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March 30, 2004

The Honorable Michael O. Leavitt
Administrator
Air Docket
Environmental Protection Agency
Mail Code: 6102T
1200 Pennsylvania Ave., NW
Washington, DC 20460
Attention: Docket ID No. OAR-2003-0053

Re: Comments on Proposed Rule 69 FR 4566 to Reduce Interstate Transport of Fine Particulate Matter and Ozone, Docket ID No. OAR-2003-0053

Dear Administrator Leavitt:

The Ozone Transport Commission (OTC) is providing these comments to Docket ID No. OAR-2003-0053 in response to U.S Environmental Protection Agency's (EPA's) proposed rule for its January 30, 2004 publication entitled "Rule to Reduce Interstate Transport of Fine Particulate Matter and Ozone (Interstate Air Quality Transport Rule)."

As a multi-state organization created under the Clean Air Act (CAA), we are responsible for advising EPA on transport issues and for developing and implementing regional solutions to the ground-level ozone problem in the Northeast and Mid-Atlantic regions. Our members are: Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

The effect of this rule is paramount to the OTC because of the significant ozone nonattainment problem in the Northeast and Mid-Atlantic States. The potential impact of this rulemaking, be it positive or negative, on our states' abilities to protect the public health of their citizens and achieve attainment within the federally mandated timeframes makes it possibly the most important federal action on this issue since the Clean Air Act Amendments of 1990.

To be clear, attainment of the federal, health-based eight-hour ozone standard, on time, is of critical concern to the OTC member states. Continued nonattainment of this standard would prolong exposure of some 25 millions citizens to unhealthy air quality levels and exacerbate economic inequities as well, including the imposition of sanctions. EPA should strive to address both the ozone and fine particulate pollutants, with equal priority, so that the affected sectors are addressed comprehensively to achieve the standards as soon as practicable but not later than the statutorily prescribed attainment dates.

The OTC Supports a multi-pollutant approach for the power sector as the most cost-effective means of facilitating emission reductions of ozone and its precursors. States have multiple environmental responsibilities in terms of State Implementation Plans (SIPs) for ozone, fine particulate matter ($PM_{2.5}$), and regional haze. To this end, any program attempting to provide certainty to the electrical generating sector must address nitrogen oxides (NO_x), sulfur dioxide (SO_2), and mercury emissions to adequately protect public health and the environment. Control levels, be they performance standards or allowance caps, should be set to ensure national annual emissions consistent with maximum control technology available within a timeframe consistent with attainment and other regulatory deadlines, and in manner that will ensure maximum effectiveness in nonattainment areas and regional haze Class I areas.

OTC is also demonstrably supportive of cap and trade programs for non-hazardous air pollutants. OTC member states have already achieved 70% NO_x emission reductions as part of the NO_x Budget Program, which in large measure reflects the kind of emission reductions we are seeking from upwind states. During the 2003 ozone season, the OTC successfully implemented its NO_x cap and trade program that we believe serves as a successful model for the proposed IAQR. As demonstrated herein by our detailed comments and support documentation, while the IAQR is not yet what we need in terms of reductions, the proposal is an appropriate vehicle for finally addressing the transport of pollutants from this sector, and we are very encouraged that EPA has chosen to move forward with a rule.

The Mid-Atlantic and Northeast states have spent the last several months crafting and adopting a position to clearly define what we need in reductions of nitrogen oxides as part of an overall attainment strategy. We believe the adopted OTC position represents a fiscally and technically sound effort to protect public health - in a cost effective manner and on a realistic, achievable, timetable. We urge EPA to modify its IAQR to incorporate the OTC platform.

Our approach is straightforward. Our analysis demonstrates that we need significant reductions from the power sector <u>and</u> other large stationary NO_x sources <u>in addition to</u> other national, regional, and local mobile and area source measures, to have any hope of achieving attainment. Our modeling further demonstrates that even with the Interstate Air Quality Rule (IAQR), there remains significant air pollution being transported – and cost effective emission reduction opportunities within the remaining upwind inventory – to warrant significantly greater reductions within this rule.

We propose the following national emission reductions and timeframes to apply to the EGU Sector as part of an overall attainment strategy *(OTC Proposal attached as Appendix A)*:

	National Cap Numbers
SO_2	• 2008: 3.0 MT *<u>interim</u>* • 2012: 2.0 MT
NO_X	• 2008: 1.87 MT *<u>interim</u>* • 2012: 1.28 MT
Hg	• 2008: 15 ton <u>interim</u> cap • 2012: 10 ton maximum cap • 2015: Performance based standard yielding approximately 5 tons per year

The OTC supports trading of SO_2 and NO_x allowances within national, regional caps on an annual and seasonal basis, established as part of the federal program to help attain the ozone and particulate national ambient air quality standards (NAAQS). To ensure the allowances have the desired affect on emissions, progressive flow control may be needed, particularly for SO2. The OTC does not support a cap and trade program for mercury.

The approach EPA has set forth in the Interstate Air Quality Transport Rule (IAQR) has the potential to go a long way toward meeting the goals of addressing these emissions comprehensively and we applaud EPA for its efforts. If adopted with too weak caps, however, it can have the opposite effect – condemning states to continued nonattainment and the industry to increasing uncertainty. As such, we have overarching and some very specific concerns with the level of control sought and approach suggested by EPA in this proposal, and present those concerns first, followed by more details on our recommendation.

We have put much effort into developing the technical basis and policy consensus needed for a regional approach toward attaining the eight-hour standard in the Northeast and Mid-Atlantic states. We have also been working constructively with EPA the past several years to make our needs for a rule to adequately address transport very clear. We stand ready to continue to collaborate with EPA on the technical analysis and policy development. We hope that EPA will be receptive to the unique needs and extensive technical experience our member states offer, make use of the work we have done, and revise its proposal accordingly.

Thank you for the opportunity to comment. We look forward to seeing the next iteration of this very important rule.

Sincerely,

Christopher Recchia
Executive Director

cc: OTC Members

OVERARCHING CONCERNS

General

The Interstate Air Quality rulemaking is perhaps the most important step EPA can now take toward improving air quality and public health. It is critical, however, that this action provides substantial environmental, health and welfare benefits through reductions that go as far as necessary to ensure our region is able to achieve the national ambient air quality standards for ozone and fine particulates in the timeframes mandated in the CAA.

OTC has long acknowledged that the severity and complexity of its regional ground-level ozone problem does not allow for a "silver bullet" approach to attainment. Thus, no one regulation of any one sector will achieve the level of reductions needed to solve the region's complex ozone problem. Reductions sought from any one sector must be considered as a component of the total reductions needed for an attainment strategy for the region. EPA is considering the EGU sector in this rule, and we are willing to support such an approach as long as the reductions are in the context of and contributory to an overall attainment strategy.

Public Health

The standards we are seeking to achieve are not just targets; they are scientifically sound, health-based standards. The goal of any emission reduction strategy proposed by EPA must be to maximize public health benefits by meeting these standards. While EPA must consider the costs in proportion to benefits in recommending specific control measures, the significant public health benefits from reductions in this sector warrant further reductions. In terms of $PM_{2.5}$ reductions alone, the public health benefits from our proposed SO_2 cap would outweigh the costs by over 10:1.

Without significant reductions that help us meet attainment, states will continue to incur millions of respiratory-related illness days each year, tens of thousands of additional hospital visits - 50,000 emergency room visits in the northeast alone - and all the costs and public health impacts associated with exposing over 27 million children, 2 million with Asthma, to unhealthy air quality, all due to ozone alone (CATF, May 2002). Failure to meet the particulates standard on time means tens of thousands of additional premature deaths each year.

Outdoor air pollution, notably Ozone and Particulate Matter (PM), increases the incidence of health problems experienced by people suffering from asthma. Hospital events may be considered the "tip of the iceberg" when considering the health consequences of increased ozone levels. In an examination of mortality and hospital admission in New York City from annual adverse ozone impacts avoided by the implementation of the eight-hour standard versus current Clean Air Act implementation, hospital admissions only represented less than one-percent of all adverse effects – the top of the pyramid – while acute respiratory symptom days per year (days when person experience chest discomfort, coughing, wheezing, etc.) were nearly two million (Thurston, 1997).

Attainment Strategy

The levels of emission reductions from the power sector as outlined in the current proposal do not provide an opportunity for attainment – and in many ways would hinder states from seeking the additional reductions needed as part of an overall attainment strategy. Furthermore, the unnecessarily weak reductions over long timeframes juxtaposed to the standards of the CAA actually increase uncertainty for the sectors regulated – the opposite effect EPA is trying to achieve with a multi-pollutant rule.

EPA's own analysis of current implementation of CAA requirements – or "business as usual" – presented to the Edison Electric Institute (EEI) September 18, 2001(*attached as Appendix B*) acknowledges that not only will implementation of current programs not achieve sufficient reductions of NO_x, SO_2, or mercury from the power sector, but that they would come at a much higher cost because states would be forced to seek additional reductions to meet SIP obligations. The "straw proposal" EPA considered at this meeting as an alternative to "business as usual" called for NO_x emissions to be capped at 1.87 million tons in 2008 and 1.25 million tons in 2012; SO_2 emissions at 2.0 million tons in 2010; and, mercury at 24 tons in 2008 and 7.5 tons in 2012.

Ozone

Our analysis demonstrates that we must achieve significant emission reductions from the power sector - comparable to that proposed in EPA's straw proposal - in addition to stringent local and regional emission controls, to make meaningful progress toward attainment in the mandated 2010-2013 timeframe. Anything less than this would force states to seek additional reductions from this and other sectors – adding costs and uncertainty to industry – the alternative EPA has already acknowledged will be the logical outcome.

Our CALGRID screening modeling shows we cannot achieve 8-hour ozone attainment under the "business as usual" approach, or under the Clear Skies Act or IAQR as currently proposed. Figure 1 shows the areas remaining in non-attainment after implementation of these programs. By EPA's own admission, emission reductions achieved from the IAQR only achieve a 3-county benefit in the Ozone Transport Region (OTR) in 2010. Furthermore, a dramatic cut in all emissions "across the board" does not improve the picture substantially (Figure 2). It is only when we begin to implement power sector controls comparable to the aggressive efforts of many OTR states <u>plus</u> a substantial reduction in the mobile and area sources that we begin to see attainment is possible in most (but still not all) areas. Figure 3 shows that with such controls, all areas within the OTR reach attainment, but there are still trouble spots in the metropolitan areas – even at 50% reduction from these other sources. This level of reductions from the EGU's - and as we will discuss, the industrial boiler sector as well - is achievable and reasonable based on actual reductions achieved within the OTR on these types of sources. Combined with a cap and trade program, these reductions are flexible and economic in addition to being technically feasible.

We dispute any contention that emissions remaining after full implementation of the IAQR are exclusively local. Our modeling demonstrates that even in the extreme example of zero anthropogenic emissions within the OTR, 145 of 146 monitors show a significant (>25%) increment of the 8-hour standard taken up by transport from outside the OTR (Figure 4 and Table 1).

It is unacceptable, not only for health reasons, but also for economic equity, that such a large portion of the standard would be consumed by upwind sources. Under the IAQR, as presently proposed, our region will continue to suffer from substandard air quality AND be placing increasingly expensive controls on our local sources AND be paying higher prices for energy AND be paying economic sanctions for non-attainment. We can and must do better.

The OTC proposal still requires substantial local controls in order to achieve attainment, but the level of reductions required from the EGU (and industrial boiler) sector are more equitable and cost-effective for all sources than what would be required under the IAQR.

Particulate Matter and Regional Haze

OTC member states face similar timelines under the eight-hour standard for particulate matter. Again, the proposed rule gives no indication that these levels of reductions are consistent with the timelines mandated under the Clean Air Act.

Additionally, while these reductions may likely achieve needed visibility improvements in Class I areas, there should be no assumption that rate of progress will be met. Further, regional reductions cannot presumptively meet individual source requirements such as BART (Best Achievable Retrofit Technology).

Mercury

While mercury emissions are not addressed by this proposed rulemaking, it is our understanding that EPA intends to move this rulemaking forward with EPA's proposed mercury rule, concurrently. The relatively weak level of reductions proposed by the proposed mercury rule do not account for the full extent of co-benefits achievable under a multi-pollutant strategy, nor do they drive further reductions needed to achieve maximum control technology levels.

Furthermore, a regional cap and trade program is not an acceptable mechanism for achieving reductions for a hazardous air pollutant such as mercury. While a bubble-concept may provided needed flexibility to a given facility, each facility should be expected to meet a level of control that is protects the public health of the local community.

Interstate Transport

While the IAQR proposes sizeable reductions in NO_x and SO_2 emissions, it does not yet go far enough in terms of the magnitude and timing of these reductions to resolve regional transport concerns for, nor allow for attainment of the health-based timeframes mandated under the Clean Air Act.

Over the past 8 years, OTC member states have succeeded in reducing our own NO_x emissions by approximately 70%, while the rest of the country has reduced its emissions by only about 10%. Yet in 2010, (attainment deadline for most of the OTR), approximately 106 counties will not meet the 8-hour ozone standard, 47 of which are beyond marginal non-attainment. The IAQR, like the Clear Skies Act before it, would improve this situation by only 3 counties. EPA's and OTC's modeling alike show that, even with draconian measures applied locally, large areas will still not meet the health standards for air quality (Figure 4 and Table 1).

A key factor in determining the amount of reductions needed to adequately address transport and meet attainment needs is the level of significant contribution upon which the IAQR's geographic coverage is based. We believe that EPA has underestimated "significant contribution" by using 2 ppb ozone as a criterion – a threshold based on the less stringent one-hour standard. A lower, more stringent standard should logically apply for the more protective eight-hour standard.

Furthermore, we propose that rather than using Section 110(a)(2)(D)(i) of the Clean Air Act solely as a SIP "recall" provision, EPA make Section 110(a)(2)(D)(i) determinations when reviewing SIP submittals for the eight-hour standard. These determinations must be made when an attainment SIP is initially submitted. This would require some aggressive analyses by EPA of SIPs from states that have been determined to contribute to downwind areas; such analyses were done and upheld in court under the NO_x SIP Call case. EPA must establish a process during the SIP submittal and approval process to show that all areas have addressed transport in downwind areas.

Because of the complex nature of ozone pollution, the test for significant contribution, unfortunately, cannot be oversimplified in terms of reductions that are "highly cost-effective." The relative cost of reductions in the originating upwind area must be weighed against the cost of local reductions attempting to offset reductions in a downwind nonattainment area. For example, an upwind area's contribution should be considered significant if the area could reduce ozone in a downwind area by 1 ppb at a cost of $1,000 per ton - if the cost of achieving the same 1 ppb reduction with local controls in the downwind area is $20,000 per ton. Significant contribution from upwind areas is a function of the level of pollution controls and cost in the downwind area because of far-reaching transport of air pollution, complex meteorology, and the close proximity of nonattainment areas in the OTR.

States-Rights

Tools offered by the Clean Air Act, such as ability to seek reductions from specific downwind sources afforded under Section 126 have played a crucial role in the past, allowing states to seek remedy from those sources inhibiting its progress toward attainment. A coordinated legislative or regulatory approach is obviously the preferred approach to addressing transport, however, states must retain the right to use these tools in addressing upwind contributions if the approach ultimately chosen, does not address the emissions that continue to prohibit upwind states from attaining the air quality standard.

Multi-pollutant regulation that falls short of the reductions needed to address the transport of pollutants by the attainment dates specified in the CAA would be a disservice to the sector being regulated – committing us all to future uncertainty and repeated revisiting of the program objectives. The unnecessarily weak reduction targets in the present rule also continue the health and economic inequities that presently exist as a result of OTR states doing more, while others do less.

States have an obligation to protect the public health of its citizens and the environment in which they live. To this end, states must retain the tools afforded in the CAA and flexibility they need to address additional emission reductions or unique regional needs. However, by developing a program that sufficiently addresses the transport problem upfront, EPA can avoid the need for states to use this mechanism in the future.

Finally, we would warn EPA against prejudging the effect of any program, whether it is the NO_x SIP Call or IAQR, in addressing the air quality impacts raised in states' 126 petitions. The Clean Air Act obligates EPA to review the information available at the time of the request to review the impact of specific sources on the air quality of a downwind area. By assuming that a petition's obligation has been met by the regional reductions of any regulatory mechanism, EPA would be shirking its responsibility to assess each petition on its individual merits.

Process

The published "rule" is really a preamble, giving us a sense of the goals and intention of the rule, but none of the actual rule language. OTC has already provided oral and written testimony on these generalized concepts at the public hearing held last month.

OTC is very concerned that the recent pattern of EPA rulemaking (8-hour implementation, for example) is to provide very general principles for public comment at first, followed by increasingly more specifics with less and less time to review, with very little time between the close of one comment period and the opening of the next. More importantly, there is seemingly no change in the rule as it is refined reflecting any comments received in the earlier comment period. We suspect that is happening here as well.

OTC considers this rule to be of paramount importance. We are putting substantial effort into analyzing and putting forward credible alternatives to EPA's rule. It is critical that these efforts have a positive influence on the rulemaking and the final rule.

The process EPA is pursuing to move this rulemaking forward does not allow for timely sharing of data that has gone into the development of the proposal nor thoughtful consideration and incorporation of comments provided by the states that have extensive experience in implementing programs for this sector: the states that will ultimately be left with the responsibility of seeking additional reductions to achieve air quality that meets the health-based federal air standards.

This rule is extremely important, and we do not wish to delay a final promulgation of a strong rule that appropriately addresses interstate transport of pollutants. At the same time, we want to avoid review and comment on a proposed rule that is significantly clarified and perhaps even significantly modified a few weeks later. Toward this end, we requested an extension of this comment period to encompass the actual release of rule language and a reasonable period thereafter. It appears that that request is not being granted, so we are providing these comments now.

SPECIFIC CONCERNS

In this section we address specific concerns we have with EPA's proposal, how we addressed them through our own modeling and research, and recommendations for EPA on how to proceed with this rule with respect to a given subject. Where EPA had solicited specific comment on a particular point, we note our response to it by referencing the appropriate page in the January 30, 2004 Federal Register publication of the IAQR preamble.

IAQR Assumptions

General

In developing the IAQR, EPA has conducted IPM and other modeling runs that provide the technical underpinnings of what the proposed reductions will do environmentally and economically. EPA then analyzes the results with certain other assumptions and constraints in mind, which may or may not be part of the model. Such modeling and technical analyses are critical to making an informed decision about the adequacy of this or any other rulemaking. Therefore, the "nuts and bolts" inputs to the models - assumptions including fuel prices, heat input, inventories and other data – have to be carefully considered as they can have a significant impact on the projected outcomes of implementing the program.

Furthermore, the IPM cannot account for all important considerations, such as pollution control technology advancements, energy efficiency and alternative energy improvements, and price changes associated with commitments to meet upcoming requirements.

Some of the assumptions used in design and constraint of the IAQR program – and the analysis supporting the program – underestimate the timing and extent of reductions achievable. Some of these assumptions directly affect the prediction of the model, such as the growth rate and underlying prices of natural gas, others affect how the model is used, such as in the case of labor constraints placed on the installation of controls, length of the SIP and permitting processes, etc.

OTC also used the IPM model to perform several runs with different assumptions. In this process we learned more about what the model can and cannot do, and how the assumptions used to set up and interpret the model can affect the recommended outcome. We are convinced that the IPM is a very powerful tool, and do not raise these issues because we wish to refute or object to its use; but, as with all models, it is not without its limitations. We have analyzed our model runs with this in mind, and bring to EPA's attention some of the assumptions of concern we found troubling and how OTC recommends EPA address these concerns.

The following provides a critical analysis of some of the assumptions upon which the IAQR program and modeling are based or otherwise constrained, how they affect model outputs, and how we believe that should be reconciled based on our and other available analyses.

Availability of Labor

While we believe many of the type of assumptions EPA makes about labor are applicable, we do not believe the consequences are as severe a limiting factor nor will the rate of installation be affected as significantly as EPA predicts (FR Vol. 69 No. 20 pg. 4622). For example, approximately 111 SCR units were installed from 2001-2003. This is considerable more than had been installed, on average, in the previous decade. This is also significantly more than the number of installations expected under either EPA or OTC's proposal. This demonstrates an ability to be flexible in meeting short term regulatory demands – and experience gained by this labor force, as the Institute for Clean Air Companies has indicated in its March 2004 labor analysis.(ICAC, 2004)

The length of time required for pollution control equipment installation is overestimated in several respects. First, the rate of installation for different equipment varies. While SCR are labor intensive and take twenty-four months, flu-gas desulphurization units may be installed in a relatively short amount of time. Installation of control equipment should also progress at an increasing rate in the out years.

Second, the type of construction method implemented depends on timing and economic constraints. According to ICAC, performing fabrication work on the ground, that is assembling large sections as modules reduces the amount of field labor hours needed for a project. In states with deregulated markets, it is likely that there will be added incentive to choose this method of construction because of costs savings. The method of construction also increases the overall installation rate of control equipment. Finally, very little of the actual installation must be restricted to or coordinated with scheduled outages, making it feasible and typical for construction and the bulk of installation to occur year-round.

Furthermore, there is more flexibility in the labor pool than is accounted for. Availability of boilermakers is not the single exclusive factor. There is flexibility and variety in the type of labor that may be used depending on the control equipment installed, and the phase of the construction. Installation of flue gas desulphurization equipment, for example, may be performed by a variety of craft laborers not technically considered "boilermakers." There is a significant volume of steel work and metal fabrication involved as well, which makes use of a different type of labor.

There is also variation by state on the use of laborers belonging to the Boilermakers Union. Nearly 1/3 of states in the IAQR are not unionized and therefore have flexibility in using other, non-unionized labor or laborers from Canada (as in the case with the NO_x SIP Call). In these respects, there is a large pool of labor that may be considered part of the available labor that may not technically considered "boilermakers."

Recently, there has been some mention that perhaps construction managers will actually be the "labor constraint" in short supply. Again, experience with the NO_x SIP call show us the work gets done. We think it highly unlikely that qualified managers will be difficult to come by.

Finally, with reasonable certainty and advance notice that this rulemaking is going forward, industry and labor organizations can also respond by training new members of the required labor forces for this work. This is where making a decision not too far out into the future (now through 2008 is fine) provides adequate certainty and expectations for an immediately foreseeable business cycle, and will cause actual work to be done. Experience tells us anything further than five (5) years out will simply not be actively engineered, financed or planned for installation. It takes three (3) years to engineer, permit, finance and construct these systems. We should be prepared to implement a substantial portion of these programs by the end of 2007.

Regulatory Impediments

One of the constraints imposed on the analysis, is that industry will not begin installation until after the SIP process (and all associated litigation) is complete. While we cannot do anything about the litigation of a rulemaking, we do note that an injunction implementing an EPA rule is very unlikely, and a strong schedule within the upcoming business cycle would go a long way to providing certainty that action is needed by EGU owners and operators.

States have a precedent of expediting engineering review and permitting requirements for installation of control equipment as in the case of the NO_x SIP Call or OTC NO_x Budget Program. There is an opportunity for OTC member States to move forward as a region to address industry concerns related to timing of SIP development and permitting timelines. Additionally, there are opportunities to assist states by developing model rules and other tools to expedite the timeframe for rule promulgation.

We fully expect our states to expedite both SIP development and submission and retrofit of pollution control equipment on existing facilities. All states within the NO_x SIP Call region should be positioned to do the same. A SIP submitted under this rule should take no more than 12 months.

Fuel Prices

EPA has expressed that the two objectives of its program were to not 1) cause significant fuel switching from coal to natural gas, or 2) significantly increase the costs of electricity. As discussed below, OTC took this into account in designing its program. However, the base assumptions of the model are critical to look at, because they can significantly affect the choices made about retrofitting a plant or constructing a new one, continuing to use coal, or switching to natural gas.

The price of natural gas has risen dramatically over the past several years, and appears to be stabilizing at a relatively high level compared to past predictions and EPA assumptions in its model runs. A low natural gas price has the effect of encouraging early fuel switching as soon as a small amount of investment pressure is imposed on another fuel source – be it oil, coal or another fuel source. New facilities brought on line will also tend to be natural gas under a low-gas-price assumption.

Maintaining a diversity of generation capacity is important to stabilize prices, and we believe reflecting a higher gas price now and in the model is more realistic. The Cambridge Energy Research Associates (CERA) and the Energy Information Administration (EIA) both predict higher natural gas prices from here on out, and these should be adjusted in EPA's model.

This will have the effect of encouraging more EGU owners to retrofit non-gas fuel units with proper pollution controls, and to build a mix of new units, rather than rely solely on natural gas to meet future demand. This will also tend to encourage continued advancements technically and economically on pollution controls for the other fuel sources, notably coal.

Heat Input and Electricity Demand Growth

The NO_x emissions limitations correspond to the sum of the affected States' historic heat input amounts, multiplied by an emission rate of 0.125 mmBtu for 2015 and 0.15 mmBtu for 2010. Historic heat input is derived as the highest annual heat input during 1999-2002. OTC member States will be at a disadvantage, given that many of their sources are already more efficient than remaining uncontrolled sources outside the region. An output-based calculation is a more appropriate method to calculate emissions and would reward industries that have made changes to increase efficiency.

Furthermore, the model is sensitive to the growth rate imposed. The expectation is that the growth in electrical generation capacity (and therefore demand) will be 1.5% per year.

The EIA predicts about 1.8%. The higher growth rate seems to more accurately predict past demand rates, although the IPM assumes that all of this must be provided for by new EGU capacity. It is important to recognize that some new electrical demand can be met by energy efficiency and renewable resources that the model cannot account for satisfactorily.

EPA and OTC ran model runs exploring the effect of the increased growth rate on the model predictions. Interpretation of the results, however, depends on proper consideration in light of the efficiency and renewables factor mentioned above, and that the increased BTU heat input will have a tendency to make any caps appear to require much lower effective emission rates among the EGU sources (present and future) than would otherwise occur.

Inventory

EPA should not reinvent the wheel – in establishing a whole new, unproven, inventory for the purpose of this proposed program. It is important that EPA use inventories that follow EPA protocol for development and have been thoroughly vetted by states (FR Vol. 69 No. 20 pg. 4622).

There are several inventories that fit this bill, including: the 1996 Base Case, 1999 NEI, Title IV, and NO_x SIP Call. These are all superior alternatives to the 2001 proxy inventory used for predicting emission reductions – and presumably budget allocation – under the IAQR. Further, the inventory was developed for a geographic scope and source sectors which differ than those covered by the IAQR.

Some may argue that emission inventory inadequacies should delay the rule until states have developed and EPA has incorporated the most up-to-date inventory possible. We do not agree with a delay in the rule promulgation for the purposes of refining inventories. As mentioned above, adequate inventories already exist for almost all states affected.

PROGRAM DESIGN - OTC Model Results and Recommendations

In the IAQR, EPA proposes that a cap and trade program is one option that states may utilize for achieving the reduction goals outlined in the rule, and outlines some elements of a cap and trade program design. For a cap and trade program to work effectively, it must be well-designed in terms of what units the program applies to, the level at which the budget caps are set and how the budget is allocated, whether banking of allowances is permitted and how banked allowances are used, whether NO_x and SO_2 allowances will be permitted to be interchanged in the trading program, and how the program impacts the critical reductions that are needed during the ozone season. The OTC sees a number of issues in each of these program area design elements with what EPA is proposing in the IAQR. We have also identified a few additional factors to consider based on our experience in implementing the NO_x budget program within our region.

OTC has responded with a counter proposal that builds on much of what EPA has presented in its proposed rule, but which provides caps and schedules that enable us to steer toward achieving attainment, something the proposed IAQR does not. In developing this proposal and analyzing the impacts of its implementation, OTC performed multiple mode runs using CALGRID (California Photochemical Grid Model) to determine reductions needed, and IPM (Integrated Planning Model) to determine the energy and electricity generation impacts of those options.

