoid preconstruction NSR permitting requirements:

WEPCO might avoid both PSD and NSPS applicability by adding or enhancing pollution control equipment, or in the case of PSD, restricting operations below maximum potential such that the emissions increases necessary to trigger applicability would not occur. The WEPCO should discuss its plans in this regard with EPA.... Thus, although this memorandum will serve to answer many of the questions necessary to reaching final determinations, you should advise WEPCO that ultimately applicability depends upon changes in emissions after the renovations and whether the company decides to take the steps which would enable it to lawfully avoid coverage. (See, September 9, 1988, memorandum from D.R. Clay of U.S. EPA to D.A. Kee of U.S. EPA, available at www.epa.gov/region07/air/nsr/nsrmemos/wpco2.pdf.)

WEPCO may lawfully avoid both PSD and NSPS requirements by adding or enhancing pollution control equipment, or, in the case of PSD, restricting operations below maximum potential, such that the emission increases necessary to trigger applicability would not occur. Based on information supplied by WEPCO, it is our understanding that the company already intends some enhancement of pollution control equipment, and WEPCO may desire to undertake a combination of the measures outlined above rather than subject itself to the Act's new source requirements. If this is indeed the case, WEPCO should so inform me so that appropriate discussions may be held between WEPCO, this office, and the State, regarding the steps that would be necessary to render the project not subject to PSD and NSPS. (See, September 12, 1988, letter from D.A. Kee of U.S. EPA to J.W. Boston of WEPCO, available at www.epa.gov/region07/air/nsr/nsrmemos/wscnsnel.pdf.)

In addition, in responding to Congressional oversight regarding its implementation of the NSR programs for coal-fired EGU's, EPA touted the flexibility provided by the NSR program for implementation of emissions-reducing measures in order to avoid preconstruction NSR permitting requirements:

EPA regulations contain broad "netting" provisions that enable source owners to offset emissions increases with equivalent reductions and thereby avoid the applicability of new source emissions standards or BACT limits. Under NSPS, netting may occur within the affected facility (e.g., an individual utility boiler) and involve physical restrictions on emissions capabilities (such as addition of pollution control equipment). Under PSD and nonattainment area new source review, netting may occur within the entire plant and may involve operational as well as physical restrictions on the plant's emissions. (See, June 19, 1991, letter from W.G. Rosenberg of U.S. EPA to J.D. Dingell, Chairman of the Subcommittee on Oversight and Investigations in the U.S. House of Representatives.)

Under RTP's view of the NSR program, the owner or operator of an EGU is empowered to employ any method or technique it chooses, either voluntarily or through enforceable permit terms, to avoid emissions increases and thereby avoid preconstruction NSR permitting requirements. Compliance with the NSR program even under this interpretation is exorbitantly costly, but not as costly as it would be if source owners and operators were constrained with respect to the available techniques for avoiding emissions increases. Yet that constraint is precisely what EPA seeks to do under its so-called "NSR enforcement initiative." For example, in a brief filed in *U.S. v. DTE Energy*, EPA presents its enforcement theory:

Meanwhile, DTE has developed unique policies with the express purpose of avoiding NSR scrutiny during the recordkeeping and reporting window.... The company [] artificially inflates the price of electricity from time-to-time with the express purpose of temporarily depressing generation from a given unit, such that no annual emissions increase would be reported to regulatory authorities. These tactics are temporary measures to avoid NSR, but the types of "life extension" projects at issue can add decades to the life of a power plant.

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EPA has also stated, in an applicability determination from Administrator Lisa Jackson, that a source cannot avoid NSR by artificially managing emissions to stay within its baseline. (See, Civil Action No. 2:10-cv-13101, E.D. Mich., "Plaintiff's Opposition to Defendants' Motion for Summary Judgment Based on the 2002 NSR Reform Rules," Docket #114, July 8, 2011.)

As EPA's enforcement arm continues to seek a court willing to accept this theory of NSR enforcement, EPA's program office in the context of its regulatory impact analysis for the proposed rule takes a diametrically opposed position. As shown by the following statement in the preamble to the proposed rule, EPA's conclusion regarding a small number of EGU's at which preconstruction NSR permitting requirements will be triggered is based on the assumption that, even for a modification to an EGU which is initially projected to cause a threshold emissions increase, the owner or operator of the EGU can lawfully evade NSR simply by hoping that electric demand will not increase:

[A] state could decide to adjust its demand side measures or increase reliance on renewable energy as a way of reducing the future emissions of an affected source initially predicted (without such alterations) to increase its emissions as a result of a CAA section 111(d) plan requirement. In other words, a state plan's incorporation of expanded use of cleaner generation or demand-side measures could yield the result that units that would otherwise be projected to trigger NSR through a physical change that might result in increased dispatch would not, in fact, increase their emissions, due to reduced demand for their operation. 79 *Fed. Reg.* at p. 34,928.

EPA has not demonstrated how such an approach is consistent with the existing major NSR provisions that require a major source to project post-change emissions before undertaking a project. With respect to demand growth, EPA has explicitly stated even if a facility could have met the level of demand before a change, if "...it can be shown that the increase is related to the changes made to the unit, then the emissions increases resulting from the increased operation must be attributed to the modification project..."²

Moreover, EPA's assurances that few projects at existing EGU's implemented for the purpose of complying with the proposed rule will trigger preconstruction NSR permitting requirements ring hollow, as those assurances are reminiscent of EPA's earlier statements regarding maintenance projects, and pollution control projects. For example, in 1991, EPA assured Senator John Dingell, that the WEPCO ruling would not affect power plant life extension projects.³ EPA then proceeded to initiated enforcement actions against all "life extension projects."

² "Technical Support Document for the Prevention of Significant Deterioration and Nonattainment Area New Source Review Regulations," U.S. EPA Nov. 2002.

³ See letter from William Rosenberg, Assistant Administrator Office of Air and Radiation, U.S. EPA, to Senator John Dingell, June 19, 1991.

With regards to pollution control projects, until 2005, EPA implemented a pollution control technology exclusion from major NSR for environmentally beneficial projects. In 2005, the DC Circuit overturned that exclusion as contrary to the CAA. EPA later filed a request asking the Court to specify that its mandate would not have retroactive effect (which the Court found not ripe for decision); yet, at the same time, EPA's enforcement office filed enforcement actions against coal-fired utilities that relied on EPA's PCP exclusion in good faith. With this history, EPA cannot expect any facility to trust that EPA would craft a legally supportable exclusion that would be upheld by the Court, and that EPA would not enforce against a facility relying on such an exclusion, when a Court later rules against that exclusion.

Indeed, EPA's request for comments regarding the appropriateness of a categorical exemption from NSR for projects undertaken to comply with the proposed rule is a red herring and is disingenuous. It is telling that this, a legal issue plainly turning on the clarity of statutory language and on congressional intent, is nowhere raised in the "Legal Memorandum" prepared by EPA, the express purpose of which is to "provid[e] background for the legal issues discussed in the preamble for [the] proposed rule." (See, docket item EPA-HQ-OAR-2013-0602-0419, "Legal Memorandum for Proposed Carbon Pollution Emission Guidelines for Existing Electric Utility Generating Units," at p. 1.) As EPA is well aware, policy-driven exemptions such as this are contrary to the broad statutory language governing applicability of the NSR program to modifications at existing EGU's, and efforts to provide these exemptions has been consistently rejected by the courts. *New York v. EPA*, 413 F.3d 3 (D.C. Cir. 2005); *New York v. EPA*, 443 F.3d. 880 (D.C. Cir. 2005).