The CALGRID model was developed under contract to the California Air Resource Board in 1989. (Yamartino, 1989). Several upgrades have been made to the model over the years (Kumar, 1996a). The CALGRID model has been the subject of a number of peer reviews (eg.,Yamartino, et. al., 1992; Kumar, et. al., 1994) and comparisons with other air quality models (Kumar, 1996b; Jiang, 1998; Schulman, 1998). CALGRID has been widely used in the United States and overseas because it is not dependent on resource-intensive meteorological models for air quality model inputs. OTC has contracted with Earth Tech to continue refinements of the CALGRID model for individual state use to help develop ozone and PM attainment strategies. Although a screening tool presently, it is expected to be ultimately suitable for SIP quality modeling work.

The Integrated Planning Model was commissioned by EPA and is a proprietary model of ICF. OTC sought and received EPA's permission to use its assumption database for the purpose of running OTC's proposed strategies.

A series of modeling runs were performed to evaluate the OTC multi-pollutant proposal. As described, modeling was performed with IPM using EPA's modeling assumptions version 2.1.6. Three modeling runs that OTC performed are outlined in Table 2. Scenario 1 relies on EPA demand growth and natural gas price assumptions. Scenarios 2 and 3 rely on EIA demand growth and natural gas price assumptions. As a reminder of the assumptions that were used for each of the scenarios, we use superscripted notation indicating either EPA or EIA assumptions (e.g., Scenario 1^{EPA}).

EPA average annual demand growth for 2001-2030 is 1.55%; EIA's average annual demand growth for the same time period is 1.74%. The EIA natural gas price assumptions are fixed for all runs (i.e., the price projection is the same for all scenarios based on the EIA assumptions). The EPA natural gas price assumptions are based on a demand curve and therefore vary depending on the scenario. For these scenarios, the natural gas prices are an output of the model. Apart from the alternative demand growth and natural gas price assumptions, all other underlying assumptions were held constant across the four scenarios; what varied were the levels and implementation of the caps.

Table 2 Summary of OTC Modeling Scenarios

Scenario	NO_X	SO_2	Hg
Scenario 1[EPA] **EPA demand growth assumptions and gas prices**	NO_x SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012 National annual cap and trade	none
Scenario 2[EIA] **EIA demand growth assumptions and gas prices**	NO_x SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012, National annual cap and trade Transfer of allowance bank allowed subject to Progressive Flow Control beginning in 2008 based on 10% trigger and 2:1 surrender ratio	none
Scenario 3[EIA] **EIA demand growth assumptions and gas prices**	NO_x SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012 National annual cap and trade Transfer of allowance bank allowed subject to Progressive Flow Control beginning in 2008 based on 10% trigger and 2:1 surrender ratio	5 ton cap in 2015 National annual cap and trade

Attached as Appendix C is a summary report of these runs and a description of the results. Reference is made to this report for documentation on conclusions we reach and discuss in the following sections.

Applicability

The OTC does not agree with several aspects of this rule's applicability. Most notably, in terms of EPA's determination as to "significant contribution," and secondarily, with respect to applicable units affected.

We do not agree with the proposed geographic scope of this proposal and the merits of the proposed 0.15 $\mu g/m^3$ threshold level as indicating a potentially significant effect of air quality in nonattainment areas in neighboring States (compared to a 0.10 $\mu g/m^3$ threshold) (FR Vol. 69 No. 20 pg. 4584). Applicability, thresholds – and geographic scope, should be based on the precedent and legal terms provided in the Clean Air Act. It is more appropriate to use thresholds established under AOI (Area of Influence) and AOV (Area of Violation) in gauging significant contribution.

Unit size and emissions are the most important factors to consider in defining applicability – more important than whether a unit is primarily used to generate electricity (FR Vol. 69 No. 20 pg. 4610). EPA considers emissions from the electric power industry to be "a relatively large amount," and requests comment on how to determine what constitutes ``a relatively large amount'' of the relevant emissions from other sectors. Clearly, EGU units are a significant source of these pollutants, and most significantly responsible for the transport of pollutants into the OTR. EPA should not try to redefine applicability or whether a source constitutes a "relatively large amount" of emissions; it is a term with no legal basis or precedent of use. As a qualitative description, it's fine; as a regulatory threshold or applicability standard, it is not.

Trading under the OTC NO_x Budget Program (now under the NO_x SIP Call) included sources larger than 250 MMBtu, including EGUs, large industrial boilers, and cement kilns. These sources should be included in the trading scheme proposed in the IAQR. If these sources are not subsumed under the IAQR trading program, they will be orphaned – and the efficacy of an IAQR trading scheme will backslide to less than the current NO_x SIP Call. The data are clearly available to support inclusion of these units.

For control of sulfur dioxide and particulate matter, once again, EPA already has performed extensive analysis demonstrating appropriate control level and applicability. Studies performed for the Title IV program or mercury MACT demonstrate that control of sources at least as large as 25 MW or greater is appropriate. Furthermore, there are many sources of this nature throughout the OTR – many that are already included in trading under the NO_x SIP Call.

We urge EPA to include electrical generating units, large industrial boilers, and cement kilns 250 MMBtu or 25 MW and larger across the board for NO_x and SO_2 under the two cap and trade programs proposed in the IAQR.

Finally, with respect to inclusion of tribal sources (FR Vol. 69 No. 20 pg. 4587), for a cap and trade program to work effectively, inclusion of sources should be based on factors such as size, emissions, and relative contribution to nonattainment. For the cap and trade program to work effectively, there should be no distinction of sources based on location. EPA should define the sources included in this proposal based on size and emissions.

Budget-Caps

In the IAQR, EPA proposes NO_x and SO_2 caps that are notable reductions from those that are currently in place through the Acid Rain and NO_x SIP Call programs. While these are sizable, more stringent caps that go into place earlier are needed to mitigate transport and meet attainment goals. We have already discussed our modeling results that indicate the significance of transport to our non-attainment problems. We also note that attainment of the standard should not be in question. Both the eight-hour ozone and the PM fine standards are scientifically-based health standards that have undergone a long history of development, establishment and challenge. The lives saved and annual health benefits of meeting the standards are also well-established. As a result, any leniency on the caps and any delay in their implementation is costly.

OTC's proposed national caps are based on an attainment strategy for the OTR. The proposed level of control is certainly technologically feasible. And our analysis shows that, if banked SO_2 allowances are addressed, significant emission reductions may be achieved in the early years – with a limited impact on retail electricity prices.

With respect to the appropriate mix of reductions or timing (FR Vol. 69 No. 20 pg. 4623), we stress that attainment should be the goal for concurrent NO_x and SO_2 reductions. Both pollutants have well documented health effects and economic consequences. The IAQR region faces significant nonattainment of the standard for both pollutants. Furthermore, the basis for a multi-pollutant trading program is to achieve reductions based on the decisions sources make on the economics of level and timing of pollution control.

The goals of reducing either pollutant should be based on attainment needs and achievability. Again, we suggest that the appropriate level of NO_x and SO_2 emissions from power plants are 1.87 million and 3.0 million tons respectively by 2008, and 1.28 million and 2.0 million tons by 2012. In addition, OTC believes initial mercury control levels should not exceed 15 tons, with an ultimate performance requirement that achieves a final mercury reduction to approximately 5 tons per year by 2015, a 90% reduction from current emissions. (We discuss mercury in more detail in a later section)

If this proposal is intended to address the transport of NO_x and SO_2 – as it name purports, and if the goal of this proposal is to address transported emissions that preclude downwind states from achieving attainment – as it should – then it is difficult to advocate emission reductions from the affected sectors of one pollutant over another or one which fails to achieve adequate reductions to eliminate the transport problem. The Ozone Transport Commission wants a program that will achieve significant reduction of upwind ozone precursors so as to provide the region with a mechanism to achieve attainment within the context of a comprehensive strategy.

OTC's proposal, assuming the increased energy costs and growth rates, would achieve a 58% reduction in NO_x and a 67% reduction in SO_2 in 2010 from the EPA base case scenario, approaching twice as much improvement as the IAQR (IAQR yields 36% and 38% reductions for NO_x and SO_2 respectively in the 2010 timeframe).

Overall, we expect the costs of OTC's program to be achievable for less than $2,000 per ton for the NO_x and SO_2 reductions through 2020 (See Appendix C), the total cost to be on the order of about $7.6 Billion in 2010 and $11.1 Billion in 2020, with a monetized benefit of about $80 Billion and $140 Billion in those years, respectively. The cost for compliance will be fractions of a cent per KWh, and a reasonable percentage of the total system operating costs for EGU units (approximately 10%). Compared to the IAQR, we expect the program to cost less than 4% more, for a 44-47% reduction from IAQR NO_x and SO_2 emissions.

Regarding budget allocation, states should not be required to set aside a percentage of allowances for auction (FR Vol. 69 No. 20 pg. 4623), we feel that overly prescriptive methodology is intrusive for a number of reasons. First, it oversteps the federal role in supporting states in environmental control. Second, it goes against precedent established in the OTC NO_x Budget Program and subsequent NO_x SIP Call.

We believe states are in the best position to allocate allowances and administer state specific programs. States rely on EPA to facilitate a stringent, coordinated approach to address national and regional emissions. For this extensive a program, it is also necessary for EPA to provide well defined guidance and consistent inventories that follow a well defined protocol. We believe the best use of resources is for EPA to oversee the allocation, tracking, and reconciliation of allowances similar to its role in the OTC NO_x Budget Program and NO_x SIP Call. Finally, we believe it would interfere with ability of some states to opt out of portion of trading program – where the rule allows.

Regarding states electing to participate in the EPA-managed NO_x cap and trade program be required to participate in the EPA-managed SO_2 program, and vice-versa (FR Vol. 69 No. 20 pg. 4633), it is appropriate to have an "all or nothing" approach – where states subject to the IAQR either participate in both trading programs to maintain the integrity of the cap or they do not participate or all. For those states not subject to the IAQR who choose to opt-in, they should have the flexibility of participating in only one of the programs in the hope of garnering wider participation. It is important that states in the IAQR region fully support in both programs to achieve the full extent of benefits predicted by EPA for this program.

For reasons discussed below, we do hope the IAQR is extended to the west, thus alleviating the need to address states not subject to the IAQR.

Banking

The efficacy of the SO_2 cap that EPA proposes in the IAQR is highly impacted by the sizeable bank of Title IV SO_2 allowances that have accumulated to date. This can only be ameliorated through a more stringent cap level, some method for graduated use of the banked allowances, or both. Our preliminary modeling demonstrates that without a mechanism for addressing the glut of banked allowances, there is little incentive for early reductions and little chance of actual emissions coming close to meeting the cap until 2020.

Effect of Fuel Prices and Growth

We discussed above the potential affect of natural gas prices on the results. Even without the higher EIA assumptions, OTC's proposal (Scenario 1) does not cause significant fuel generation mix change from the IAQR, resulting in approximately 1% less coal and 1% more combined cycle gas from the IAQR estimates. Accounting for the increased prices, the pressure to switch would be even less.

Accounting for growth pressures with increased generation, combined with progressive flow control, does put pressure on new generation to be significantly natural gas, although coal usage still increases from 50% share in 2010 to 55% in 2020, with a substantial amount of new pulverized coal coming on line. Under this scenario (OTC Scenario 2), in spite of 110GW new and repowered coal generation, the coal market share decreases by 3% over the IAQR, with a corollary increase in combined cycle gas, due to the overall increase in energy demand.

The increased natural gas fuel prices and the increased growth have a tendency to increase the number of existing coal facilities retrofitted with advanced pollution controls.

Interchangeability of Allowances

In the proposal, EPA raises questions about the potential of trading NO_x and SO_2 allowances interchangeably – and what might be an appropriate exchange ratio. IT IS NOT APPROPRIATE TO TRADE ALLOWANCES OF NO_X AND SO_2 INTERCHANGEABLY (FR Vol. 69 No. 20 pg. 4635). There is no precedent for the interchangeability of allowances for pollutants that have such distinct atmospheric interactions and individual environmental impacts. The only precedent for interchangeability of two pollutants is that of NO_x for VOC reductions in SIP accounting.

This policy is based on the science: the interaction of NO_x and VOC as precursors in ozone formation. The efficacy of reducing NO_x or VOC varies depending on the preponderance of NO_x or VOC emitting sources in a region – whether a region is NO_x or VOC "limited." Depending on which pollutant is the limiting factor, reductions of one pollutant over another are preferable for reducing ozone levels. Finally, the application of this exchange of SIP credits is limited in scope and application.

NO_x and SO_2 behave too differently in the atmosphere, deposition and water bodies, and the control of the pollutants are too disparate, to warrant the complication of trying to trade them interchangeably. Even if one could defend a proposed ration or "exchange rate" between the two, which is scientifically questionable, the complex accounting would be a nightmare. We strongly encourage EPA to not pursue that path.

Ozone Season Reductions

To date, we have seen no analysis for this proposal that would demonstrate sufficient levels of NO_x reductions during the ozone season ensuring that there is no backsliding when transitioning from the summer-time NO_x SIP call program to an annual IAQR trading scheme. There should be a nested, eastern ozone season cap to ensure that excessive allowances are not used in the summer months – exactly at the time when reductions are needed the most. Any trading under an annual NO_x cap should include a mechanism ensuring significant ozone season reductions.

Fuel Generation Mix

As discussed above, the mix does not vary greatly between OTC's proposal and the IAQR or EPA Base Case Scenarios. Under all three programs, coal and natural gas use increase over time. Under the OTC proposal, there is a greater switch to use of Bituminous coal, as pollution control retrofits enable greater use of local coal sources. When active mercury control is added in 2015 (scenario 3), coal use remains virtually level at 20,500 tBTU, but decreases in market share relative to combined cycle gas, and relative to the IAQR. There is an 11% shift away from increased coal use to natural gas, almost all for new capacity, when mercury controls are factored in. This is why OTC recommends waiting for a determination of performance based control levels until 2012, to see how changes in the price of control and advancing technologies affect the outcome. We believe that with improved pollution control installations, coal – and locally derived coal – plays an increasingly valuable role in the energy portfolio of the future.

Energy Prices

The total system cost differential of these programs can be used to gauge the effect they would have on wholesale and then retail prices of electricity. The OTC modeling runs provide estimates of wholesale electricity prices (in $/megawatt hour). EPA's IPM modeling outputs do not report either wholesale or retail price impacts. However, we estimate that Scenario 2 will result in a +5% difference in wholesale electricity prices in 2015 and a +4% difference in wholesale prices in 2020, as compared to the IAQR Proxy. Scenario 3 is projected to add 4 to 6% on to account for the mercury controls. Retail price impacts will be lower (on a percentage basis) in all cases.

Costs and Benefits

All of these programs have benefits that far outweigh the costs, all on the order of over 10:1. OTC's proposal has the added benefit of enabling attainment to be achieved, which has additional benefits not factored in or calculated into the equation. This means that electricity and development inequities cease, and sanctions are not incurred, in addition to the direct public health and environmental benefits achieved. The benefit of OTC's program is expected to be on the order of about $80 billion in 2010 and in excess of $140 billion in 2020. This only includes premature deaths due to particulates. This does not quantify benefits of reduced illnesses, mercury improvements, environmental benefits from improvements in acid rain, eutrofication, regional haze and the like. The costs, with the mercury program, are on the order of about $7.6 Billion in 2010 and $11.1 Billion in 2020.

History has shown that the market will respond in positive ways to both price and policy signals. This was evident with the oil price shocks of the 1970s and with the 1990 Clean Air Act Amendments (CAAA). In the former instance, the increased oil prices (brought about by a combination of the 1973-74 oil embargo and the so-called 1979 Iranian shutoff) encouraged a whole new generation of more efficient and cleaner energy technologies so that energy use and energy prices were reduced over time. At the same time, implementation of the CAAA, taken as whole, has generated high returns in terms of improved air quality and lower costs over the past three decades (Krupnick, 2002). The reason is that the approach of the CAAA, similar to that advocated by OTC in this instance, unleashed competitive pressures which found ways to reduce costs in all markets (Burtraw, 1998). These same competitive pressures strengthen the likelihood of reasonable costs and highly positive benefits in adopting the OTC multi-pollutant position, according with what we see in the IPM modeling (specifically scenarios 2 and 3).

Yet, we should recognize that the IPM simulations of the emission caps likely overstate the cost to respond to the lower emission targets. One recent review of economic research on technological change indicates that both the cost and performance of supply and demand side technologies would likely improve compared to standard reference case assumptions (Sanstad, 2001). Consistent with this perspective, one of EPA's own studies underscored this likelihood. In responding to a Senate request for analysis of the four pollutant legislation (with different but still significant emission targets), the EPA Office of Air and Radiation found that electric generation costs declined by 25 percent by the year 2015 when substituting modest changes in cost and performance of both supply and demand-side technologies (Environmental Protection Agency, 2001). To the extent that this more dynamic representation is not captured in the IPM simulations, costs are more likely overstated. Hence, the cost of these policies should be adjusted for the greater and quicker adoption of supply and demand side technologies that would occur in response to the price signal that accompanies the adoption of these caps.

COORDINATION WITH OTHER PROGRAMS

EPA has requested comment on whether IAQR might replace certain programs – or at least meet the regulatory obligation of certain programs. Participation in the IAQR should not supercede or assume to meet the obligations of existing programs – particularly in the case where the objectives are markedly different. Further, coordination with other programs should be done in a way that is legally defensible. Multi-pollutant regulations that are delayed by legal challenges gain no emission reductions and provide no greater degree of certainty for anyone.

Again, the goals of reducing either pollutant should be based on attainment needs and achievability. Once again, we suggest NO_x and SO_2 emissions from power plants be capped at 1.87 million and 3.0 million tons respectively by 2008, and 1.28 million and 2.0 million tons by 2012.

Whether this program may be considered as meeting the obligation of the NO_x SIP Call, specifically, the NO_x SIP call has not yet even been implemented in the majority of NO_x SIP Call states. Furthermore, there has been no proper analysis that would satisfy whether the reductions in the SIP Call would meet the reduction goals advanced in the program.

Compliance with the PM2.5-related annual emissions reduction requirement is not sufficient for compliance with the seasonal ozone-related emissions reduction requirement (FR Vol. 69 No. 20 pg. 4586). The annual cap should be set at a level that demonstrably achieves sufficient levels of reductions to address transport of ozone precursors responsible for nonattainment in downwind states. Further, an eastern, seasonal cap should be in place – at least as a backstop – ensuring sufficient ozone season NO_x reductions.

The full implementation of emissions reductions deemed highly cost effective or participation in a region wide or statewide cap and trade program (rather than source-specific emissions limits) cannot be construed as satisfying the Best Available Retrofit Technology (BART) requirements of the CAA (FR Vol. 69 No. 20 pg. 4586).

OTC does not support regional reductions in lieu of basic control requirements at sources that are proven to significantly contribute to visibility impairment in Class I areas. The “highly cost effective” term is a threshold for individual source control. While a regional cap and trade program will most likely achieve significant regional haze goals, the basis of the BART program is to apply specific control technology to sources that are demonstrated to significantly contribute to a Class I areas reduced visibility.

It should be noted that Phase I of the OTC NO_x Budget Program was application of RACT to sources greater than 25 MW and 250 lbs/MMBtu NO_x emission. Reductions achieved from the 2 additional phases of trading were in addition too – rather than in place of installing control technology.

Whether this program would satisfy the first long term strategy for regional haze (FR Vol. 69 No. 20 pg. 4587), specifically, reductions from this program would undoubtedly go a long way toward achieving the first long term goals for regional haze requirements. However, regional reductions cannot be considered to automatically satisfy BART level controls. Further, it is not possible at this time to determine whether haze reductions would meet the first phase goals for rate of progress. This is not possible until states have performed the engineering analyses required for BART under the 1999 EPA Regional Haze rule. We would, of course, be interested in seeing any data or modeling demonstrating the timing of PM2.5 reductions and visibility improvement in Class I areas that has been performed to date. Finally, the standard is not to meet reasonable progress defined as a straight line to natural background, the standard is to perform the reductions "as soon as possible, but no later than…", which means that if the EGU's impact on regional haze can be reduced sooner than on a uniform rate of progress, that needs to occur. We believe it can, as demonstrated here, so we would not support the determination that the IAQR satisfies the first long term goals of the regional haze program.

Regarding whether the cap and trade approach proposed in this rulemaking is a suitable mechanism that could be expanded to help other States to meet their regional haze obligations under the CAA (FR Vol. 69 No. 20 pg. 4587), while this type of mechanism may be appropriate for achieving reductions needed for improving visibility in Class I areas, the timing and extent of emission reductions do not appear to comport with the rate of progress requirements delineated in the 1999 federal regional haze rule.

Mercury

OTC's multipollutant proposal proposes a stepped approach for mercury that in the early years relies on benefits to be derived from scrubber installation and NO_x controls on coal fired units. We achieve approximately 14 tons of reductions by 2010 based on SO_2 and NO_x alone. Twenty-four additional tons are removed with the implementation of the mercury component of OTC's program. Although the "co-benefit" reduction is not as great as we had hoped for the reasons outlined in the IPM summary, the costs and merit of doing a performance based program by 2015 are well supported by the cost and benefit data. This program assumes about 105,640 MW of Activated Carbon Injection is installed versus 41,513 MW under CSI. We also expect that as systems are installed and technology advances, that the costs of this program in 2012 will be substantially less than that currently projected by the IPM model results.

As we discussed in the costs and benefits section, the competitive pressures from price and policy signals have resulted in reduced costs to meet regulatory requirements. This will likely occur for mercury as well, as these same competitive pressures provide a strong cushion that supports the adoption of a mercury cap as proposed in the OTC position (5 tons). However, we also recognize that it would be prudent to see where the technology gets us by 2012 and then decide on what an appropriate performance standard would be for mercury.

CONCLUSION

The Ozone Transport Commission has invested much time and expense to develop and explain its comprehensive alternative to the IAQR. We have done this because, quite simply, the IAQR is not adequate to address the needs of the region with regard to transport of precursors to ozone and fine particulate pollutants.

These comments are respectfully developed and submitted in the hope that EPA will significantly modify the caps and dates of its program to align with OTC's, so that the region may consider transport of these critical pollutants finally addressed at a level of adequacy that enables our member states to concentrate on other sources and fully implement their strategies for ozone and PM attainment.

We look forward to reviewing the actual rule language, seeing how our comments have been incorporated in revised rulemaking and commenting further on the next iteration of this important rule.

REFERENCES

Burtraw, Dallas. “Cost Savings, Market Performance, and Economic Benefits of the U.S. Acid Rain Program, Resources for the Future Washington, DC, September 1998.

Clean Air Task Force. Children at Risk: How Air Pollution from Power Plants Threatens the Health of America’s Children. May, 2002.

Earth Tech, 1996a. Earth Tech, Inc. Concord, MA.

Earth Tech, 1996b. Technical Justification for CALGRID as an Alternative to the UAM-IV Model in the New England Domain. Earth Tech, Inc. Concord, MA

Institute of Clean Air Companies. Skilled Labor Analysis. March 2004.

Jiang, W; D.L. Singleton, M. Hedley, and R. McLaren. 1997a. Sensitivity of ozone concentrations to VOC and NOx emissions in the Canadian Lower Fraser Valley. Atmos. Environ. 31:627-638.

Jiang, W; D.L. Singleton, M. Hedley, and R. McLaren. 1997b. Sensitivity of ozone concentrations to rate constants in a modified SAPRC90 chemical mechanism used for Canadian Lower Fraser Valley. Atmos. Environ. 31:1195-1208.

Jiang, W; M. Hedley, and D. Singleton. 1998. Comparison of the MC2/CALGRID and SAIMM/UAM-V photochemical modeling systems in the Lower Fraser Valley, British Columbia. Atmos. Environ. 32:2969-2980.

Krupnick, Alan J. “Performance of the Clean Air Act and its Amendments,” Testimony prepared for presentation to the Subcommittee on Energy and Air Quality, Committee on Energy and Commerce U.S. House of Representatives, Washington, DC, May 1, 2002.

Kumar, N.; F. Lurmann, and W.P.L. Carter. 1995. Development of the Flexible Chemical Mechanism Version of the Urban Airshed Model. Final Report STI-94470-1508-FR. PTSD, California Air Resources Board. Sacramento, CA 95814. August 30, 1995.

Kumar, N; A.G. Russell, T.T. Tesche, and D.E. McNally 1994. Evaluation of CALGRID using two different ozone episodes and comparisons to UAM. Atmos. Environ. 28(17) 2823-2845.

Kumar, N; A.G. Russell, and G.J McRae. 1992. A Project to add the Carbon-Bond 4 Chemistry to the California Air Resources Board Model (CALGRID). Sigma Research Agreement No. A974-222. PTSD, California Air Resources Board. Sacramento, CA 95814. November, 1992.

Sanstad, Alan. “Technology scenarios and the costs of capping electric power emissions in the National Energy Modeling System,” Working Memo, Lawrence Berkeley National Laboratory, Berkeley, California, August 1, 2001.

Schulman, L.L and G.E. Moore. 1998. Photochemical grid modeling of four high ozone episodes in the New England domain: CALGRID vs. UAM-IV. Proceedings of the 10th Joint Conf. On Applications of Air Pollution Meteorology. Amer. Metero. Soc. Boston, MA. 01742. pp 505-509. January, 1998.

Scire, J.S; R.J Yamartio; G.R. Carmichael, and Y.S. Chang. 1989. CALGRID: Amesoscale Photochemical Grid Model. Volume II: User's Guide. Sigma Research Report No. A6-215-74. PTSD, California Air Resources Board. Sacramento, CA 94814. September, 1989.

Thurston, G. U.S. Senate Testimony. February 5, 1997

U.S. Environmental Protection Agency, Office of Air and Radiation, Office of Atmospheric Programs, "Economic Analysis of a Multi-Emissions Strategy," prepared for Senators James M. Jeffords and Joseph I. Lieberman, October 31, 2001.

Yamartino, R.J; J. Scire.; S.R. Hana; G.R. Carmichael, and Y.S. Chang. 1989. CALGRID: A Mesoscale Photochemical Grid Model. Volume I: Model Formulation Document Sigma Research Report No. A6-215-74. PTSD, California Air Resources Board. Sacramento, CA 94814. September, 1989.

Yamartino, R; J. Scire; G.R. Carmichael, and Y.S. Chang. 1992. The CALGRID mesoscale photochemical grid model. Atmospheric Environment. 26A:1493-1512.

Figure 1

2010 CAA vs. CSI

8-hour Ozone Modeling for July 1995 Episode

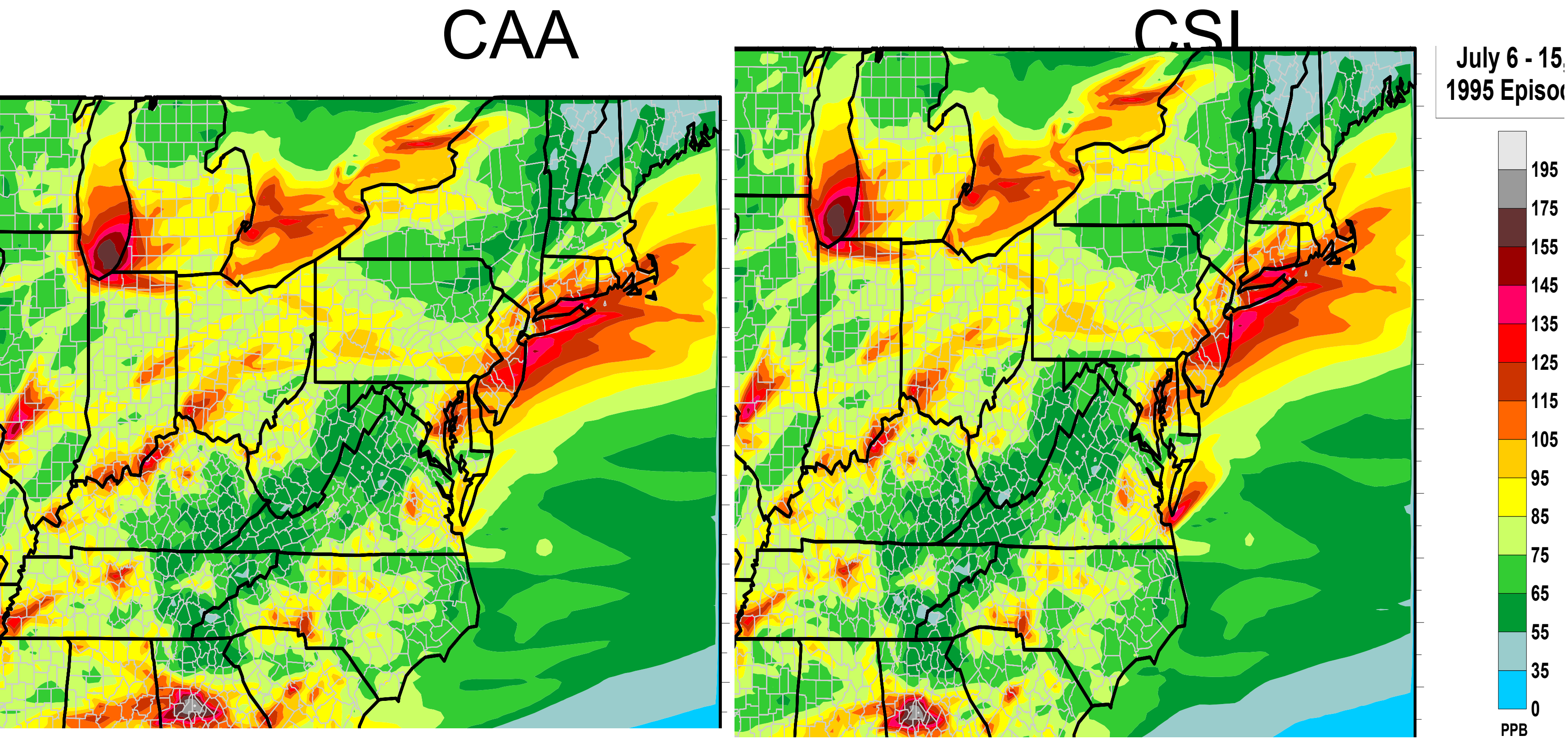
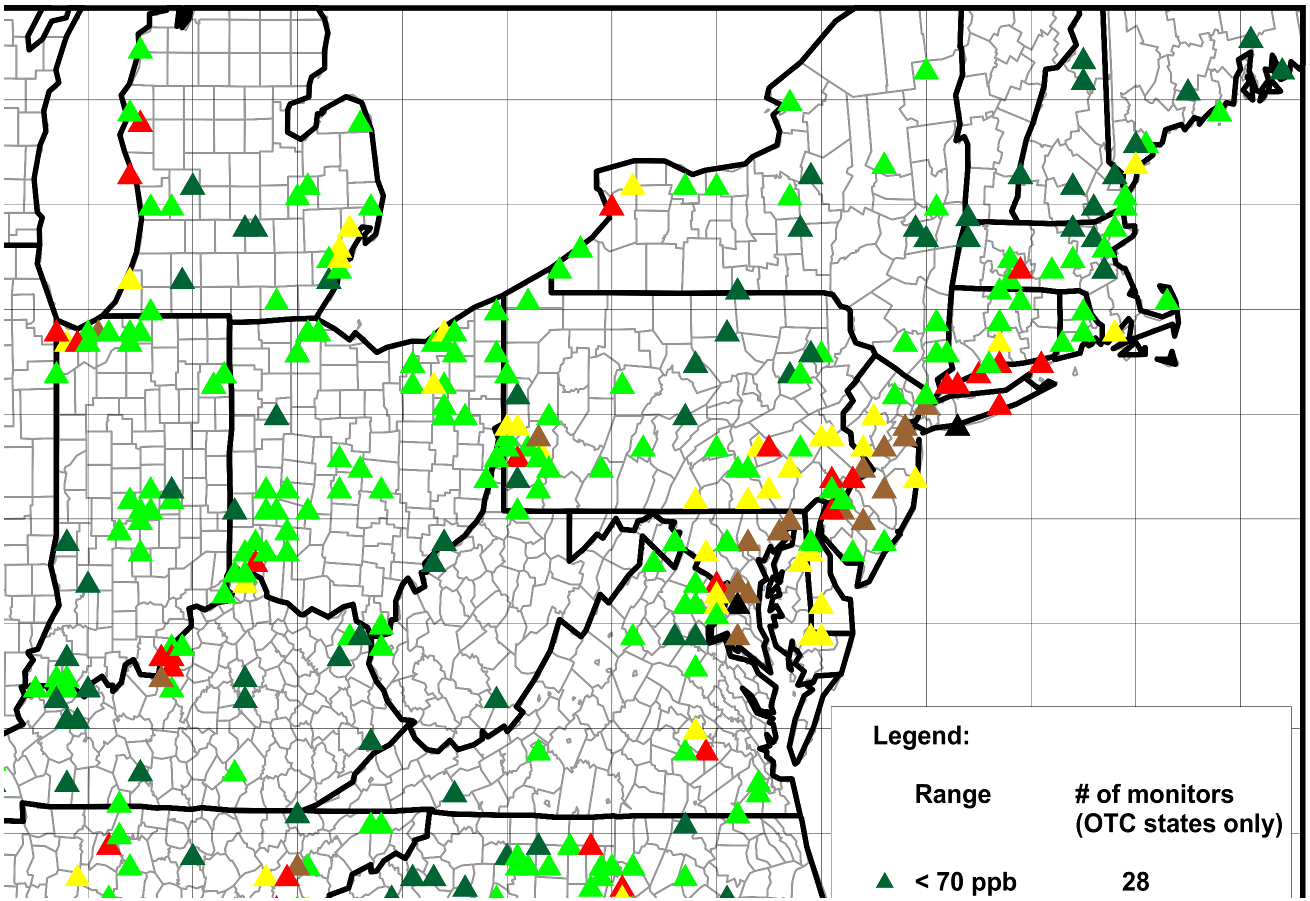


Figure 2

OTC Proposal
CSI - 25%, - 25% Area & Mobile 2010



▲ <70, ▲ 70-80, ▲ 80-85, ▲ 85-90, ▲ 90-100, ▲ >100 (ppb)

Preliminary: Based on June 1995 Episode

Figure 3

Maximum Adjusted Control Case 8-hour Ozone Concentrations at Ozone Monitors
R102 (2010 OTC Resolution minus 50% Area NOx & VOC and 50% Mobile NOx)
Based on Maximum Design Values 1999-2001, 2000-2002, & 2001-2003
CALGRID Modeling Domain - JUNE/JULY 1995 Episodes

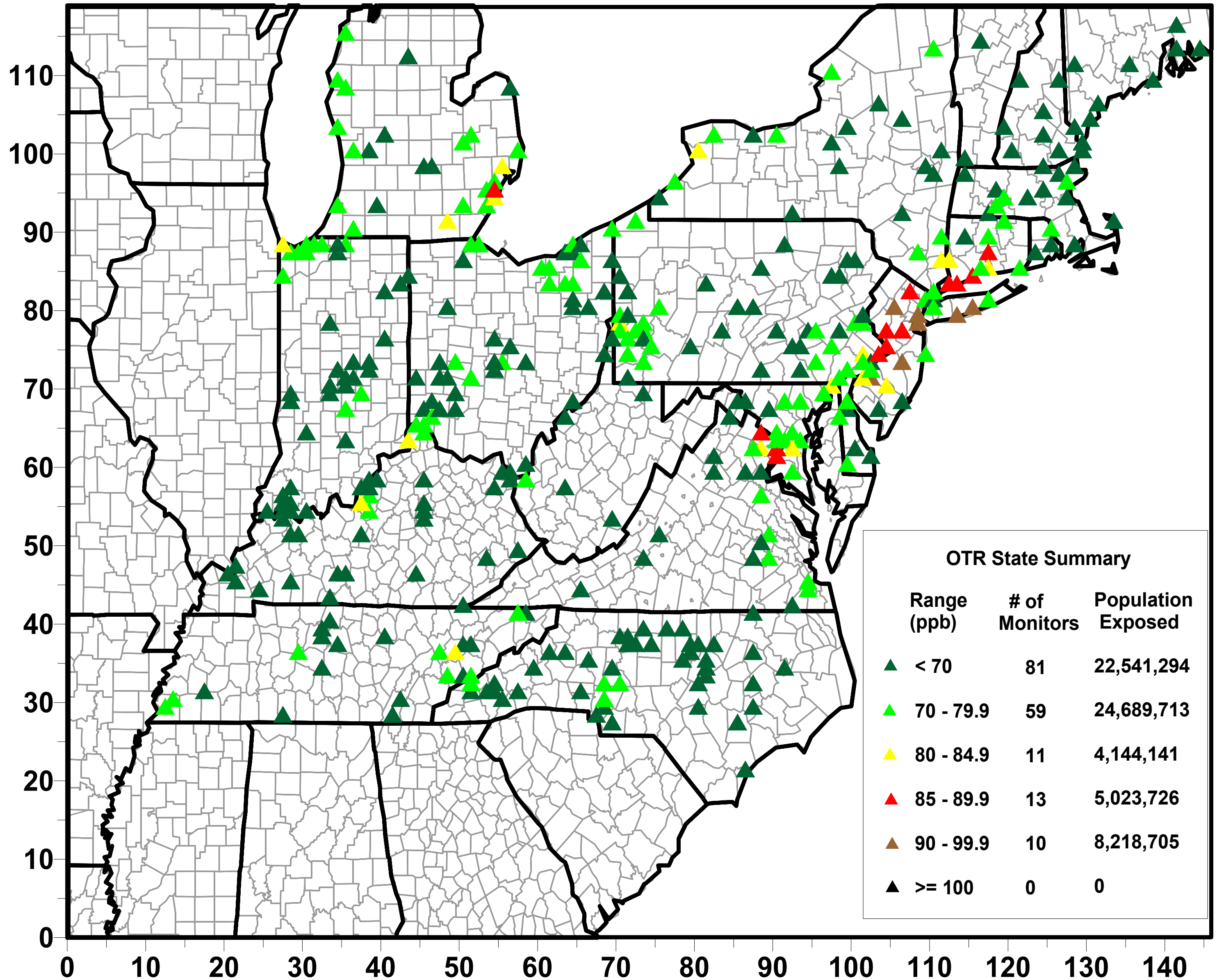


Figure 4

Ramifications – Zero Anthropogenic OTR

CALGRID Modeling Domain, Maximum Adjusted Control Case 8-hour Ozone Concentrations at Ozone Monitors
2010 CSI, Zero Out Anthropogenic Emissions in the OTR

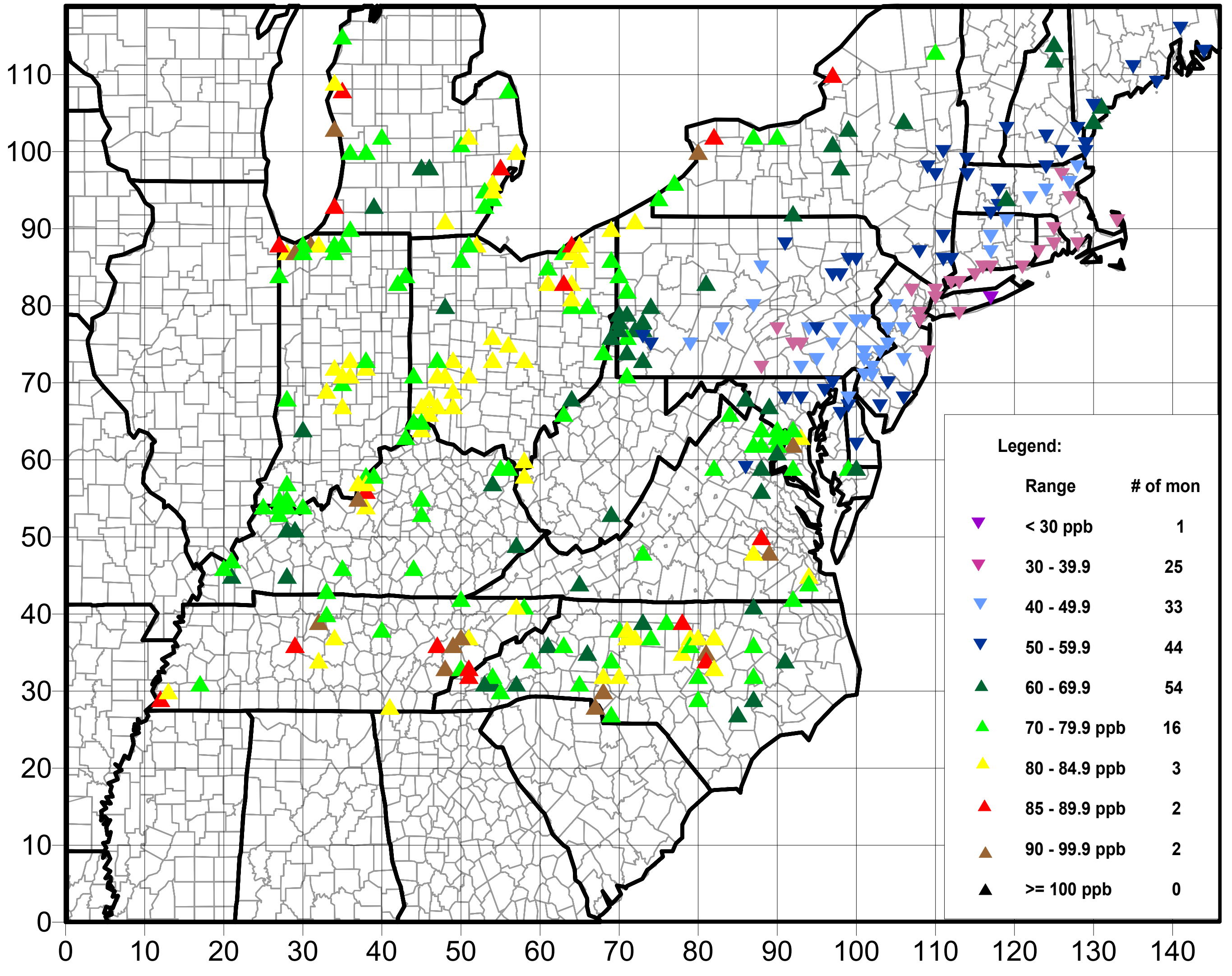


Table 1

Ramifications

Transported Ozone (ppb)	# Monitors	% of Standard
< 30 ppb	1	25 %
30-39.9 ppb	25	44 %
40-49.9 ppb	44	56 %
60-69.9 ppb	54	81 %
70-79.9 ppb	16	94 %
80-84.9 ppb	3	106 %
85-89.9 ppb	2	113 %
90-99.9 ppb	2	119 %

Final – Approved January 27, 2004

Multi-Pollutant Strategy Position of the Ozone Transport Commission

A. Introduction

This is the Ozone Transport Commission's (OTC's) recommended position on multi-pollutant legislation for the EGU sector, or any legislation or rulemaking that may intend to implement these provisions by rule or law.

Using its multi-pollutant statement of principles as a framework, the OTC has developed broad consensus on nitrogen oxide (NO_X) reductions needed from the power sector for ozone attainment in the 2010-2013 timeframe, as presented in our adopted Resolution 03-01. The resolution, attached, also acknowledges that broad emission reductions must be made across other sectors and in the context of multi-pollutant controls.

1. Supporting the Multi-Pollutant Approach

- The OTC Supports a multi-pollutant approach for the electrical generating (EGU) sector (as well as other sectors) as an efficient means of gaining necessary emission reductions in ozone and its precursors from specific sources of emissions. Whether, how and when other pollutants are controlled is directly relevant to OTC's mission to address the transport of ozone and its precursors, and to plan for, achieve and maintain attainment.

- The OTC has approved a set of multi-pollutant principles, and adopted resolution 03-01 regarding multi-pollutant control from the EGU sector.

- The OTC acknowledges that additional emission reductions of ozone precursors beyond those obtained through existing or proposed rules or legislation are needed in order to attain the health standard. These reductions are also needed sooner than presently proposed to meet statutory deadlines. Multi-pollutant legislation designed to achieve attainment by the dates specified in the existing federal Clean Air Act (CAA) would be a helpful and efficient way of reaching attainment.

2. Attainment Dates and Standards

- The OTC does not support any legislation or rule that seeks to:

  a) Relax the 8-hour Ozone Standard;
  b) Extend attainment dates for meeting the standards beyond those dates established by the CAA; or,
  c) Change the designation of an area as a means to allow more time for attainment than would otherwise be allowed by an area's measured air quality.

- The OTC will not support any legislation or rule that fails to hold upwind areas and sources, whether or not those areas are in attainment, accountable for any significant contribution to downwind area non-attainment. The OTC supports legislation or rules that require emission reductions from upwind areas and sources in a manner and timeframe that allows attainment of the standard in the Ozone Transport Region (OTR) by the required dates if not sooner.

3. Carbon and Greenhouse Gases

The Northeast and Mid-Atlantic states recognize that greenhouse gas emissions have become a significant issue and believe it is best addressed at the national level. Many of the states in our region have already implemented or plan to implement measures to reduce greenhouse gas emission and have joined together to implement regional greenhouse gas reduction initiatives.

The CAA expressly authorizes the OTC to recommend and develop strategies to reduce nitrogen oxides and volatile organic compound emissions as precursors to ozone. Our states also have roles with regional planning organizations to reduce regional haze and particulate emissions. Pollutants contributing to these problems are in large part a function of combustion for energy production. Accordingly, we recognize the importance of addressing efficiency as a significant element in reducing all these emissions. In considering multi-pollutant legislation, regulatory and operational efficiency are also critical to effective environmental programs. Addressing this would enable electricity generators and other affected sectors to have a higher level of certainty and predictability to optimize investment decisions regarding pollution controls and operating procedures. Therefore,

- The OTC encourages Congress to act on a national program or programs promoting efficiencies that address emissions such as carbon dioxide and other greenhouse gases in a cost-effective, coordinated, and streamlined manner.

4. Use of Pending Legislative and Regulatory Proposals as a Framework for Discussion

- The OTC will support provisions of a Clear Skies Act or other multi-pollutant legislation that reflect the positions identified herein;
- The OTC will support provisions of rulemaking and rules that contain the positions identified herein.

5. The Numbers

- The OTC supports a Cap and Trade Program for NO_X, sulfur dioxide (SO_2) and other non-hazardous pollutants.
- The OTC does not support cap and trade for Mercury (Hg) beyond a facility's borders. The OTC supports a bubble concept for mercury at a given facility.
- In addition to these caps, the U.S. Environmental Protection Agency (EPA) should also set a seasonal Eastern NO_X cap to address regional ozone as a subset of the national cap.

	National Cap Numbers
SO_2	• 2008: 3.0 MT *interim* • 2012: 2.0 MT
NO_X	• 2008: 1.87 MT *interim* • 2012: 1.28 MT
Hg	• 2008: 15 ton interim cap • 2012: 10 ton maximum cap • 2015: Approximately 5 tons per year

- Phase I (2008) mercury reductions are generally considered to be the achievable through the application of SO_2, NO_X and particulate matter (PM) control, acknowledging additional reductions being required by several OTC state multi-pollutant programs.

- Phase II (2012) mercury reductions are achievable through further application of SO_2, NO_X and PM controls needed to achieve the respective caps and standards and application of some additional mercury-specific control measures.

- Phase III (2015) mercury reductions are to be set by a performance standard to be identified no later than 2012, and are generally expected to require additional mercury-specific control technology applications beyond those required in 2012.

- Banked SO_2 allowances from Title IV trading program must expire by 2010. There would be a transition to a new banking system reflecting the cap and trade approach contained in this proposal.

- Flow Control for NO_X and SO_2 (such as that successfully implemented in the OTR through the NO_X Memorandum of Understanding for NO_X) is needed to ensure banked allowances do not interfere with meeting our air quality goals.

6. Applicability

- The OTC recommends and prefers that the multi-pollutant approach address other large industrial boilers at the same time, appropriately modifying the emission caps accordingly.

- The OTC will support addressing only EGU units at this time at the cap levels presented in the table above.

- The OTC expects to address other sectors not addressed in a multi-pollutant bill or rule as necessary to assure attainment is achieved.

7. States' Rights

States have an obligation to protect the public health of their citizens and to meet the requirements of numerous federal environmental regulations. The Clean Air Act provides a number of tools allowing states to address air quality problems unique to the state as well as regional problems, including the transport of air pollution from upwind areas and sources.

- Any multi-pollutant legislation enacted must retain a state's ability to protect the health of its citizens by maintaining tools created under the Clean Air Act to address regional ozone problems and air pollution transported from upwind areas and sources.

- The OTC may develop and implement more stringent caps and other provisions as necessary to attain our air quality goals.

B. Other Issues Potentially Associated with A Multi-Pollutant Approach

1. New "Transitional" Designations

- The OTC does not support establishment of "Transitional Areas."

- As with non-attainment areas, the OTC does not support extending attainment deadlines for "Transitional Areas."

2. Transport

- The OTC supports a requirement that all source categories significantly contributing to an area's non-attainment be required to implement controls and programs at least as stringent and on the same timeline as those being implemented by the state in which the non-attainment occurs.

- The OTC will not support EPA approval of any State Implementation Plan (SIP) for any state that does not adequately reduce any significant contribution to downwind non-attainment from its sources.

- The OTC supports the incorporation of the concepts of "area of violation" and "area of influence" as a replacement for nonattainment area definitions as these concepts more realistically acknowledge the role of transport and should be designed to facilitate the attainment of the ozone air quality standard.

3. Section 126 Petitions

- The OTC does not support reducing states' section 126 petition authorities, or EPA's obligation to respond to any and all petitions in a timely manner as presently required by the CAA.

- The OTC objects to any requirement that states conduct or submit cost/benefit assessments as a precondition to filing any petition or EPA's action on that petition. The

OTC does not support any economic test or analysis that makes it more difficult for EPA to impose corrective requirements on upwind sources shown to significantly contribute to downwind non-attainment.

- The OTC does not presume that any cap and trade program can fully address the local impacts of transported air pollution, and as such believes the existing Section 126 petition authorities are both necessary and appropriate.

4. EPA Bump-up Policy

- The OTC does not support use of EPA's bump-up policy as a means to simply delay attainment dates for non-attainment areas, or for its use in the absence of a corollary upwind attainment strategy. Any bump-up policy should not be used as a rationale for upwind sources to delay work required for them to reduce emissions significantly contributing to downwind area non-attainment.

5. Right to Regulate

- The OTC objects to any provisions of law that preempts states from taking action to regulate new or existing sources, or that precludes states from being more restrictive than the federal government as presently allowed under the CAA.

6. Alignment of Attainment Dates

- The OTC supports EPA's efforts to align the PM fine and 8-hour ozone attainment dates within existing timeframes, so that the SIPs may be concurrently submitted and implemented.

7. Other

- The OTC objects to restricting the scope of regional and source specific haze considerations to sources within 50 km of Class I areas rather than a distance supported by science.

- In addition to provisions of rule or law that require existing facilities to upgrade pollution controls when initiating a major modification, The OTC supports the additional requirement that existing sources conduct a Best Available Control Technology (BACT) analysis when a facility reaches forty (40) years of age, and that it be required to implement BACT or equivalent controls that time.

MISC 03-1

STATEMENT OF PRINCIPLES OF THE OZONE TRANSPORT COMMISSION REGARDING REDUCTIONS OF OZONE PRECURSOR EMISSIONS AND OTHER RELATED REGIONAL AIR POLLUTANT EMISSIONS

WHEREAS the Ozone Transport Commission (OTC) has addressed regional ground level ozone problems in the Northeast and Mid-Atlantic States, as well as other related regional air pollutants; and

WHEREAS the OTC States have already implemented very aggressive and costly pollution control measures to reduce both volatile organic compounds (VOCs) and nitrogen oxides (NOx) emissions; and

WHEREAS OTC has determined that a multi-pollutant emission reduction program can be an attractive approach to cost effectively address both ozone and other regional pollutants simultaneously, including regional pollutant transport, thereby providing multiple environmental benefits; and

WHEREAS if pollutant transport is not addressed, other extraordinary measures would have to be considered at a local level that, if available, may be less effective or cost effective; and

WHEREAS States have multiple environmental responsibilities over the coming years, both in terms of State Implementation Plans for ozone, fine particulate matter (PM2.5), and regional haze, and other environmental goals and requirements related to toxic materials, estuary impacts, total maximum daily loads, and climate change; and

WHEREAS given that numerous scientific studies by OTC, EPA, and others have demonstrated that air pollution being transported into the OTC States is very significant, States must be assured maximum reductions in transport over State lines in order to meet environmental goals; and

WHEREAS concurrent emission reductions of mercury, other toxic materials, and greenhouse gases should be encouraged in order to maximize environmental benefits and energy efficiency, enhance cost effectiveness, and encourage pollution prevention and resource conservation;

THEREFORE BE IT RESOLVED that a strong, effective, and expeditious multi-pollutant emission reduction program is a critical need for OTC States to meet their environmental goals and to provide clean, healthful air to its citizens; and

FURTHERMORE such a program should, with respect to emissions of nitrogen oxides (NOx) and sulfur oxides (SOx), include emission reductions for electric generating units and other major stationary NOx and SOx sources, should be set to ensure national annual caps consistent with maximum control technology available within a timeframe consistent with attainment and other regulatory deadlines, and in a manner that will ensure maximum effectiveness in nonattainment areas and regional haze Class I areas; and

FURTHERMORE that mercury emissions caps should be set that reflect maximum control technology available at the time of implementation, timed to coincide with the NOx and SOx caps, but providing maximum additional emission reductions of mercury beyond emission reductions that would happen with NOx and SOx caps alone; and

FURTHERMORE that carbon dioxide (CO_2) caps if included in the program should be set in order to support and be consistent with individual State efforts to reduce emissions of this pollutant, through energy efficiency, resource conservation, and other means; and

FURTHERMORE to complement such a program EPA should adopt stringent national motor vehicle, engine, and fuel emission control measures for NOx, VOCs, PM, and other pollutants, and area source VOCs, in order to support States in both the development of these SIPs and in the achievement of other environmental goals; and

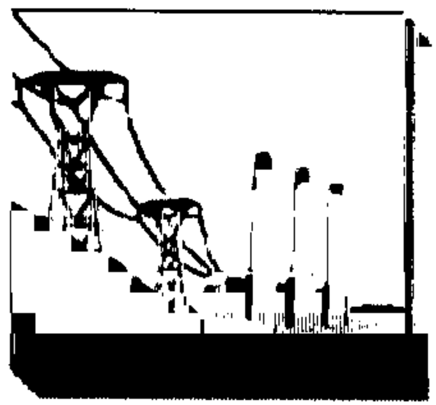
FURTHERMORE any Federal program must respect the right of States to solve the local portion of their air quality problems, and that any Federal program must allow the States to develop their own approaches for meeting the State-related national caps, including the use of State or regional emission caps more stringent than Federal caps, as long as such a program ensures that States are accountable for the downwind impacts of their emissions; and

FURTHERMORE technology-based requirements for pollution control should not be weakened through the introduction of site-specific risk assessment or other approaches that fail to take into account the downwind impacts of air transport of pollutants; and

FURTHERMORE any programmatic reforms to Federal air quality standards or requirements, whether by legislation or regulation, must achieve emission reductions of NOx, SOx, mercury, and CO_2 if included in the program, at least equal to those currently required under the Clean Air Act.

Approved March 4, 2003

Discussion of Multi-Pollutant Strategy

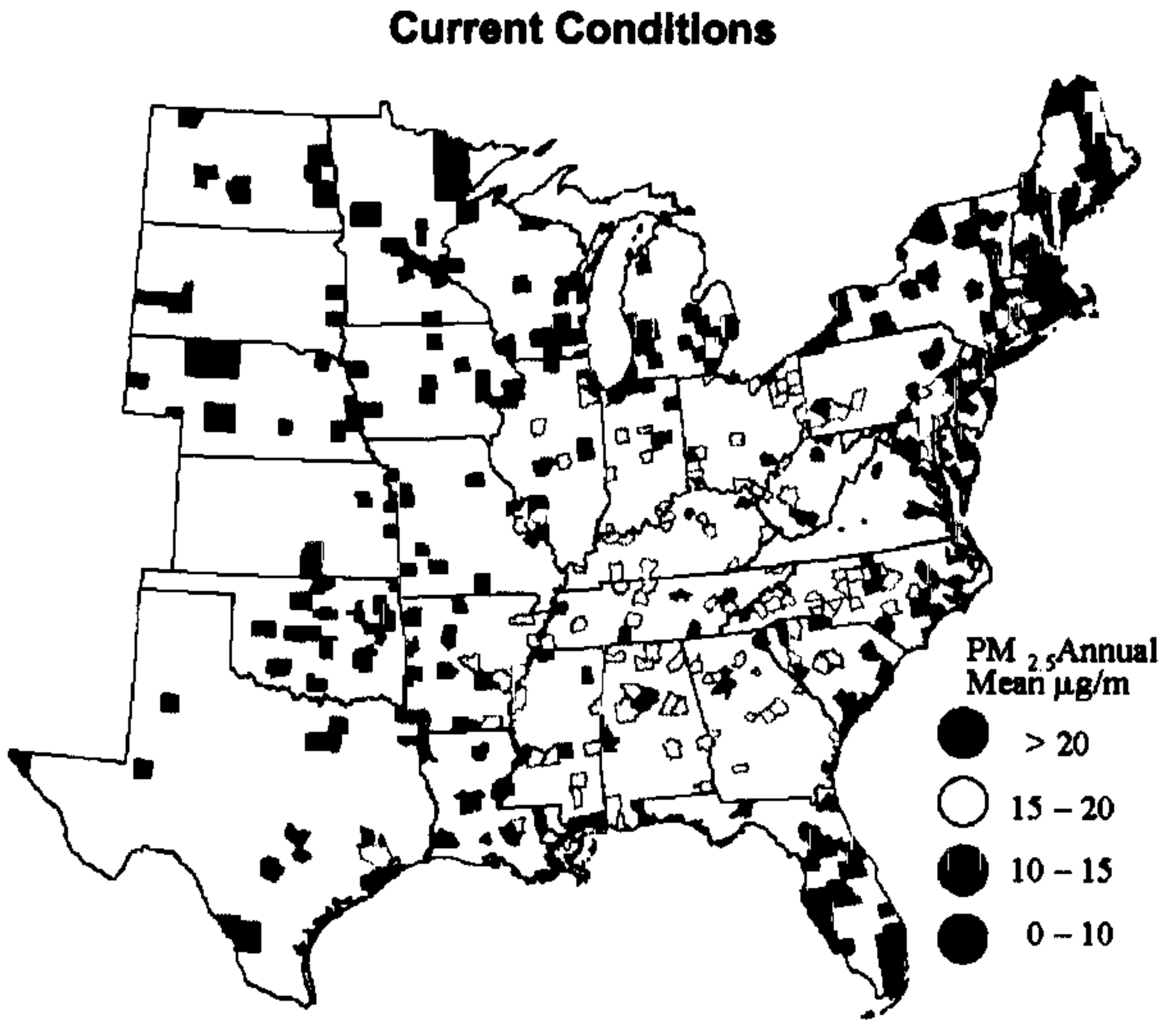


Meeting with EEI

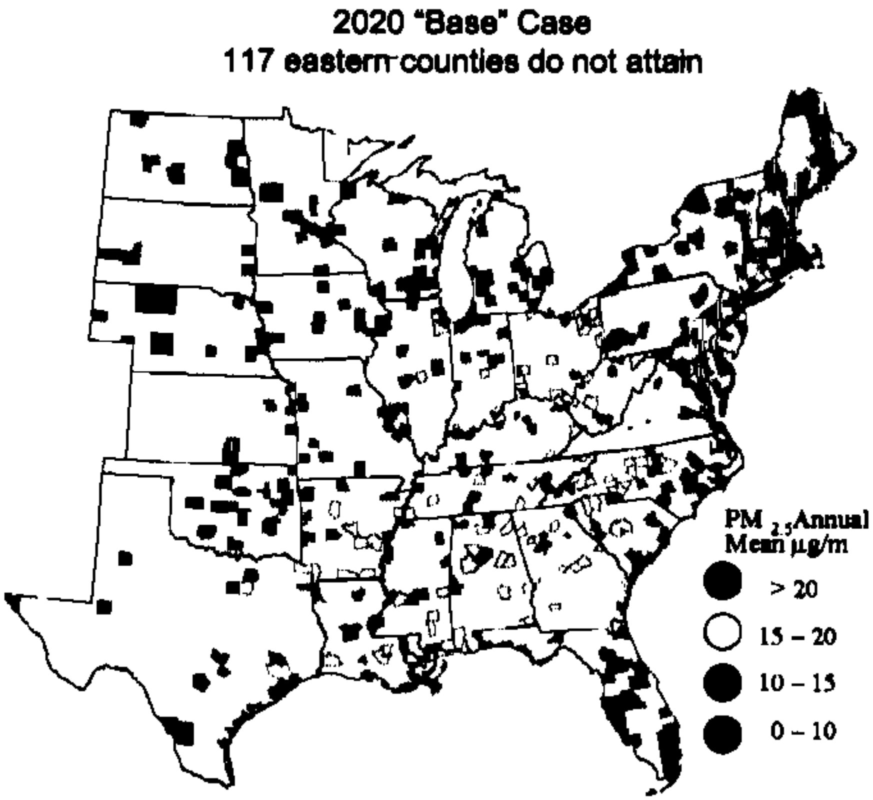
U.S. Environmental Protection Agency

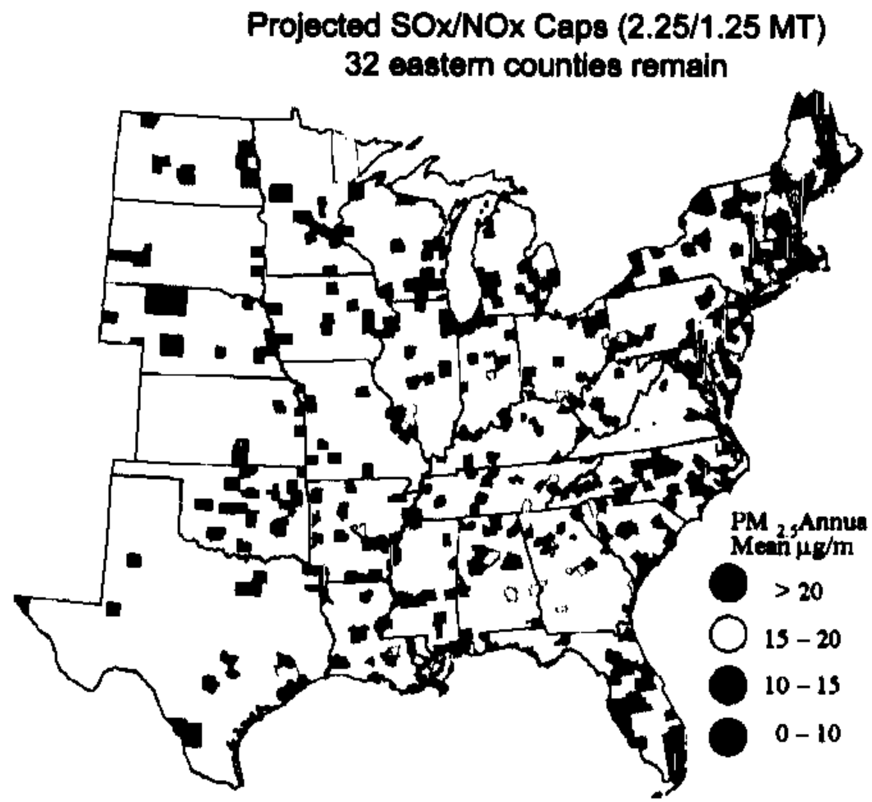
September 18, 2001

PM2.5 Non-Attainment – Current Data



Alternative Base-case projections for PM2.5



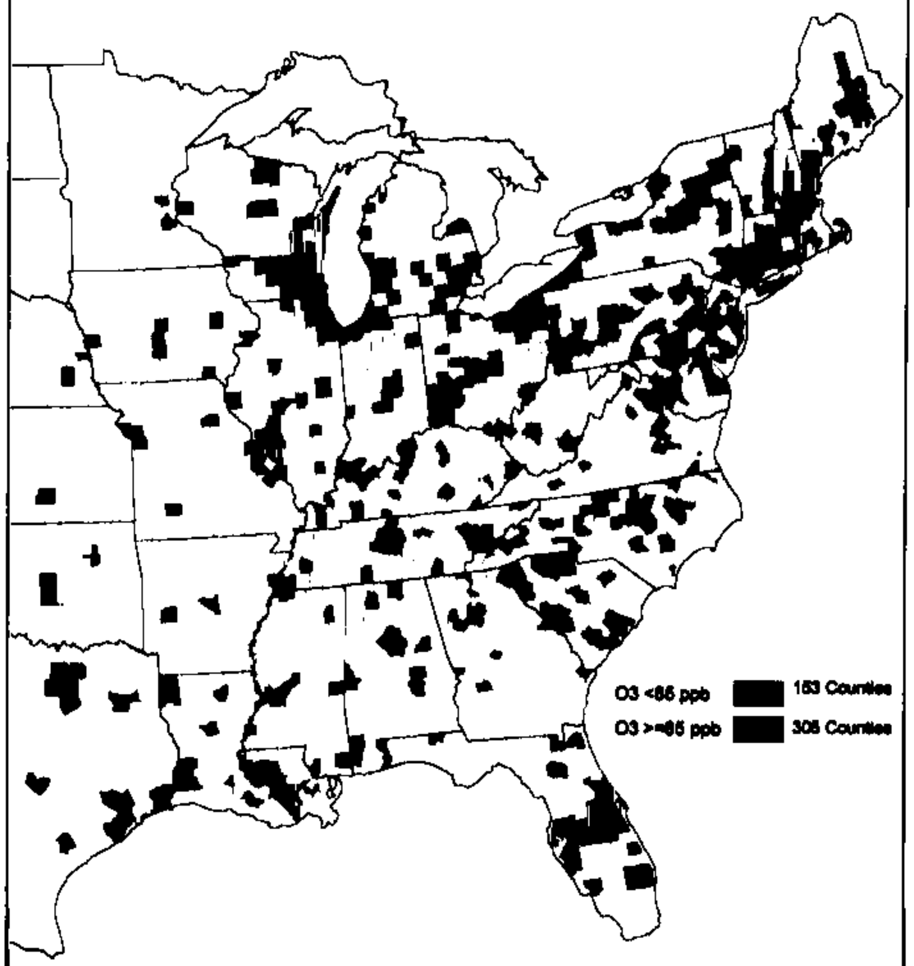


Schedule for implementing $PM_{2.5}$ NAAQS and Regional Haze Programs

2002-4	Regional planning bodies model annual SOx/NOx PM strategies
2003	3 years of $PM_{2.5}$ air quality data compiled and assured
2004-5	EPA designates areas for $PM_{2.5}$
2005	Likely Scenario: States file section 126 petitions for PM transport
2005-6	Interstate transport rule to address SOx/NOx emissions for $PM_{2.5}$ NAAQS and regional haze
2007-8	Attainment and Regional Haze SIPs due for $PM_{2.5}$
2010	Compliance date for interstate transport rule/126 petitions sources
2010	5 year deadline for attainment of $PM_{2.5}$ NAAQS
2013-14	Compliance for BART sources (*2018-19 for trading*)
2015-17	Potential 5-yr plus 2-yr attainment date extensions for local problems
2018	Second Regional Haze SIPs due

Ozone Non-Attainment – Current Data

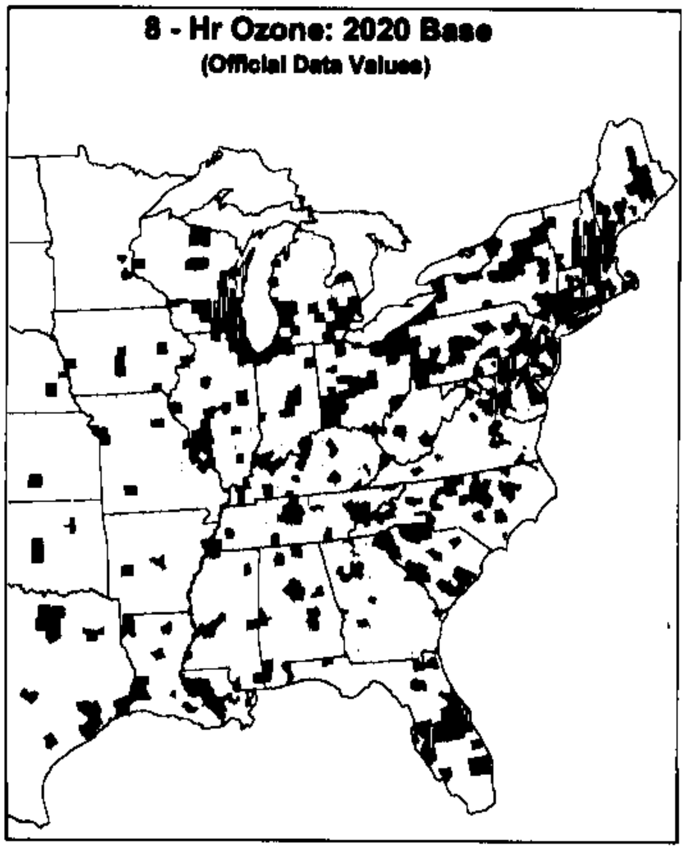
8 - Hr Ozone: 1997 - 1999
(Official Data Values)



Currently 305 counties in the eastern U.S. exceed the 8-hr ozone standard

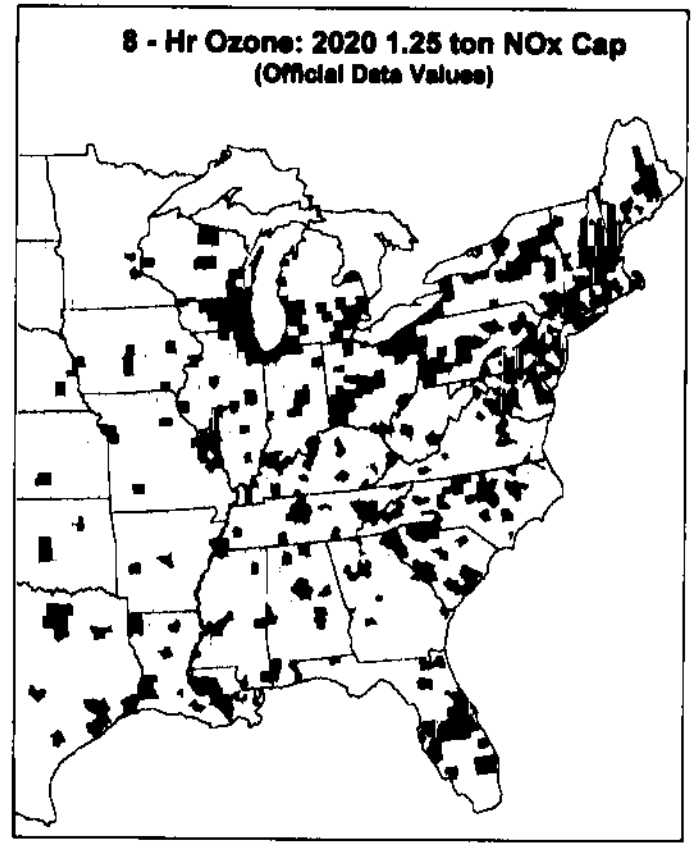
Alternative Base Case Projections for Ozone

- In 2020, with implementation of the SIP Call and Tier II, 42 eastern counties do not attain 8-hour NAAQS
- A 1.25 ton NOx Cap (national) reduces non-attainment to 27 counties



O3 <85 ppb

O3 >=85 ppb



Schedule for implementing 8-hour Ozone NAAQS and related actions

2003	Final rule on implementation of 8-hr O3 NAAQS
2004	Designation of 8-hour nonattainment areas Reinstate the NOx SIP call with respect to the 8-hour NAAQS
2005	Complete new modeling for additional "coarse grid" states. Make additional SIP calls as results dictate
2007	8-hr ozone NAAQS SIP submission date
2007-2008	Compliance with full NOx SIP call budgets for 19 States (assumes EGU at 0.15 #/mm Btu) EGU compliance for any "newly added coarse grid" States
2007-2010	Assess impact of SIP call budget New regional NOx reductions (SIP Call II) as appropriate with tighter limits
2009	Part D/Subpart 1 default date (5 years from NA designation)
2014+	Potential 5-yr plus 2-yr attainment date extensions for local problems

Mercury Timeline

- Propose MACT Regulations: December 15, 2003
- Promulgate MACT Regulations: December 15, 2004
- Compliance Date: December 15, 2007
- ** Case-by-Case MACT: All units commencing construction after 12/20/00 are subject to the case-by-case MACT provisions of section 112, which implemented on a state-by-state basis **

Mercury Reductions

- Range of Reductions Considered:
  - 60% - 95% (from mercury contained in coal)
  - 60% or greater reductions - $1.7 billion (for reductions ranging from 60-95%) - using activated carbon only
  - 80% or greater reductions - $2.7 billion (for reductions ranging from 80-95%) - using activated carbon only
  - If composite sorbent (lime + activated carbon) is used, control costs are reduced by > 40% to $1.1 billion and $1.7 billion, respectively.

- Under MACT, all sources (existing and new) would be subject to a source-specific limit.

COMPARISON OF REQUIREMENTS UNDER BUSINESS-AS-USUAL AND THE STRAW PROPOSAL

Potential Control Levels for Electric Generating Units under a Multi-Pollutant Approach

2004
- NOx Phase I: NOx SIP call

2008
- Hg Phase I: Cap at the co-benefits level (24 tons), annual national trading program
- NOx Phase II: 1.87 million ton cap, with an annual national trading program

2010
- SO_2: 2.0 million ton cap, with an annual national trading program

2012
- Hg Phase II: 7.5 ton cap, annual national trading program + 70% facility-specific reduction requirement.
- NOx Phase III: 1.25 million ton cap, with an annual national trading program

2004	2006	2008	2010	2012

Potential Control Levels for Electric Generating Units Under Business-As-Usual

2004
- NOx SIP Call

2008
- Hg MACT: 70% facility-specific reduction requirement

2010
- Ozone NAAQs: 1.09 million NOx ton cap in OTAG region, with region wide trading program

2012
- $PM_{2.5}$: 2.0 million ton SO_2 cap, with an annual national trading program

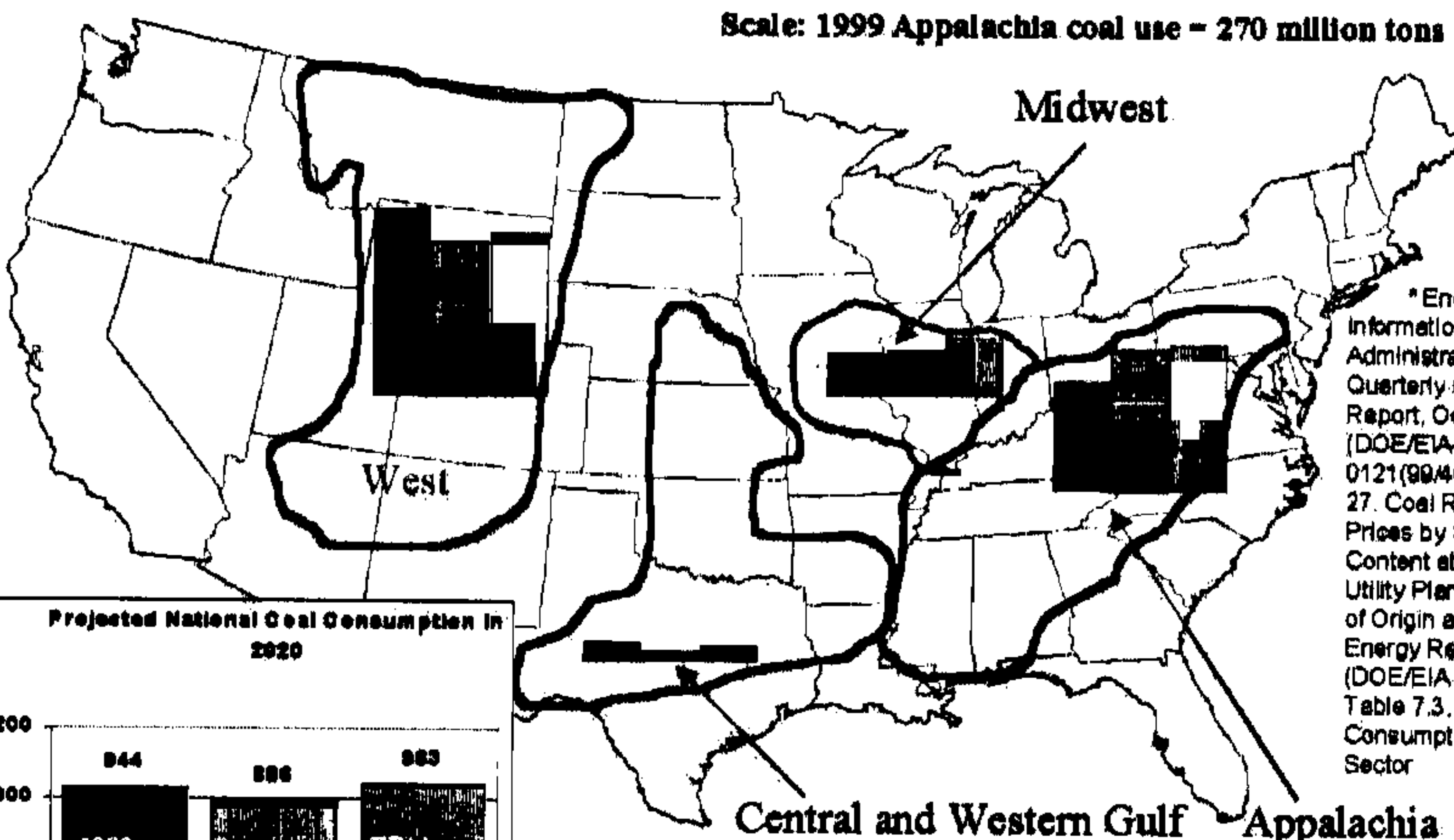
BUSINESS-AS-USUAL
EPA's OBLIGATIONS UNDER THE CAA

- EPA has analyzed a regulatory "business-as-usual" future to provide an estimate of the true cost (i.e., net cost) of the Agency's straw proposal
- While future requirements would likely include MACT standards for mercury and reductions in both NOx and SO_2 in order to help achieve the 8-hour ozone and $PM_{2.5}$ NAAQS, the specific levels of emission control are uncertain
- For the purposes of the business-as-usual analysis, EPA estimated the scope and timing of these requirements as well as the caps on emissions:
  - Though EPA has not yet determined the required Hg reductions for MACT under the CAA, for this analysis EPA modeled a facility-specific 70% reduction of Hg from fuel in 2008.
  - To simulate efforts to achieve the $PM_{2.5}$ and revised ozone NAAQS, EPA modeled an annual NOx emission cap in the OTAG region -- rather than at a national level -- at 1.09 million tons (equivalent to about 0.10 lb/mmBTU) in 2010.
  - For purposes of achieving the $PM_{2.5}$ NAAQS and national progress in reducing regional haze, EPA modeled an annual national SO_2 cap at 2.0 million tons in 2012.

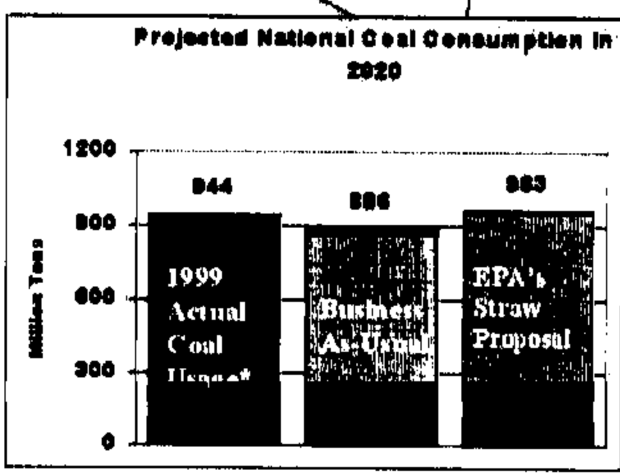
BUSINESS-AS-USUAL FUTURE
RESULTS

- EPA estimates that at the levels described above, costs would be approximately $3 billion more than under the straw proposal in 2020, even though the reductions for NOx & Hg are less significant than EPA's comprehensive strategy:
  - The higher costs are due to stranded capital investments which result from the installation of controls that later become obsolete when additional requirements are promulgated, and by the reduced lead time when compared to the straw proposal.
- The costs of a business as usual approach could be even higher due to the potential State imposition of trading restrictions through the SIP process.
  - Even if the "business as usual" control levels are less stringent, costs of achieving those reductions are still likely to be higher than those of a more stringent multi-pollutant strategy due to the trading restrictions imposed through the state-by-state implementation of SIPs and the stranded capital investments.

COAL CONSUMPTION IN 2020 BY COAL SUPPLY REGION

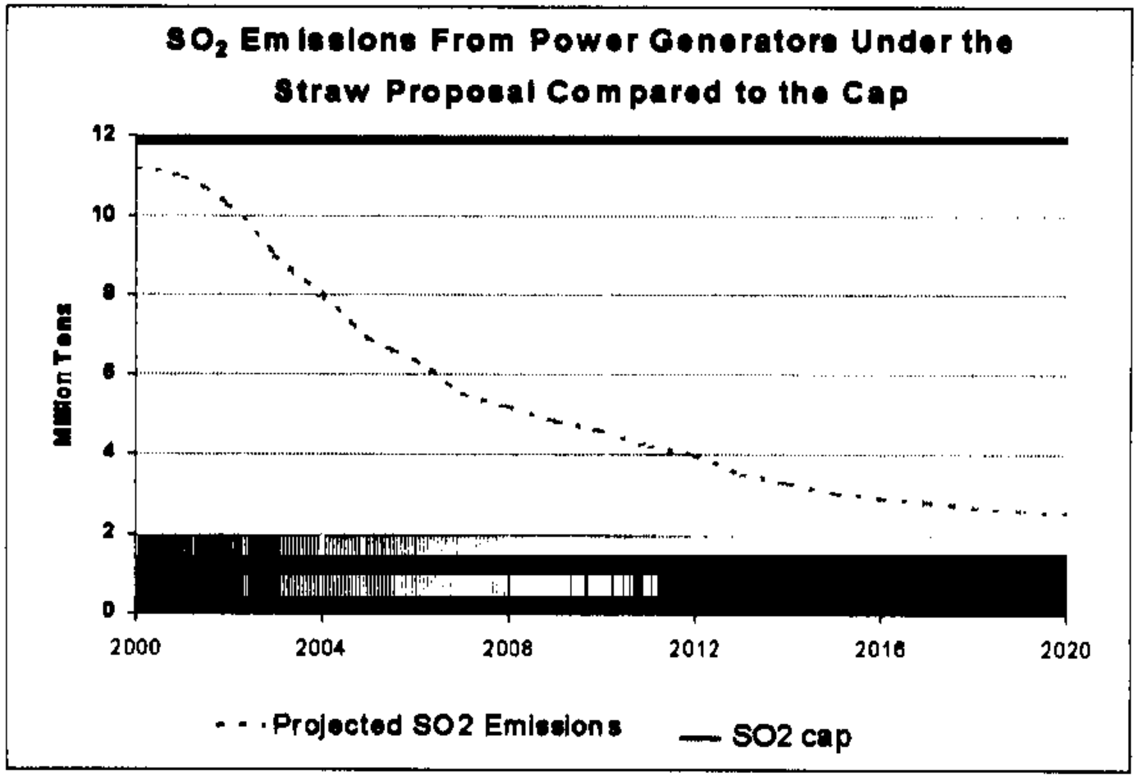


* Energy Information Administration, Quarterly Coal Report, Oct-Dec 1999 (DOE/EIA-0121(99/4Q)), Table 27. Coal Receipts and Prices by Sulfur Content at Electric Utility Plants, by State of Origin and Annual Energy Review, 1999 (DOE/EIA 0384(99)), Table 7.3. Coal Consumption By Sector



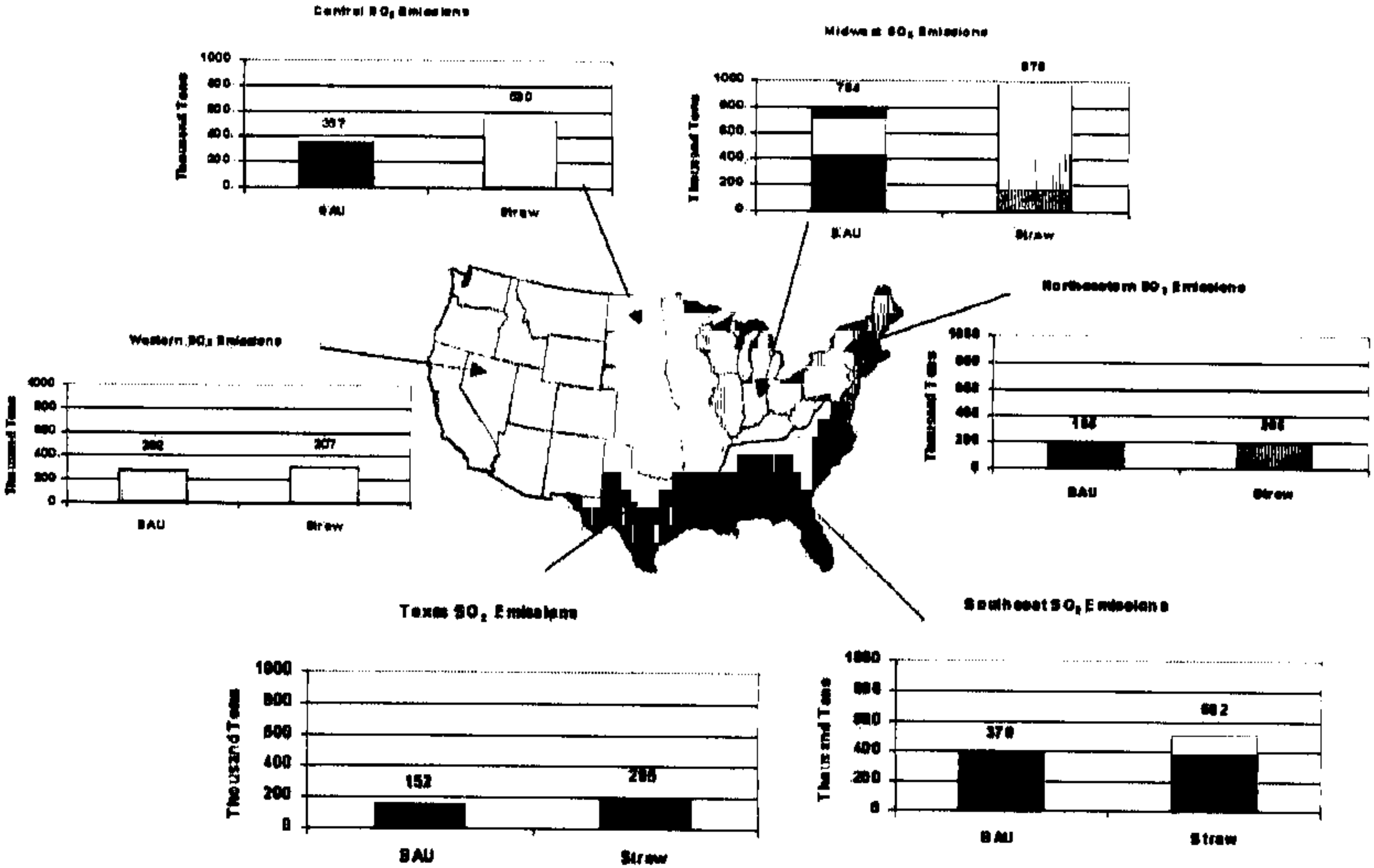
• Decreased generation from coal under BAU results in less coal consumed in 2020 compared to both the straw proposal and 1999 actual coal usage.

PROJECTED SO_2 EMISSIONS FROM POWER GENERATORS UNDER THE STRAW PROPOSAL



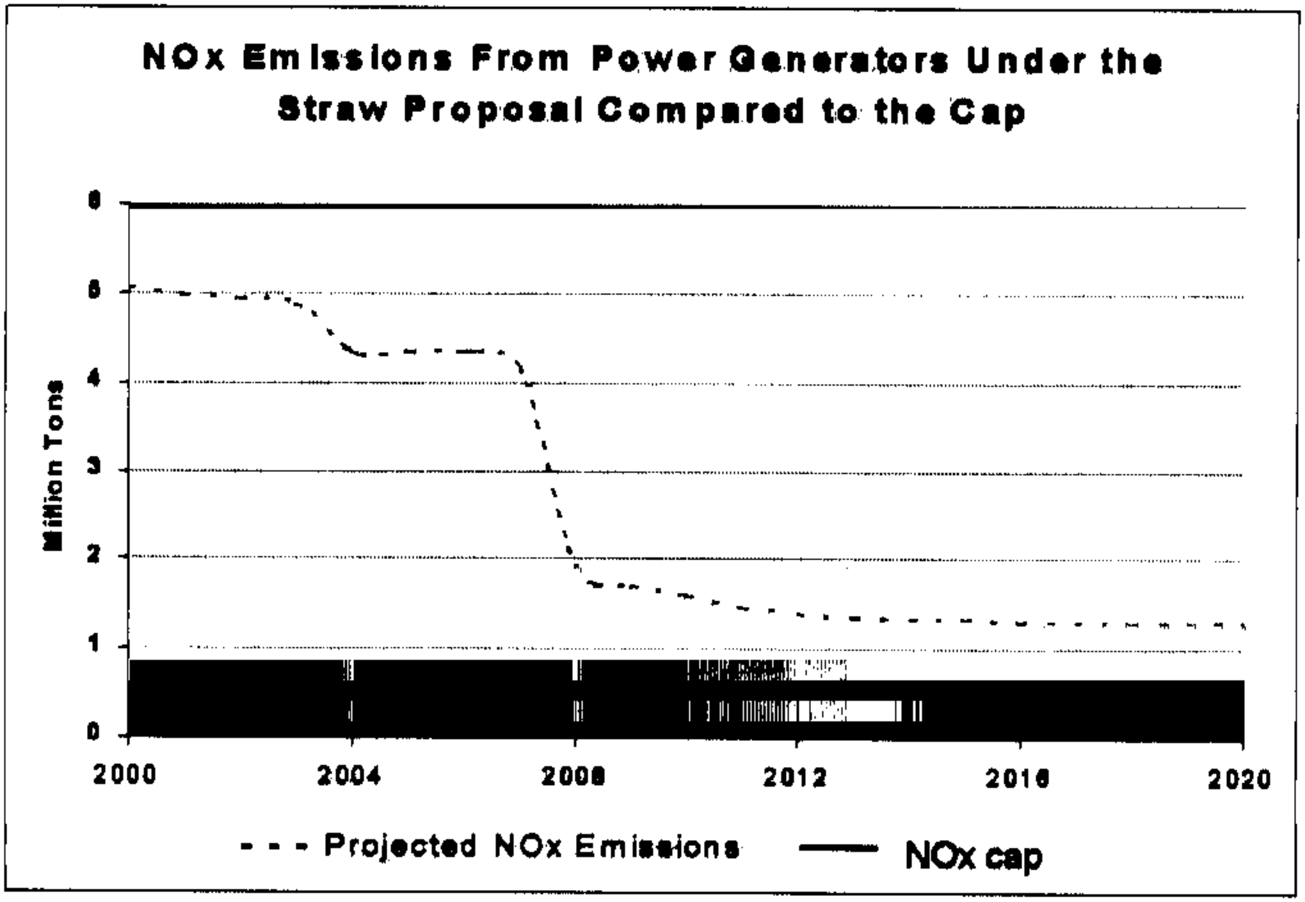
- The presence of the SO_2 allowance bank under Title IV (10.4 million tons at the beginning of 2001) will ease the transition into meeting the straw proposal's more stringent SO_2 cap of 2.0 million tons in 2010. Actual emissions from power generators are anticipated to be about 4.5 million tons in 2010, 3.0 million tons in 2015 and 2.3 million tons in 2020.

REGIONAL SO_2 EMISSIONS FROM ALL POWER GENERATORS IN 2020



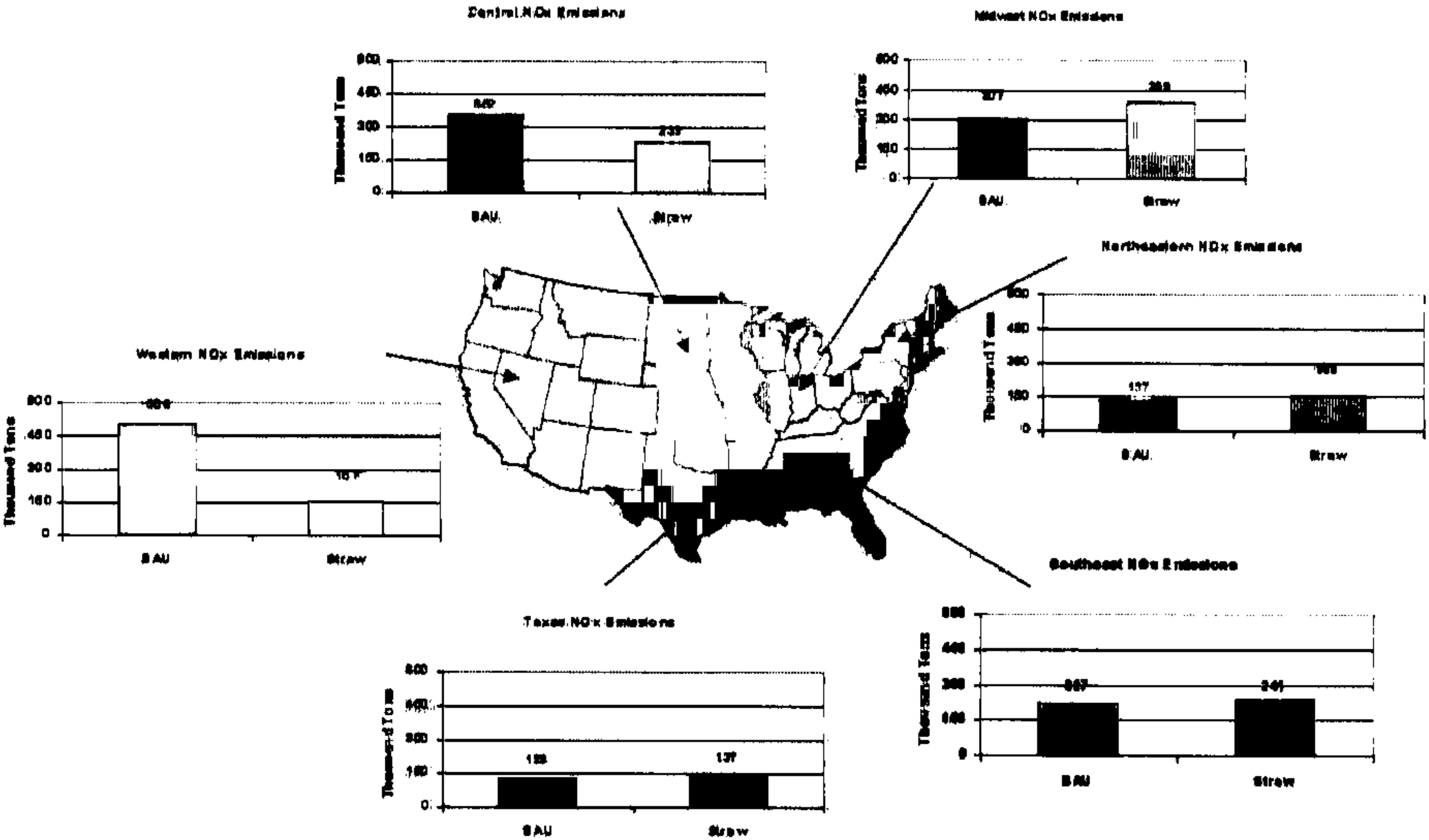
- *Note:* Includes emissions from unaffected units

PROJECTED NOx EMISSIONS FROM POWER GENERATORS UNDER THE STRAW PROPOSAL



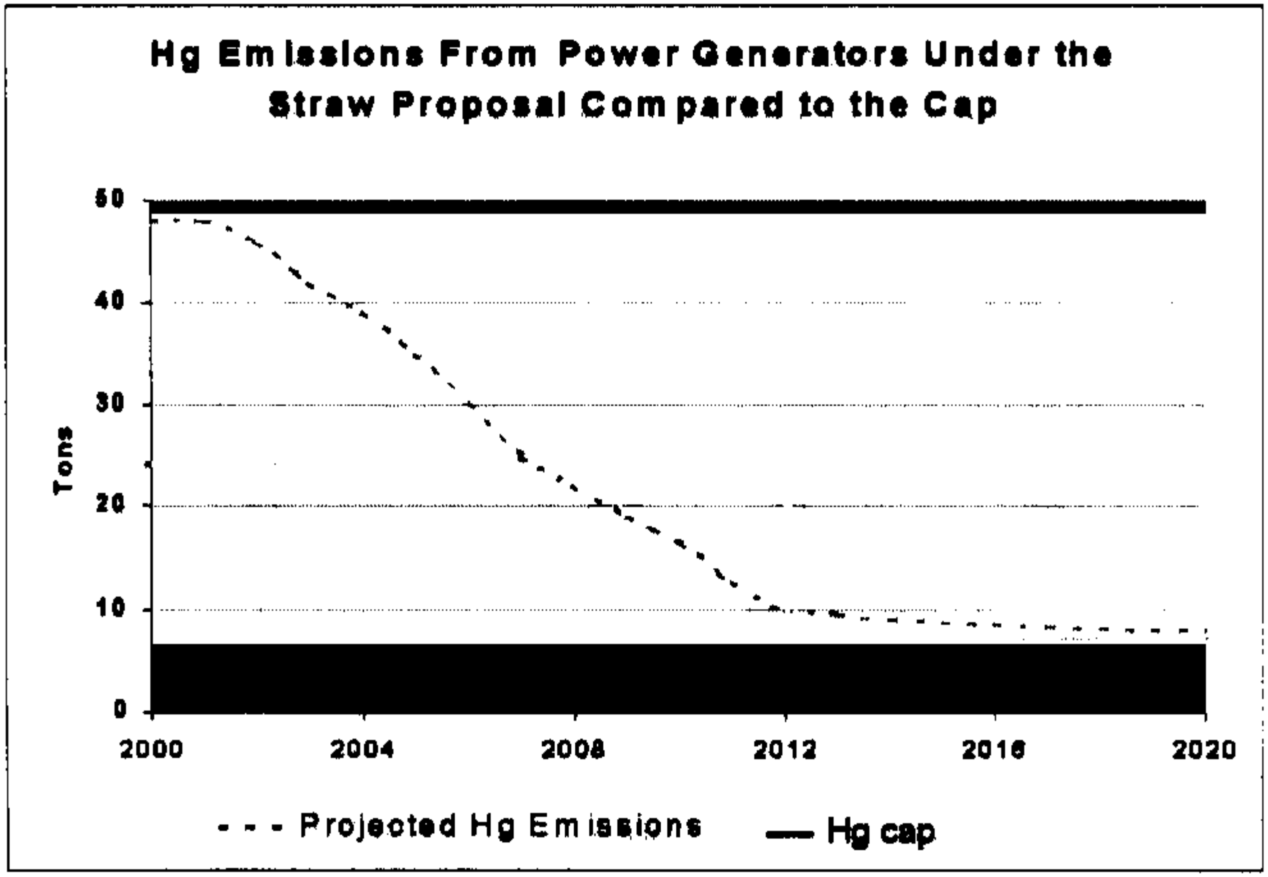
- EPA's analysis shows that sources are expected to reduce NOx emissions below the Phase II cap and bank emissions in anticipation of the more stringent limits that begin in 2012.
- The 2012 Phase III electricity generation NOx cap (1.25 million tons) is projected to be met by 2015. In 2010, NOx emissions from power generators are projected to be approximately 1.6 million.

REGIONAL NOx EMISSIONS FROM ALL POWER GENERATORS IN 2020



- *Note:* Includes emissions from unaffected units

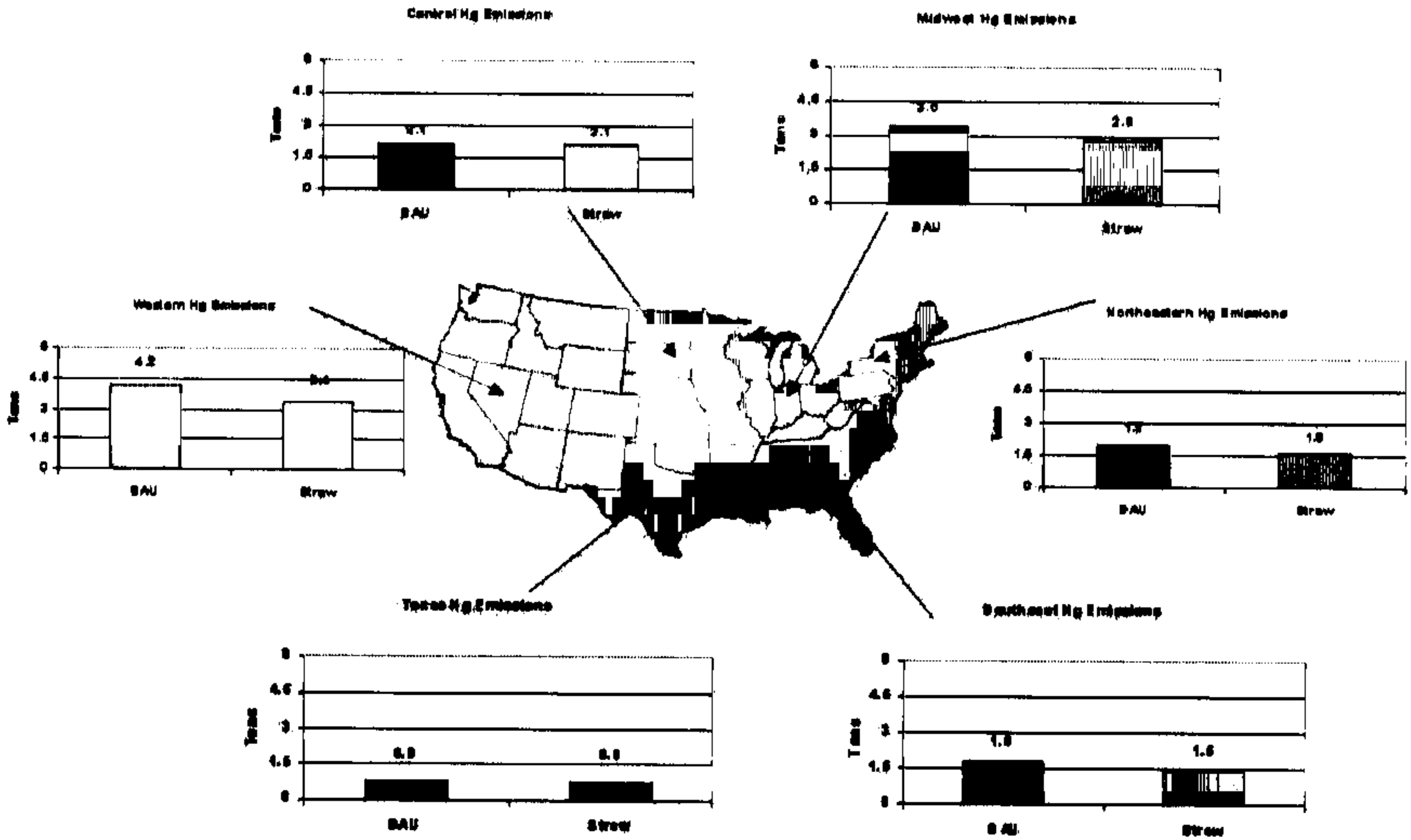
PROJECTED Hg EMISSIONS FROM POWER GENERATORS UNDER THE STRAW PROPOSAL



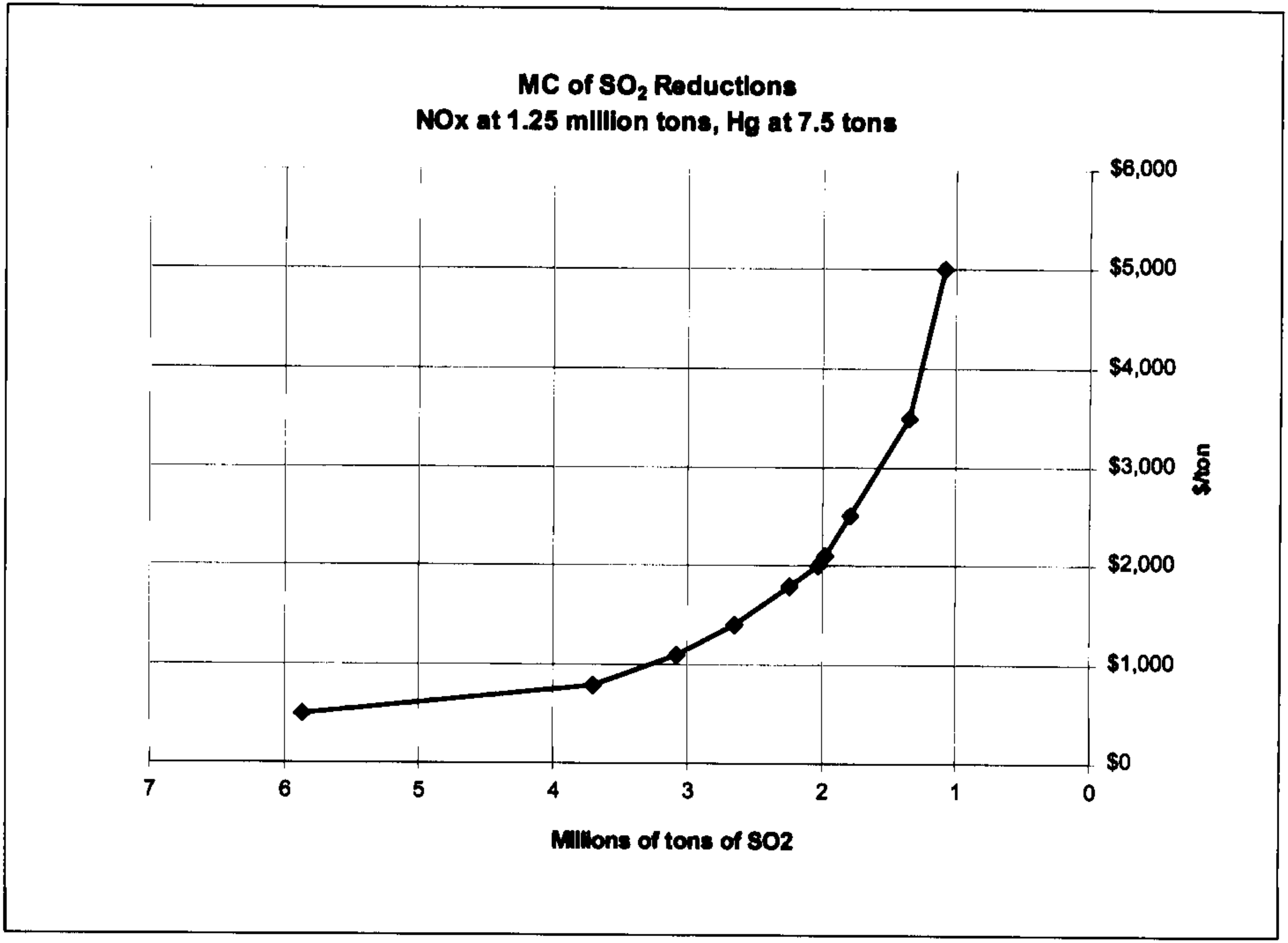
- Under the straw proposal, banked Hg allowances from either Phase I or Phase II may not be used to comply with the facility-specific 70% reduction that starts in 2012.

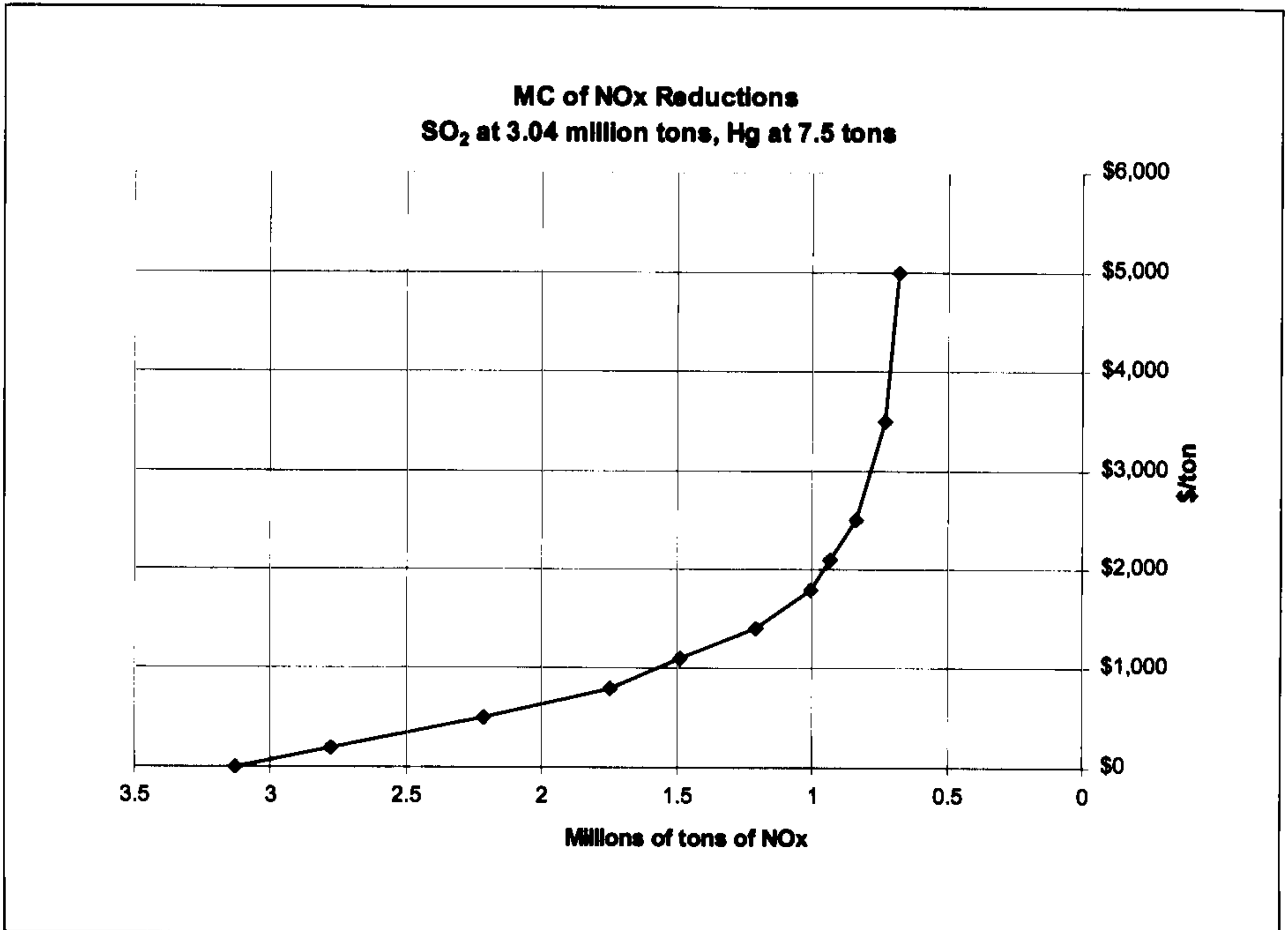
- The 2012 Phase II Hg cap on coal-fired electricity generators (7.5 tons) is projected to be met by 2020. Mercury emissions are expected to be 16.5 tons in 2010 and 8.5 tons in 2015.

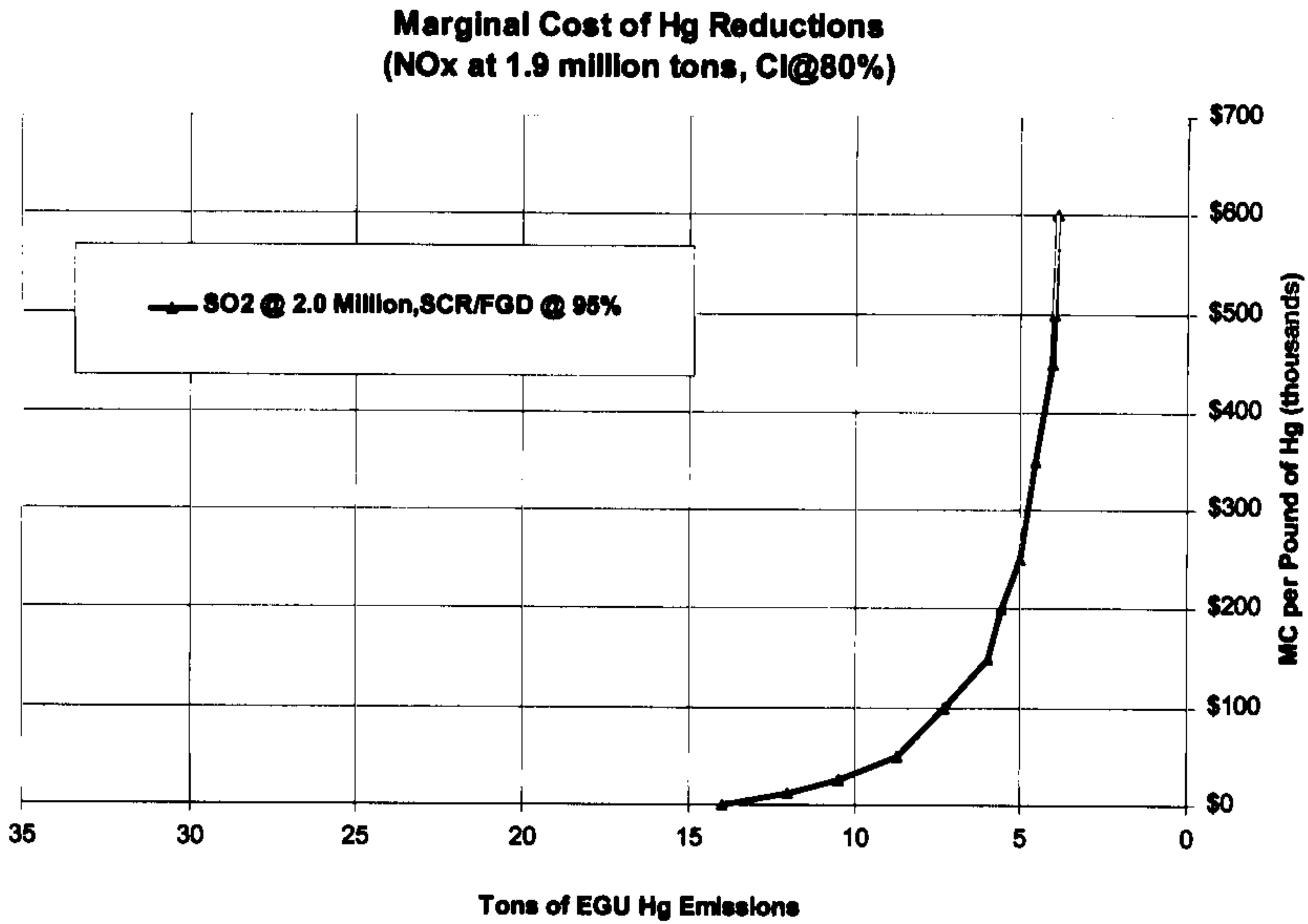
REGIONAL Hg EMISSIONS FROM ALL POWER GENERATORS IN 2020



- *Note:* Includes emissions from unaffected units


MC of SO_2 Reductions
NOx at 1.25 million tons, Hg at 7.5 tons
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
$/ton
7
6
5
4
3
2
1
0
Millions of tons of SO2


MC of NOx Reductions
SO_2 at 3.04 million tons, Hg at 7.5 tons
$6,000
$5,000
$4,000
$3,000
$2,000
$1,000
$0
$/ton
3.5
3
2.5
2
1.5
1
0.5
0
Millions of tons of NOx



Marginal Cost of Hg Reductions
(NOx at 1.9 million tons, Cl@80%)
SO2 @ 2.0 Million,SCR/FGD @ 95%
$700
$600
$500
$400
$300
$200
$100
$0
MC per Pound of Hg (thousands)
35
30
25
20
15
10
5
0
Tons of EGU Hg Emissions

CONTROL TECHNOLOGY ASSUMPTIONS

EPA's Assumptions on the Costs and Removal Efficiencies of SO2, NOx and Hg Control Technologies		
SO_2 Technology Performance	**SO_2 Removal Using Scrubbers**	→ EPA assumes 95% SO2 removal from Limestone Forced Oxidation (wet scrubber), → 96% SO2 removal from Magnesium enhanced lime (wet scrubbers), and → 90% SO2 removal from Lime Sprayer Dryer (dry scrubbers)
	Cost of Scrubbers	→ Capital: $156/kw - $201/kw → FOM:$5/kw/yr - $9/kw/yr → VOM: 1-2 mills/kwh
NOx Technology Performance	**NOx Removal Using SCR**	→ EPA assumes 90% NOx removal. → EPA's cost and performance estimates were developed using publications by utilities, vendors, and control technology experts. All recently installed SCR retrofits are capable of achieving greater than 90% removal, as documented in papers by utilities and vendors.
	Costs of SCR	Costs for 500 MW unit: → Capital: $62.12/kW → FOM: $0.41/kW-yr → VOM: 0.89 mills/kWh
Hg Technology Performance	**Hg Removal Using ACI**	→ EPA assumes 80% removal for ACI. → Initial full-scale testing at the Gaston plant supports this number.
	Costs of ACI	For units W/ HS-ESP: → Capital: $46.62/kw - $52.24/kW → FOM: $6.20/kw/yr - $7.48/kw/yr → VOM: .13 - 1.75 mills/kwh For units w/o HS-ESP: → Capital: $0.9/kw - $16.89/kW → FOM: $0.70/kw/yr - $2.62/kw/yr → VOM: 0.08 - 1.24 mills/kwh
	Hg Removal Using SCR + FGD	→ EPA assumes 95% removal for all coal types. → EPA bases its removal on analysis of ICR data (EPA, 2000) and German data (Fahlke and Bursik, 1995).

EPA'S ENERGY ASSUMPTIONS

EPA'S ENERGY ASSUMPTIONS	
Coal Price	→$0.80/mmBtu (delivered) - Business-As-Usual in 2020 →$0.79/mmBtu (delivered) - Straw Proposal in 2020
Natural Gas Price	→$2.74/mmBtu (delivered) - Business-As-Usual in 2020 →$2.70/mmBtu (delivered) - Straw Proposal in 2020
Demand in Electricity	→1.2% (assumes energy efficiency measures in the NEP)
Amortization Period	→30 years →In general, power generating and emission control technologies last longer than 30 years with maintenance and upgrades. The costs that EPA assumes in calculating the costs of meeting the straw proposal emission reductions incorporate the costs associated with any necessary maintenance or upgrade activities, therefore EPA believes it is appropriate to calculate costs amortizing over 30 years.

March 26, 2004

IPM Modeling Summary of Results

I. Introduction

A series of modeling runs were performed to evaluate the OTC multi-pollutant proposal. Modeling was performed with ICF's Integrated Planning Model (IPM) using EPA's modeling assumptions version 2.1.6.[1] A total of three modeling runs were performed as outlined in Table 1.1. Scenario 1 relies on EPA demand growth and natural gas price assumptions. Scenarios 2 and 3 rely on Energy Information Administration (EIA) demand growth and natural gas price assumptions. As a reminder of the assumptions that were used for each of the scenarios, we use superscripted notation indicating either EPA or EIA assumptions (e.g., Scenario 1^{EPA}).

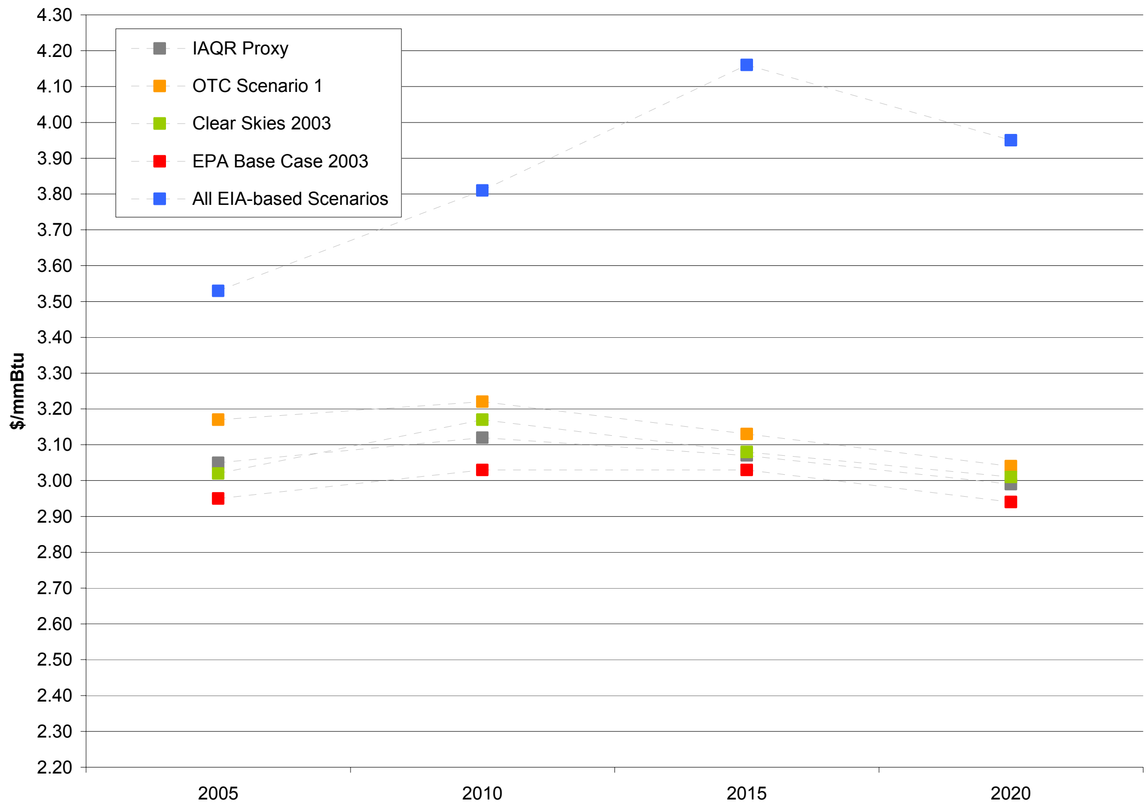
EPA average annual demand growth for 2001-2030 is 1.55%; EIA's average annual demand growth for the same time period is 1.74%. The EIA natural gas price assumptions are fixed for all runs (i.e., the price projection is the same for all scenarios based on the EIA assumptions). The EPA natural gas price assumptions are based on a demand curve and therefore vary depending on the scenario. For these scenarios, the natural gas prices are an output of the model. Figure 1.1 summarizes the national average delivered gas prices for each of the scenarios. Apart from the alternative demand growth and natural gas price assumptions, all other underlying assumptions were held constant across the four scenarios; what varied were the levels and implementation of the caps.

[1] Detailed assumptions can be found at: http://www.epa.gov/airmarkets/epa-ipm/.

Table 1.1 Summary of OTC Modeling Scenarios

Scenario	NO_X	SO_2	Hg
Scenario 1[EPA] **EPA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012 National annual cap and trade	none
Scenario 2[EIA] **EIA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012, National annual cap and trade Transfer of allowance bank allowed subject to Progressive Flow Control beginning in 2008 based on 10% trigger and 2:1 surrender ratio	none
Scenario 3[EIA] **EIA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 1.87 million ton cap in 2008 1.28 million ton cap in 2012 National annual cap and trade	Title IV SO_2 3 million ton cap in 2008 2 million ton cap in 2012 National annual cap and trade Transfer of allowance bank allowed subject to Progressive Flow Control beginning in 2008 based on 10% trigger and 2:1 surrender ratio	5 ton cap in 2015 National annual cap and trade

Figure 1.1 National Average Natural Gas Prices (delivered)



Generally speaking, the results of an individual IPM modeling run have very little meaning. Only by comparing the various runs can we begin to understand the effects of the policy. EPA has used the same modeling assumptions to evaluate a hypothetical Base Case (i.e., business-as-usual scenario), the Clear Skies Act, and a proxy for the Interstate Air Quality Rule (IAQR). We rely on these results as well as the OTC modeling results to evaluate the policy. The EPA scenarios used for comparative purposes are summarized in Table 1.2. Again, we use special notation to indicate whether the scenarios rely on EPA or EIA demand growth and natural gas price assumptions.

Table 1.2 Summary of EPA Modeling Scenarios

Scenario	NO_X	SO_2	Hg
Base Case[EPA] **EPA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 National annual cap and trade	Title IV SO_2 9.47 million tons through 2009 8.95 million tons 2010 onward National annual cap and trade	none
Clear Skies[EPA] **EPA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 2.1 million ton cap in 2008 assigned to two zones 1.7 million ton cap in 2018 assigned to two zones Annual cap and trade	Title IV SO_2 4.5 million ton cap in 2010 3.0 million ton cap in 2018 National annual cap and trade	26 ton cap in 2010 15 ton cap in 2018 National annual cap and trade with safety valve
IAQR Proxy[EPA] **EPA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 Eastern regional cap encompassing the eastern half of Texas, Minnesota, Iowa, Missouri, Arkansas, and Louisiana and all of the States to the east 1.6 million ton cap in 2010* 1.3 million ton cap in 2015*	Title IV SO_2 4.5 million ton cap in 2010 3.15 million ton cap in 2015 National annual cap and trade	none
Base Case[EIA] **EIA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 National annual cap and trade	Title IV SO_2 9.47 million tons through 2009 8.95 million tons 2010 onward National annual cap and trade	none
Clear Skies[EIA] **EIA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 2.1 million ton cap in 2008 assigned to two zones 1.7 million ton cap in 2018 assigned to two zones Annual cap and trade	Title IV SO_2 4.5 million ton cap in 2010 3.0 million ton cap in 2018 National annual cap and trade	26 ton cap in 2010 15 ton cap in 2018 National annual cap and trade no safety valve

Scenario	NO_X	SO_2	Hg
IAQR Proxy^{EIA} **EIA demand growth assumptions and gas prices**	NO_X SIP Call in 2004 Eastern regional cap encompassing the eastern half of Texas, Minnesota, Iowa, Missouri, Arkansas, and Louisiana and all of the States to the east 1.6 million ton cap in 2010* 1.3 million ton cap in 2015*	Title IV SO_2 4.5 million ton cap in 2010 3.15 million ton cap in 2015 National annual cap and trade	none

*EPA does not report the levels of the NOx caps in its summary of the IAQR modeling; however, it does indicate that the caps were very close to the final proposed IAQR levels. Therefore, we report the proposed IAQR caps in this table.

II. Emissions Comparison

We begin our analysis with a comparison of the national emissions projections for the various policies. The scenarios based on EPA demand growth and natural gas prices are summarized in Table 2.1. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case^{EPA}. Note that mercury emissions are reported for all units, including sources that are not covered by the caps. In EPA's model, unaffected units account for 8 tons of mercury emissions each year. (The affected unit size cutoff is 25 MW for NOx, SO_2 and mercury.) To calculate the mercury emissions from affected units only, you simply need to subtract 8 tons from the figures reported in the table labeled "Mercury (all units)". The percentage differences remain the same because the unaffected unit emissions are included for all scenarios. Table 2.2 summarizes the results for the scenarios based on EIA demand growth and natural gas prices.

Mercury emissions will generally decline as a result of installing additional NOx and SO_2 controls, and as a result of reducing total coal-fired power generation. However, a tighter SO_2 cap does not inevitably result in lower mercury emissions. Two basic factors will influence the mercury emissions resulting from a policy that does not cap or otherwise limit emissions of mercury, including: 1) the mercury content of the coal consumed; and 2) the assumed co-benefits resulting from alternative combinations of controls (e.g., an SCR and a scrubber). The IPM model contains 11 coal types (see table below). The first letter of the coal type codes represents the type of coal: B-Bituminous, S-Subbituminous and L-Lignite. As indicated in the table, most coal types are assigned different mercury concentrations depending on their supply region. For example, BA type coal can have a mercury content ranging from 3.69 lb/TBtu to 5.17 lb/TBtu. Assume for a moment that an SO_2 cap motivates a facility to install a scrubber. All things being equal, this would reduce the mercury emissions from the facility. However, the facility may also switch coal types once the scrubber is installed. For example, it might switch from coal type BA (which has a low sulfur content) to type BG (which a higher sulfur content). Without a cap on mercury emissions the facility would ignore the impact of this decision on its mercury emissions. Note that the mercury content of coal type BG is significantly higher than type BA across all supply regions. This change in fuel use could increase the mercury content of the facility's coal supply from 3.69 lb/TBtu to 28.73 lb/TBtu. The same type of scenario could also play out across coal types (e.g., as facilities switch from western subbituminous coal to eastern bituminous coal).

IPM® Coal Type	SO_2 Content (lb/MMBtu SO_2)	Hg Content 1 (lb/TBtu)	Hg Content 2 (lb/TBtu)	Hg Content 3 (lb/TBtu)
BA	1.0	3.69	5.17	NA
BB	1.0	3.41	4.10	7.85
BD	1.5	5.07	12.54	21.95
BE	2.2	6.08	10.45	18.42
BF	3.0	6.83	11.09	18.69
BG	5.0	8.04	17.43	28.73
SB	1.0	4.55	6.48	NA
SD	1.4	4.40	6.70	NA
SE	2.1	5.53	10.71	NA
LD	1.4	8.45	NA	NA
LF	2.1	5.88	9.79	NA

Table 2.1 Summary of National Emissions: EPA Assumptions

NOx (MTons)

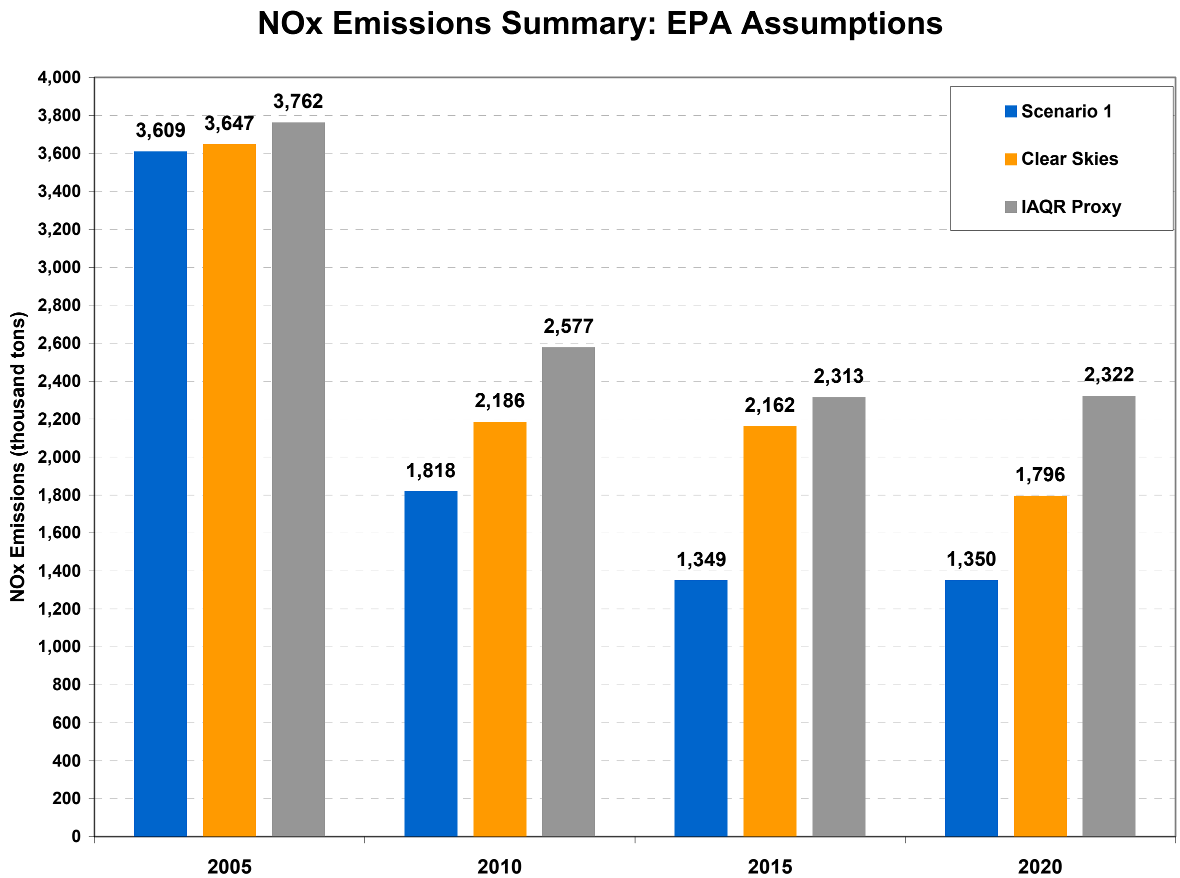
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^EPA	3,609 (-7%)	1,818 (-54%)	1,349 (-66%)	1,350 (-67%)
EPA Scenarios				
Base Case^EPA	3,896 (NA)	3,951 (NA)	4,017 (NA)	4,066 (NA)
Clear Skies^EPA	3,647 (-6%)	2,186 (-45%)	2,162 (-46%)	1,796 (-56%)
IAQR Proxy^EPA	3,762 (-3%)	2,577 (-35%)	2,313 (-42%)	2,322 (-43%)

SO_2 (MTons)

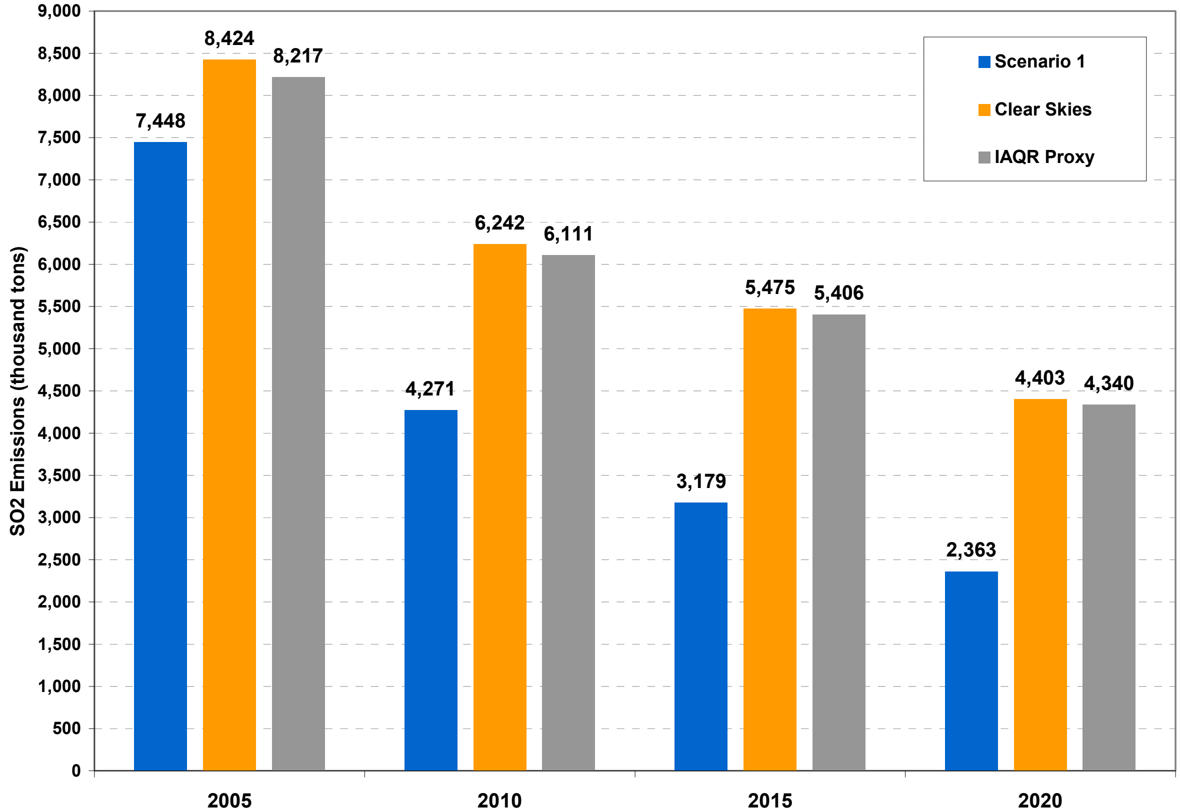
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^EPA	7,448 (-27%)	4,271 (-57%)	3,179 (-66%)	2,363 (-74%)
EPA Scenarios				
Base Case^EPA	10,267 (NA)	9,861 (NA)	9,227 (NA)	8,961 (NA)
Clear Skies^EPA	8,424 (-18%)	6,242 (-37%)	5,475 (-41%)	4,403 (-51%)
IAQR Proxy^EPA	8,217 (-20%)	6,111 (-38%)	5,406 (-41%)	4,340 (-52%)

Mercury (all units, tons)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1[EPA]	46 (-12%)	37 (-30%)	33 (-36%)	32 (-39%)
EPA Scenarios				
Base Case[EPA]	52 (NA)	53 (NA)	52 (NA)	52 (NA)
Clear Skies[EPA]	49 (-7%)	35 (-35%)	34 (-35%)	30 (-42%)
IAQR Proxy[EPA]	49 (-7%)	42 (-20%)	41 (-22%)	38 (-27%)



SO_2 Emissions Summary: EPA Assumptions



Mercury Emissions Summary: EPA Assumptions

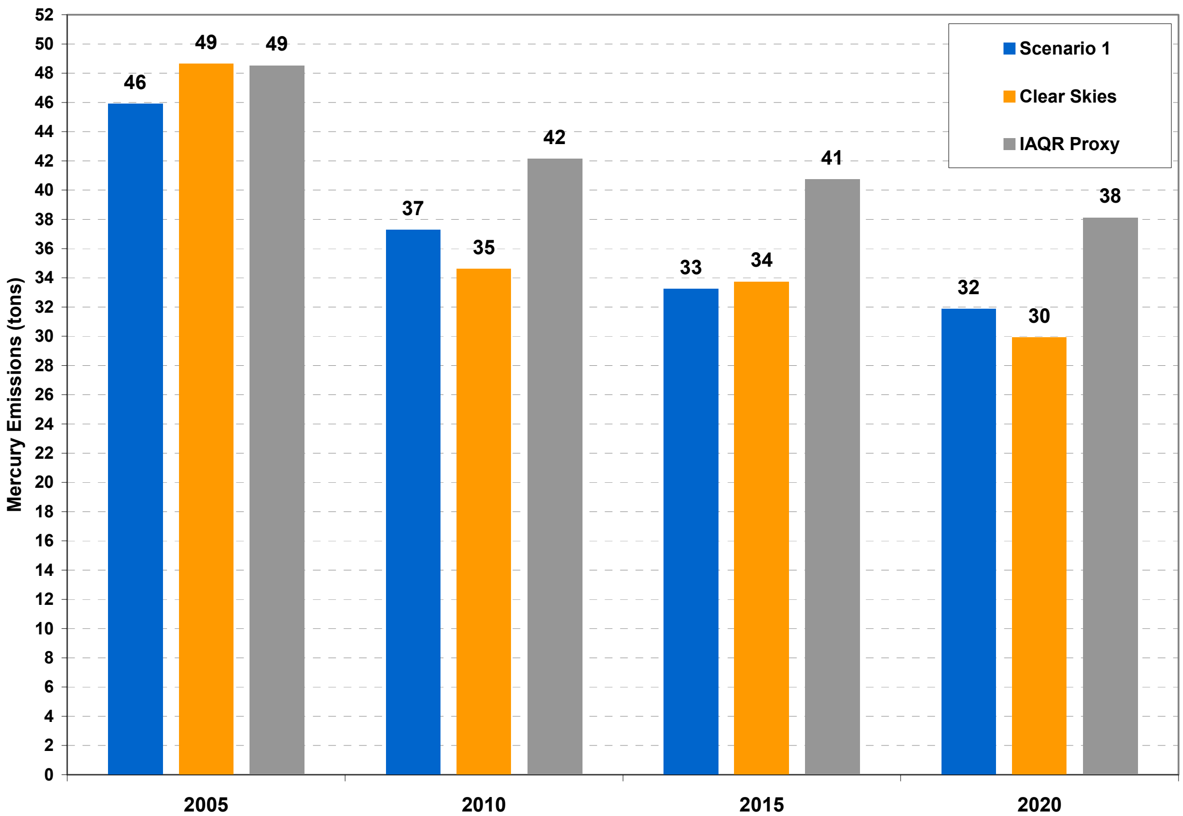


Table 2.2 Summary of National Emissions: EIA Assumptions

NOx (MTons)

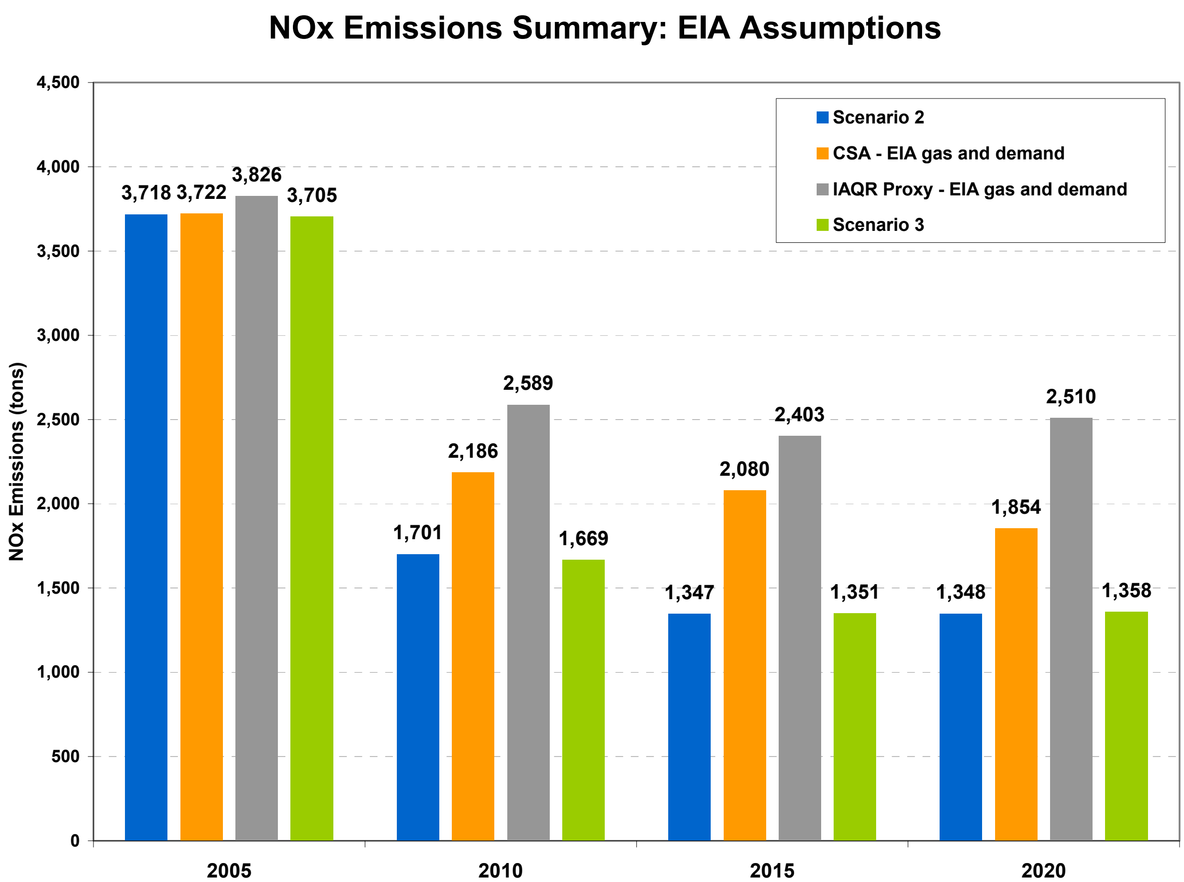
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2[EIA]	3,718 (-6%)	1,701 (-58%)	1,347 (-68%)	1,348 (-69%)
Scenario 3[EIA]	3,705 (-6%)	1,669 (-58%)	1,351 (-68%)	1,358 (-69%)
EPA Scenarios				
Base Case[EIA]	3,950 (NA)	4,019 (NA)	4,185 (NA)	4,331 (NA)
Clear Skies[EIA]	3,722 (-6%)	2,186 (-46%)	2,080 (-50%)	1,854 (-57%)
IAQR Proxy[EIA]	3,826 (-3%)	2,589 (-36%)	2,403 (-43%)	2,510 (-42%)

SO_2 (MTons)

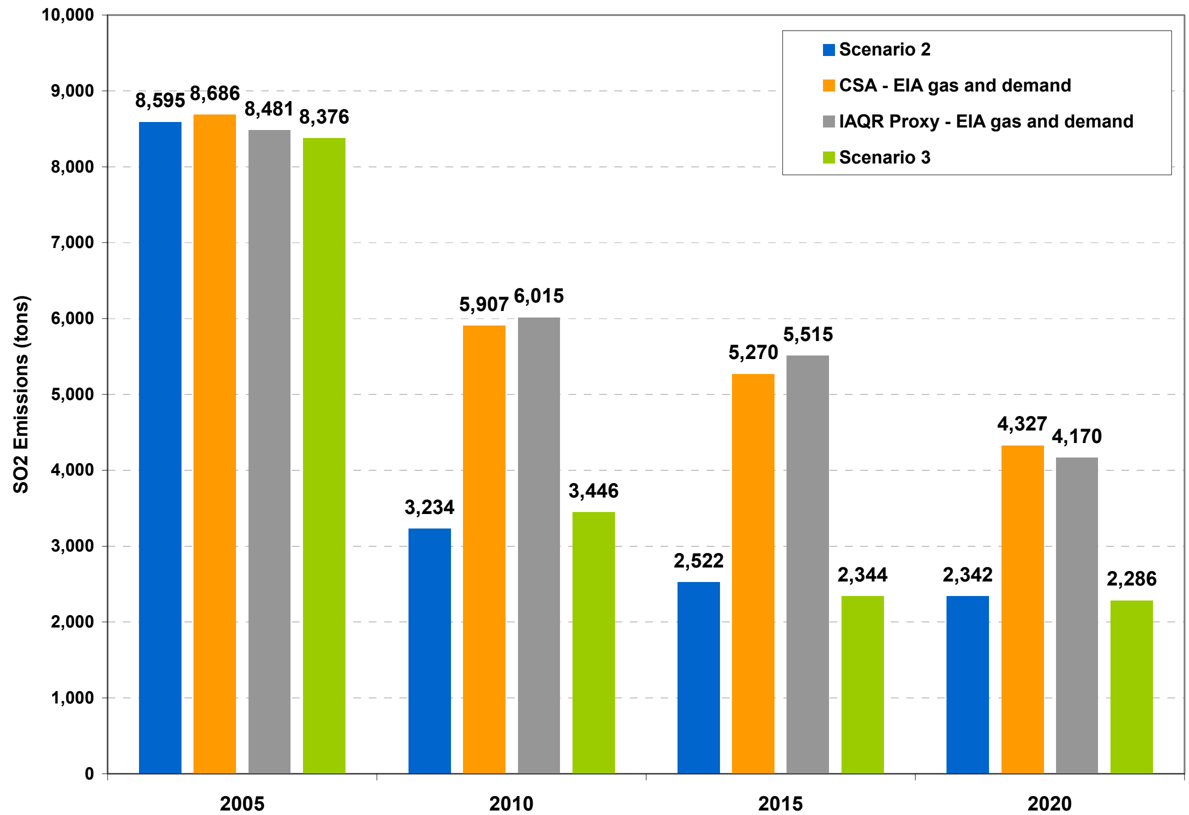
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2[EIA]	8,595 (-18%)	3,234 (-67%)	2,522 (-73%)	2,342 (-74%)
Scenario 3[EIA]	8,376 (-20%)	3,446 (-65%)	2,344 (-75%)	2,286 (-74%)
EPA Scenarios				
Base Case[EIA]	10,463 (NA)	9,747 (NA)	9,226 (NA)	8,957 (NA)
Clear Skies[EIA]	8,686 (-17%)	5,907 (-39%)	5,270 (-43%)	4,327 (-52%)
IAQR Proxy[EIA]	8,481 (-19%)	6,015 (-38%)	5,515 (-40%)	4,170 (-53%)

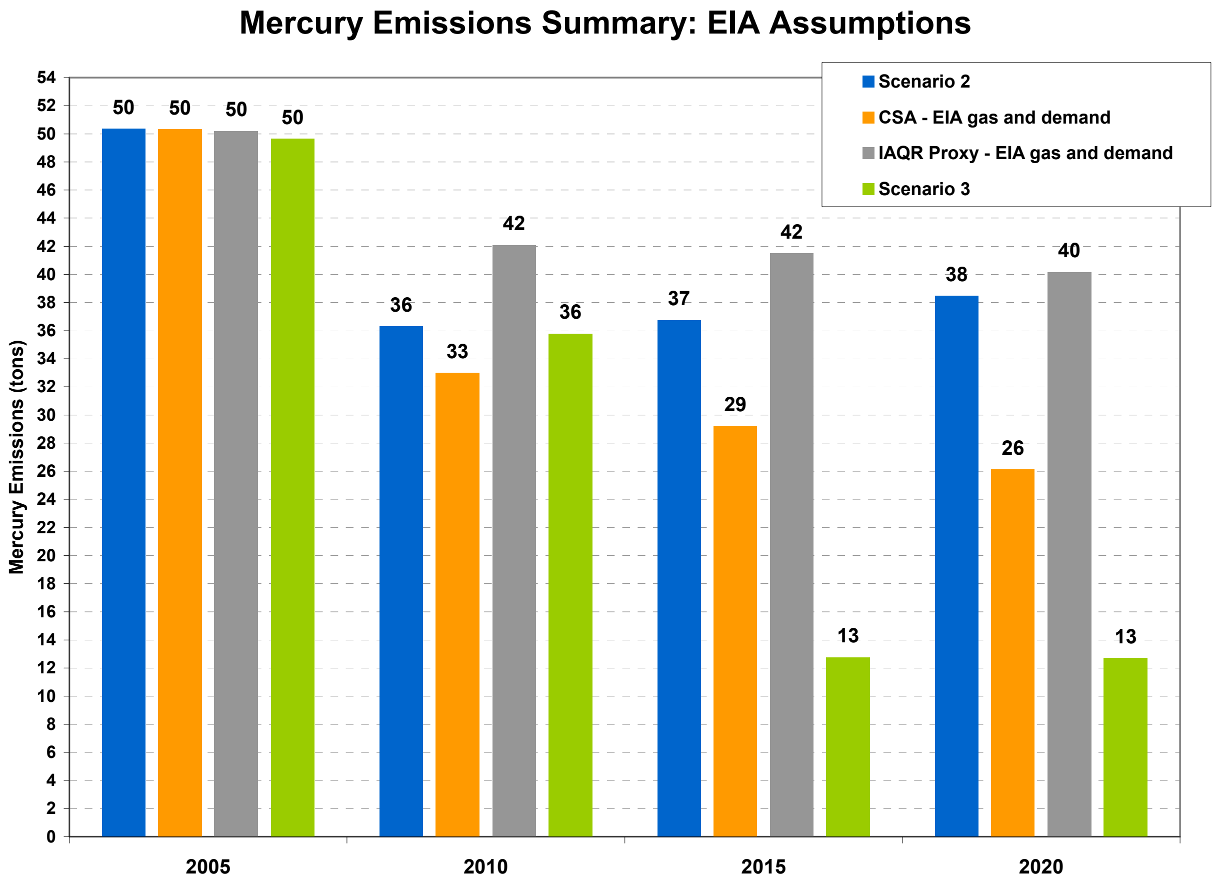
Mercury (all units, tons)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2[EIA]	50 (-7%)	36 (-32%)	37 (-31%)	38 (-31%)
Scenario 3[EIA]	50 (-8%)	36 (-32%)	13 (-76%)	13 (-77%)
EPA Scenarios				
Base Case[EIA]	54 (NA)	53 (NA)	54 (NA)	56 (NA)
Clear Skies[EIA]	50 (-7%)	33 (-38%)	29 (-46%)	26 (-53%)
IAQR Proxy[EIA]	50 (-7%)	42 (-21%)	42 (-23%)	40 (-28%)


NOx Emissions Summary: EIA Assumptions
Scenario 2
CSA - EIA gas and demand
IAQR Proxy - EIA gas and demand
Scenario 3
NOx Emissions (tons)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
3,718
3,722
3,826
3,705
1,701
2,186
2,589
1,669
1,347
2,080
2,403
1,351
1,348
1,854
2,510
1,358
2005
2010
2015
2020

SO_2 Emissions Summary: EIA Assumptions





III. Total System Costs

We now turn our attention to a comparison of the total system costs of the various policies. These are the total costs of operating the electric generating system including variable operation and maintenance (O&M) costs, fixed O&M costs, fuel costs, and capital costs.

The scenarios based on EPA demand growth and natural gas prices are summarized in Table 3.1. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case^{EPA}.

The three-pollutant Clear Skies proposal is projected to result in a modest increase in annual production costs, ranging from 1% to 6%. Scenario 1, which imposes the OTC NOx and SO_2 caps without any restrictions on the use of banked allowances, results in a slightly higher increase. Annual system costs under Scenario 1^{EPA} increase 2% (in 2005), 2% (in 2010), 4% (in 2015), and 3% (in 2020) relative to the Clear Skies^{EPA} scenario.

Table 3.1 Summary of Total System Costs: EPA Assumptions ($million)

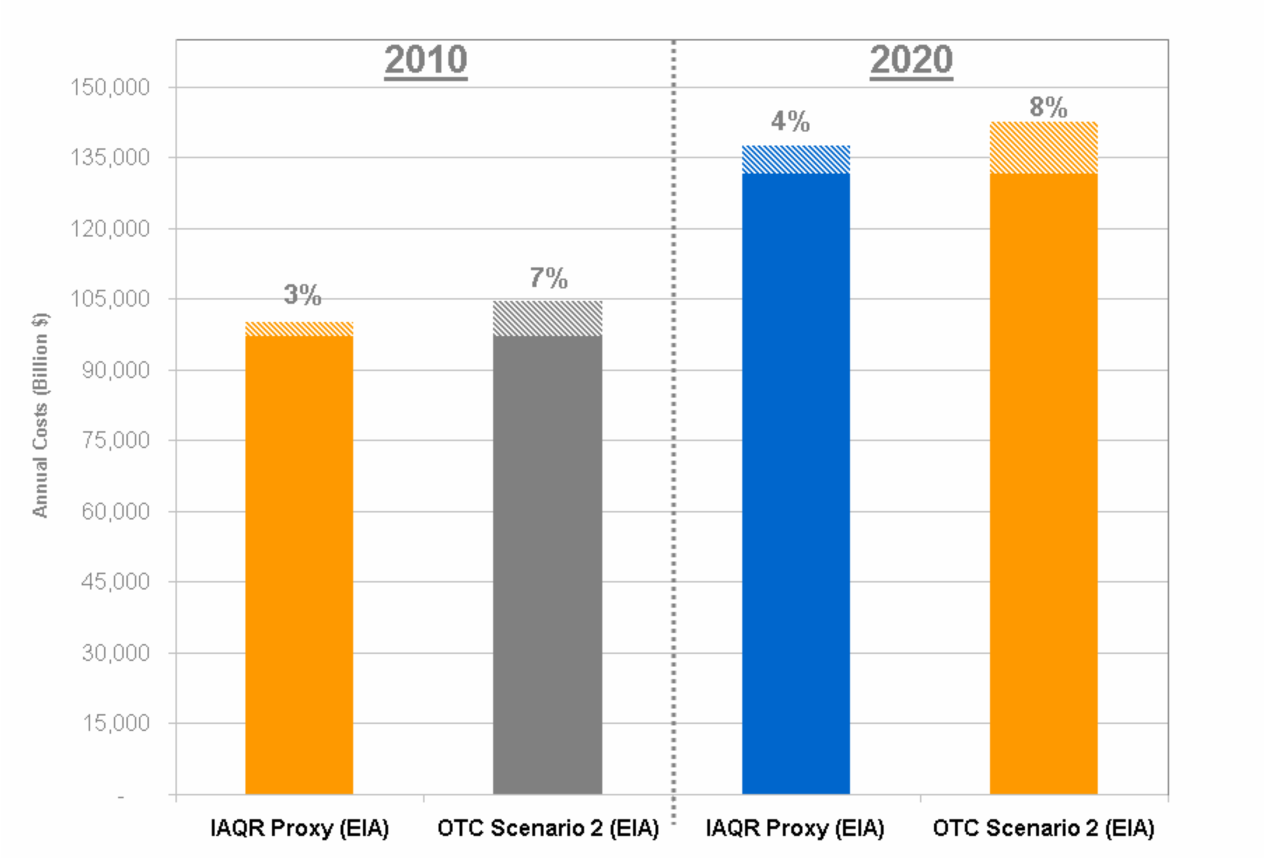
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^{EPA}	79,558 (+3%)	92,121 (+7%)	103,978 (+9%)	118,060 (+9%)
EPA Scenarios				
Base Case^{EPA}	77,200 (NA)	85,711 (NA)	95,569 (NA)	107,884 (NA)
Clear Skies^{EPA}	78,086 (+1%)	89,875 (+5%)	99,861 (+4%)	114,087 (+6%)
IAQR Proxy^{EPA}	78,429 (+2%)	89,092 (+4%)	99,634 (+4%)	113,291 (+5%)

The total system costs for the scenarios based on EIA demand growth and natural gas prices are summarized in Table 3.2. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case^{EIA}. Scenario 3^{EIA} shows the highest percent difference when compared with its comparable base case, in this case "Base Case^{EIA}".

Table 3.2 Summary of Total System Costs: EIA Assumptions ($million)

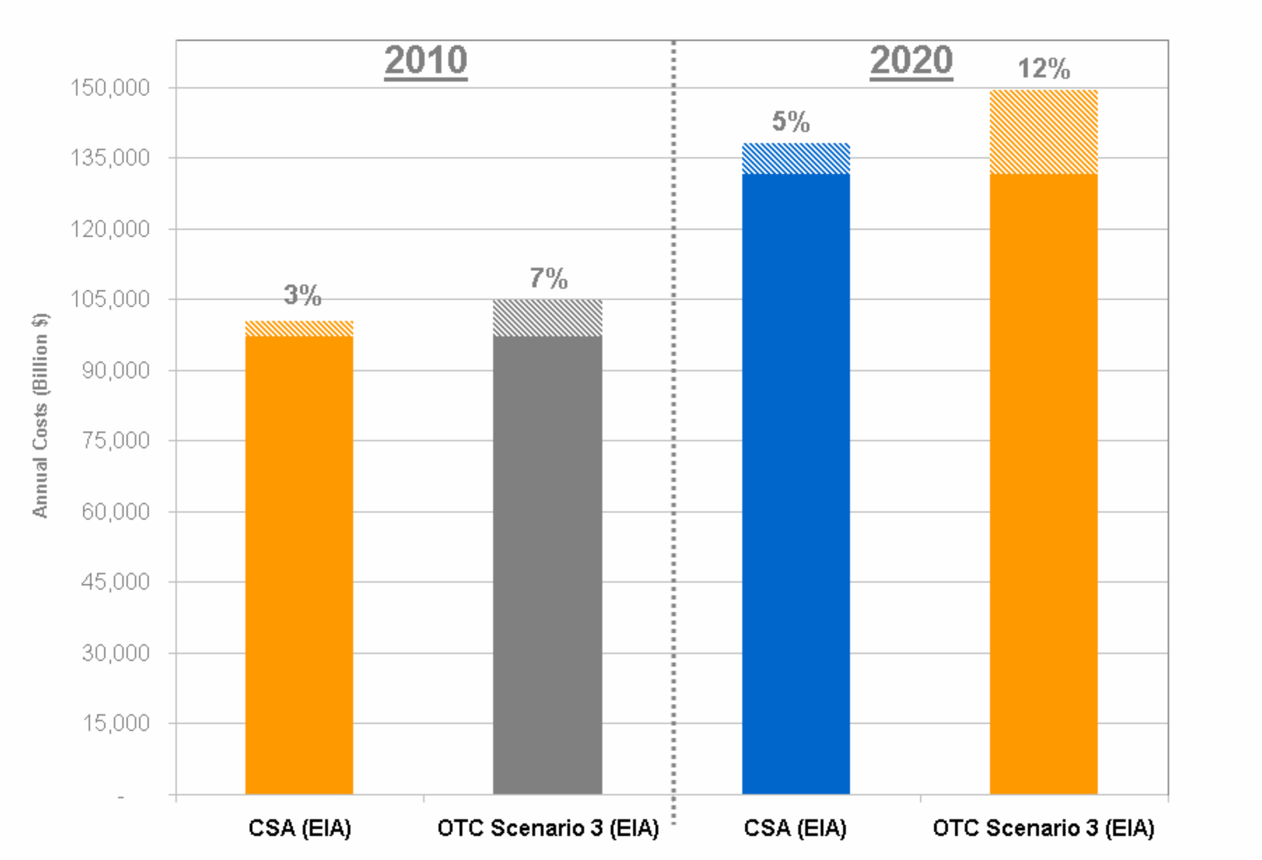
Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2^{EIA}	82,259 (+1%)	104,512 (+8%)	125,874 (+9%)	142,431 (+8%)
Scenario 3^{EIA}	82,384 (+1%)	104,646 (+8%)	133,677 (+15%)	149,269 (+14%)
EPA Scenarios				
Base Case^{EIA}	81,491 (NA)	97,029 (NA)	115,907 (NA)	131,404 (NA)
Clear Skies^{EIA}	81,977 (+1%)	100,207 (+3%)	118,982 (+3%)	137,956 (+5%)
IAQR Proxy^{EIA}	82,342 (+1%)	100,065 (+3%)	119,774 (+3%)	137,425 (+5%)

Total System Costs: Policy Scenarios vs. Base Case



Each bar (light and dark portions) represents the total costs required to operate the electric generating system. The darker portions show the Base Case[EIA] projection of total system costs. The lighter portions of the bars show the costs attributable to the multi-pollutant proposals: IAQR Proxy[EIA] and Scenario 2[EIA].

Total System Costs: Policy Scenarios vs. Base Case



Each bar (light and dark portions) represents the total costs required to operate the electric generating system. The darker portions show the Base Case^{EIA} projection of total system costs. The lighter portions of the bars show the costs attributable to the multi-pollutant proposals: CSA^{EIA} and Scenario 3^{EIA}.

IV. Compliance Summary

Three categories of control installations are summarized in the discussion that follows: SCR, SNCR, and scrubbers. These compliance results are reported in terms of megawatts (MW) of capacity. These are cumulative results indicating the total MWs of capacity with installed controls in each model run year (e.g., the 2005 results include controls installed in 2005, 2006, and 2007). Pre-existing control technology installations (i.e., prior to 2005) are not reflected in any of these results. EPA assumes 96,968 MW of existing scrubber installations, 76,686 MW of existing SCR installations, and 10,568 MW of SNCR installations. Again, these controls are not reflected in the results reported in Table 4.1. Note that scrubber installations are restricted to 5,066 MWs of capacity in the first run year (i.e., 2005, 2006, and 2007). This limit is binding in all of the policy scenarios.

Note that fewer SCR controls are installed in the first run year under all scenarios. This may be an effort to consume any banked allowances in anticipation of the fall in allowance values after the first cap is imposed.

There are fewer controls installed in Scenario 3^{EIA} as compared to Scenario 2^{EIA}: 38 GW fewer scrubbers, 45 GW fewer SCRs. This is due to the fact that there is less coal-fired power generation in this scenario.

Two of the scenarios discussed in this analysis result in mercury specific controls, namely "activated carbon injection." As the only OTC scenario with a mercury cap, Scenario 3^{EIA} is projected to result in 105,640 MW of ACI in 2015. The CSA^{EIA} scenario also drives ACI retrofits. The scenario results in a total 41,513 MWs of ACI.

Table 4.1 Summary of Control Installations: EPA Assumptions

Scrubbers (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^{EPA}	5,066 (+53%)	103,164 (+647%)	138,286 (+647%)	163,819 (+651%)
EPA Scenarios				
Base Case^{EPA}	3,301 (NA)	13,818 (NA)	18,511 (NA)	21,820 (NA)
Clear Skies^{EPA}	5,066 (+53%)	60,770 (+340%)	81,617 (+341%)	109,295 (+401%)
IAQR Proxy^{EPA}	5,066 (+53%)	62,549 (+353%)	81,619 (+341%)	112,263 (+414%)

SNCR (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1[EPA]	176 (-)	7,344 (+213%)	7,884 (+112%)	7,884 (+63%)
EPA Scenarios				
Base Case[EPA]	0 (NA)	2,347 (NA)	3,717 (NA)	4,851 (NA)
Clear Skies[EPA]	0 (-)	1,269 (-46%)	1,549 (-58%)	2,750 (-43%)
IAQR Proxy[EPA]	322 (-)	1,382 (-41%)	2,526 (-32%)	2,755 (-43%)

SCR (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1[EPA]	22,350 (-35%)	114,147 (+130%)	161,019 (+173%)	161,819 (+157%)
EPA Scenarios				
Base Case[EPA]	34,428 (NA)	49,668 (NA)	58,923 (NA)	62,959 (NA)
Clear Skies[EPA]	29,942 (-13%)	91,684 (85%)	101,844 (73%)	133,558 (112%)
IAQR Proxy[EPA]	28,245 (-18%)	73,588 (+48%)	105,309 (+79%)	106,882 (+70%)

Table 4.2 Summary of Control Installations: EIA Assumptions

Scrubbers (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2[EIA]	5,066 (+3%)	145,540 (+861%)	168,507 (+731%)	174,018 (+694%)
Scenario 3[EIA]	5,066 (+3%)	132,976 (+778%)	135,607 (+569%)	135,607 (+519%)
EPA Scenarios				
Base Case[EIA]	4,926 (NA)	15,146 (NA)	20,281 (NA)	21,906 (NA)
Clear Skies[EIA]	5,066 (+3%)	77,595 (+412%)	98,706 (+387%)	126,770 (+479%)
IAQR Proxy[EIA]	5,066 (+3%)	72,771 (+380%)	89,615 (+342%)	127,849 (+484%)

SNCR (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2^{EIA}	266 (-3%)	7,608 (+69%)	8,670 (+57%)	8,735 (+29%)
Scenario 3^{EIA}	84 (-69%)	7,407 (+65%)	7,407 (+35%)	7,407 (+9%)
EPA Scenarios				
Base $Case^{EIA}$	273 (NA)	4,499 (NA)	5,507 (NA)	6,769 (NA)
Clear $Skies^{EIA}$	-	6,211 (+38%)	6,683 (+21%)	7,915 (+17%)
IAQR $Proxy^{EIA}$	-	5,220 (+16%)	6,061 (+10%)	6,061 (-10%)

SCR (MW)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2^{EIA}	36,259 (-15%)	139,875 (+131%)	176,562 (+158%)	182,752 (+151%)
Scenario 3^{EIA}	34,808 (-18%)	135,558 (+124%)	137,286 (+101%)	137,286 (+88%)
EPA Scenarios				
Base $Case^{EIA}$	42,664 (NA)	60,425 (NA)	68,469 (NA)	72,837 (NA)
Clear $Skies^{EIA}$	37,010 (-13%)	106,747 (+77%)	130,574 (+91%)	162,910 (+124%)
IAQR $Proxy^{EIA}$	35,601 (-17%)	86,150 (+43%)	117,710 (+72%)	117,898 (+62%)

V. Generation by Fuel Type

In this section we evaluate the impact of the alternative pollutant caps and gas price/demand growth assumptions on the choices of technology used for electric power generation, as well as their impact on total generation output. The charts on the pages that follow report the share of generation (i.e., megawatt hours) by technology for each of the scenarios modeled. The most significant shift in the generation mix results from Scenario 3^{EIA}. ICF attributes the change in coal-fired power generation to the reduced construction of new coal capacity. There are 110 GWs of new and repowered coal generation built in Scenario 2^{EIA}, and only 39 GW built in Scenario 3^{EIA}.

In terms of total generation, we compare the results of the scenarios based on EPA assumptions, and the results based on EIA assumptions in Table 5.1 and Table 5.2. The differences are negligible because demand is a variable that is specified in the model. We provide these results simply to emphasize that fundamental differences in the amount of electricity produced are not driving differences in total system costs and other outputs. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case scenarios.

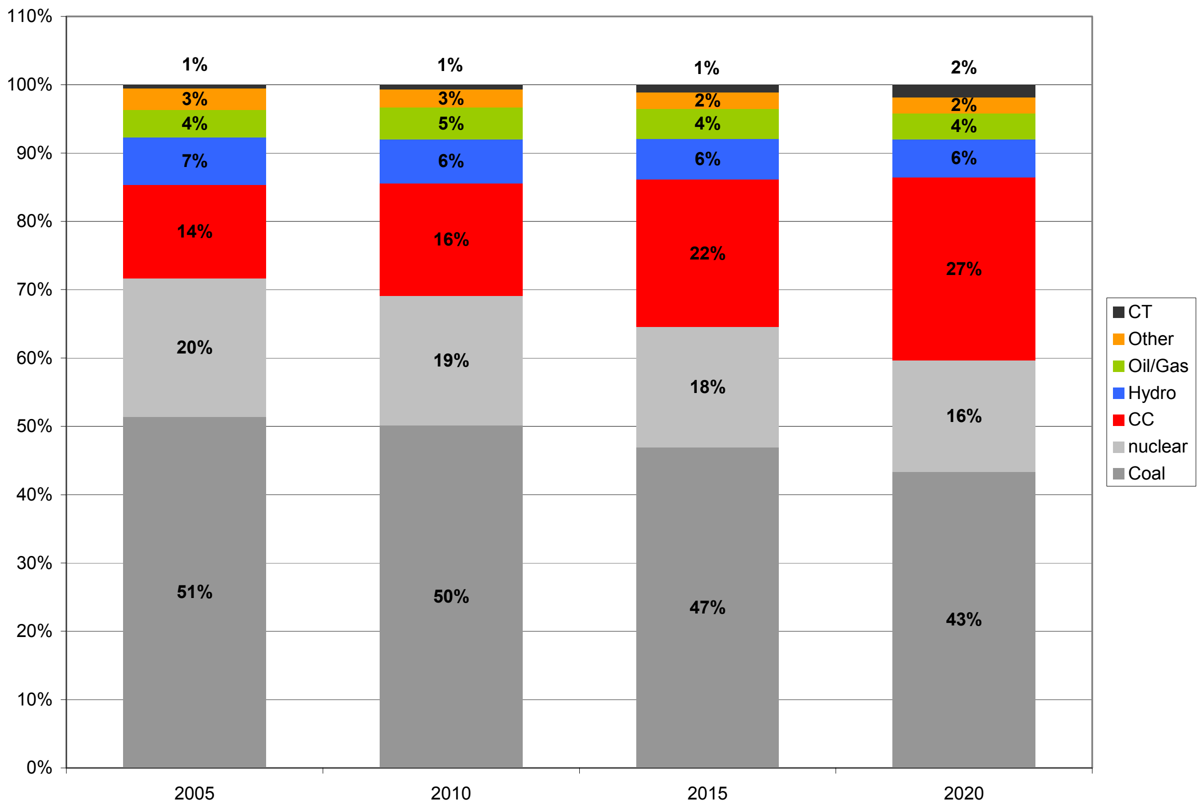
Table 5.1 Summary of Total Generation (GWh): EPA Assumptions

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^{EPA}	3,886,486 (-0.10%)	4,192,319 (-0.07%)	4,505,567 (-0.01%)	4,850,560 (-0.04%)
EPA Scenarios				
Base Case^{EPA}	3,890,469 (NA)	4,195,115 (NA)	4,506,005 (NA)	4,852,382 (NA)
Clear Skies^{EPA}	3,888,544 (-0.05%)	4,191,825 (-0.08%)	4,505,388 (-0.01%)	4,850,576 (-0.04%)
IAQR Proxy^{EPA}	3,888,367 (-0.05%)	4,192,870 (-0.05%)	4,505,730 (-0.01%)	4,850,372 (-0.04%)

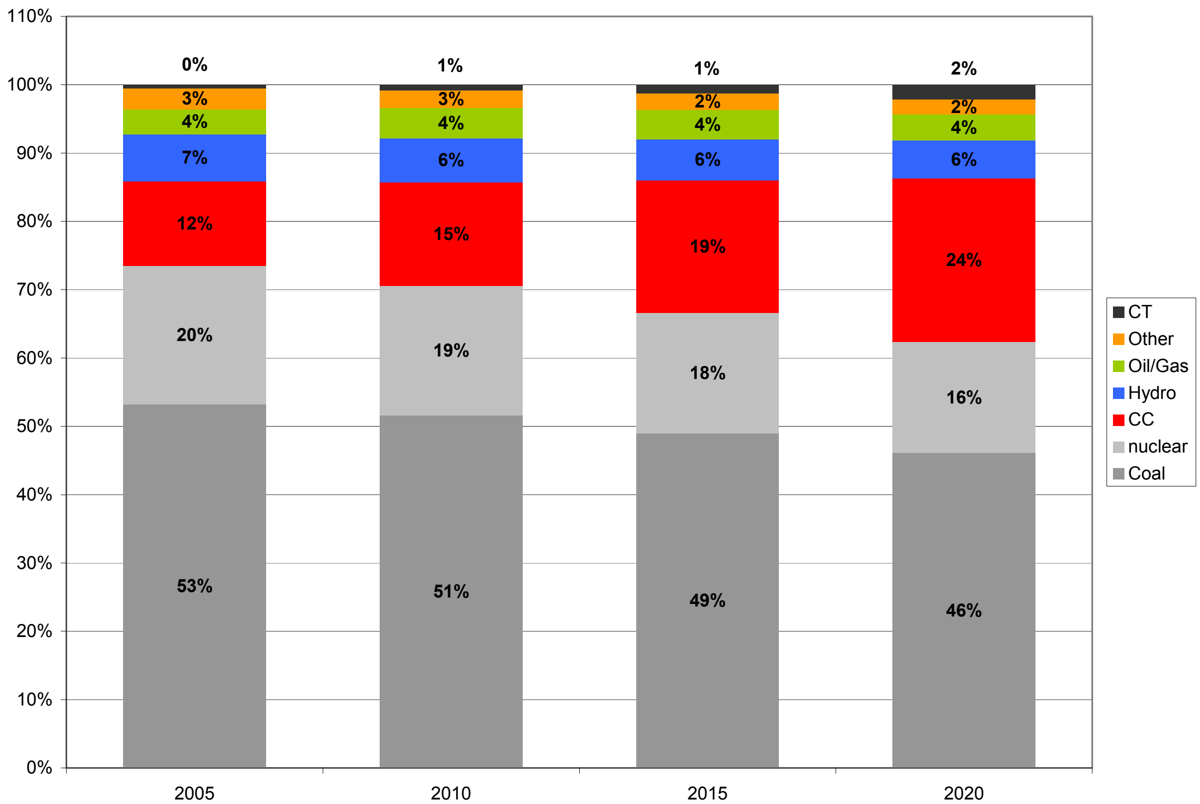
Table 5.2 Summary of Total Generation: EIA Assumptions

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2^{EIA}	3,948,521 (-0.10%)	4,386,457 (-0.04%)	4,771,700 (-0.02%)	5,165,568 (-0.05%)
Scenario 3^{EIA}	3,948,299 (-0.10%)	4,386,149 (-0.05%)	4,767,503 (-0.10%)	5,161,036 (-0.13%)
EPA Scenarios				
Base Case^{EIA}	3,952,386 (NA)	4,388,268 (NA)	4,772,437 (NA)	5,167,983 (NA)
Clear Skies^{EIA}	3,946,888 (-0.14%)	4,356,671 (-0.72)	4,723,821 (-1.0%)	5,105,582 (-1.2%)
IAQR Proxy^{EIA}	3,948,397 (-0.10%)	4,387,486 (-0.02%)	4,772,510 (+0.0%)	5,165,944 (-0.04%)

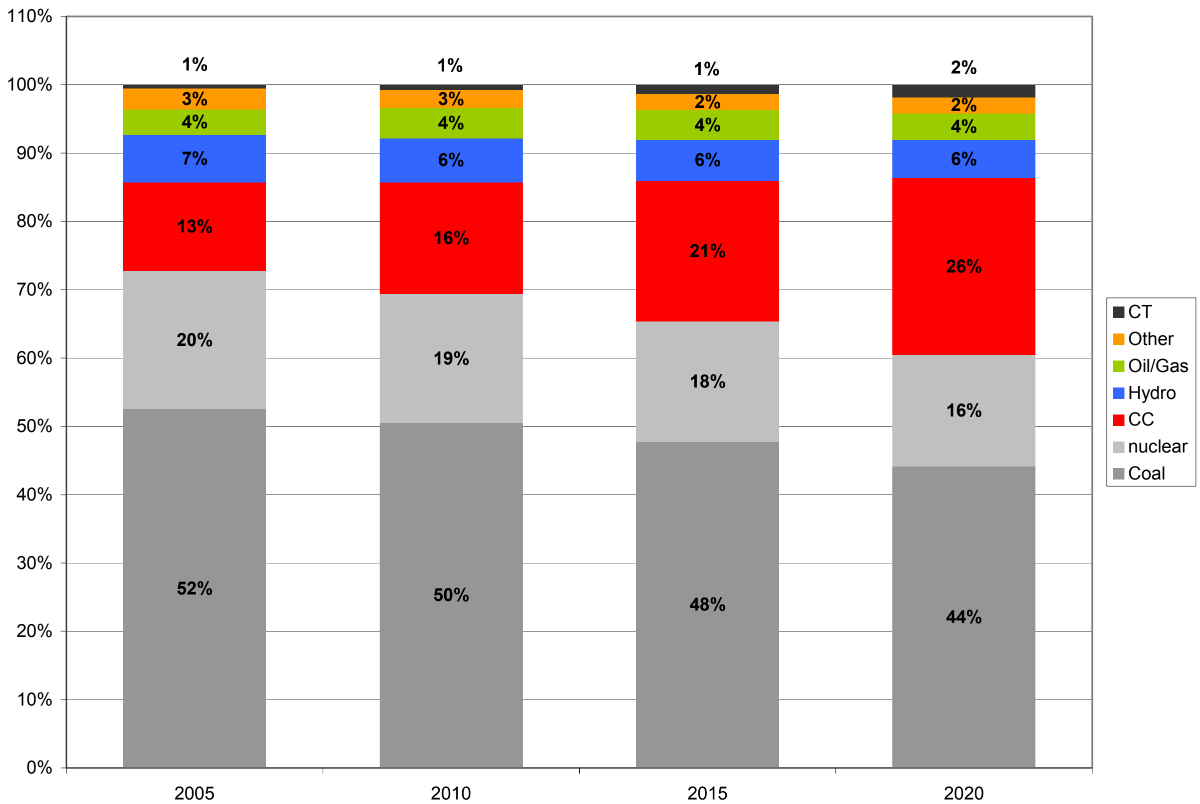
OTC Scenario 1EPA Generation Mix



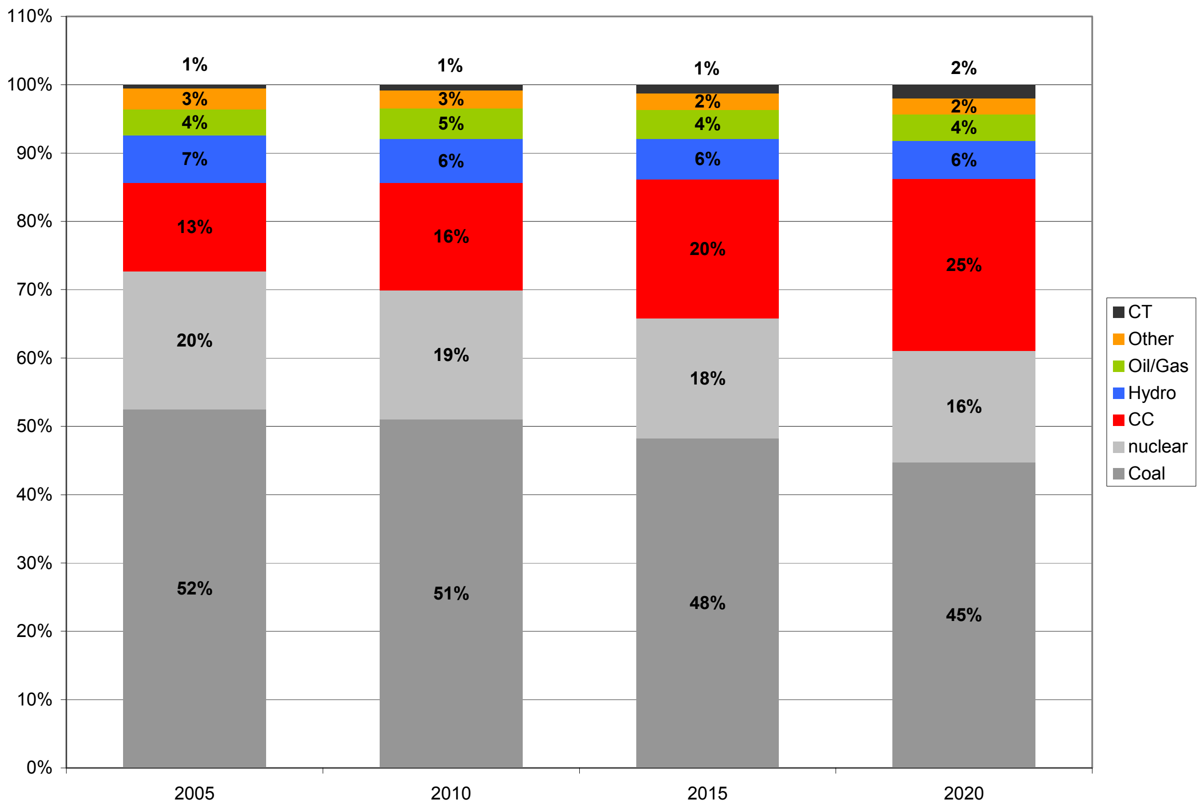
EPA Base Case[EPA] Generation Mix



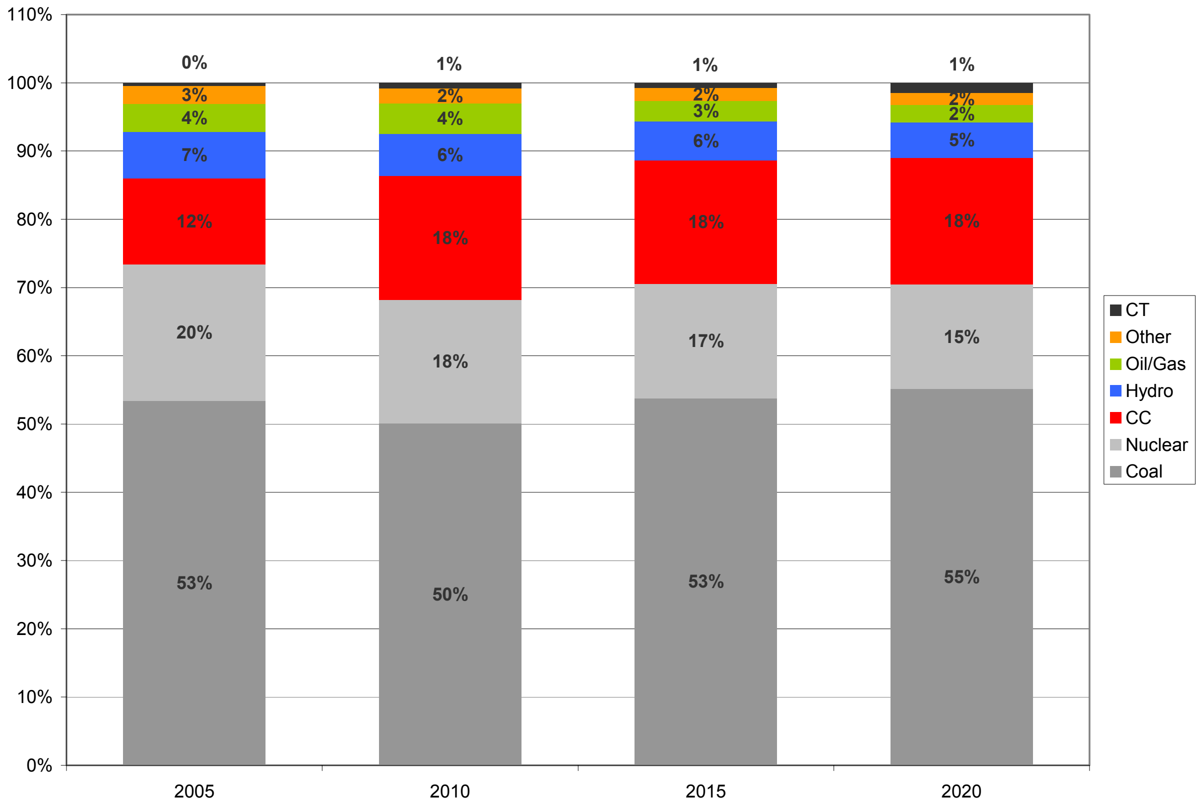
EPA Clear Skies[EPA] Generation Mix



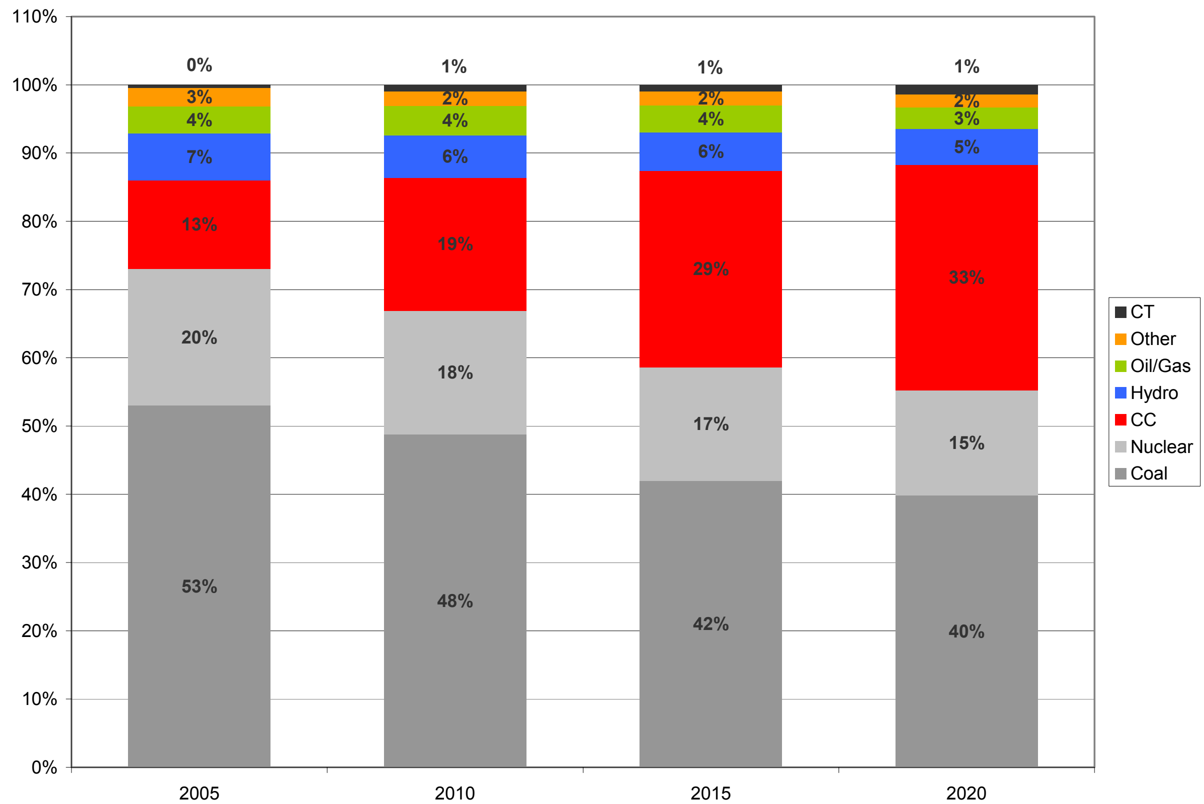
IAQR Proxy^{EPA} Generation Mix

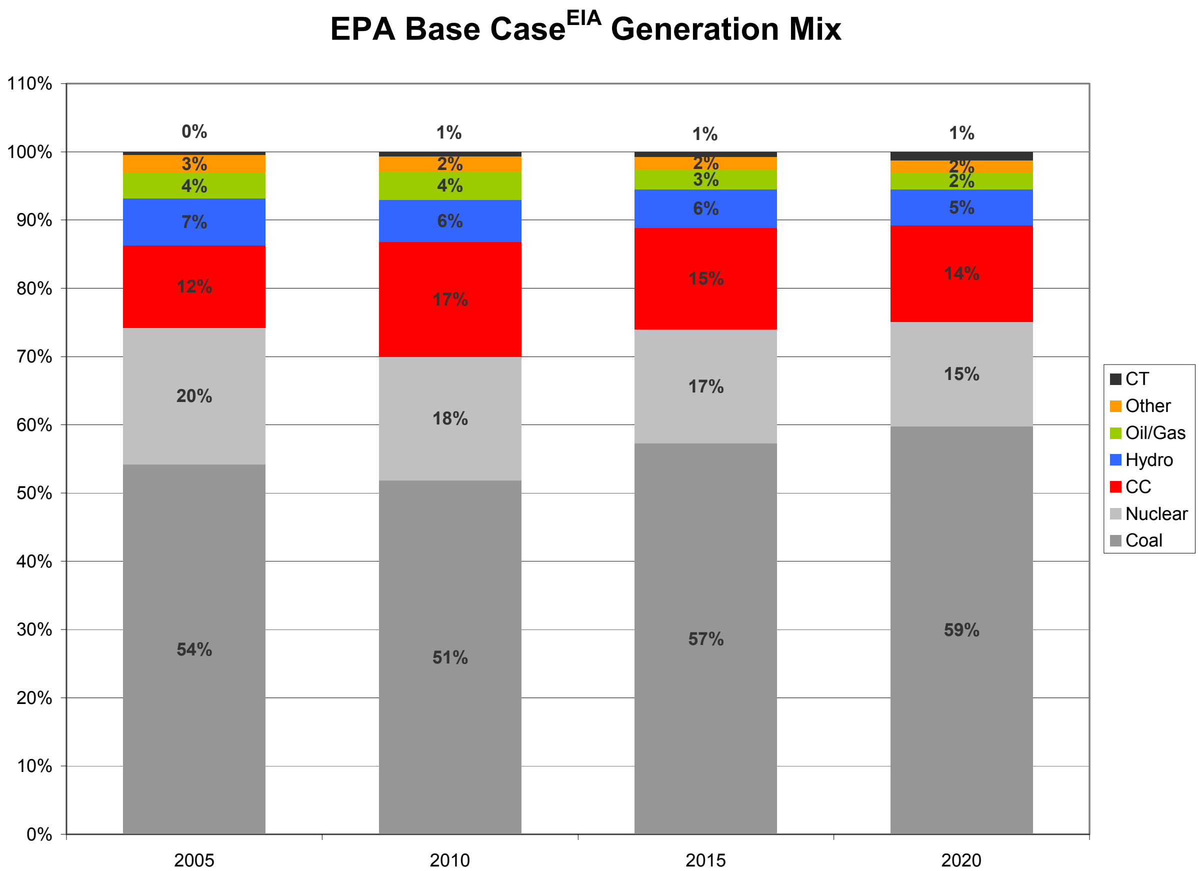


OTC Scenario 2[EIA] Generation Mix

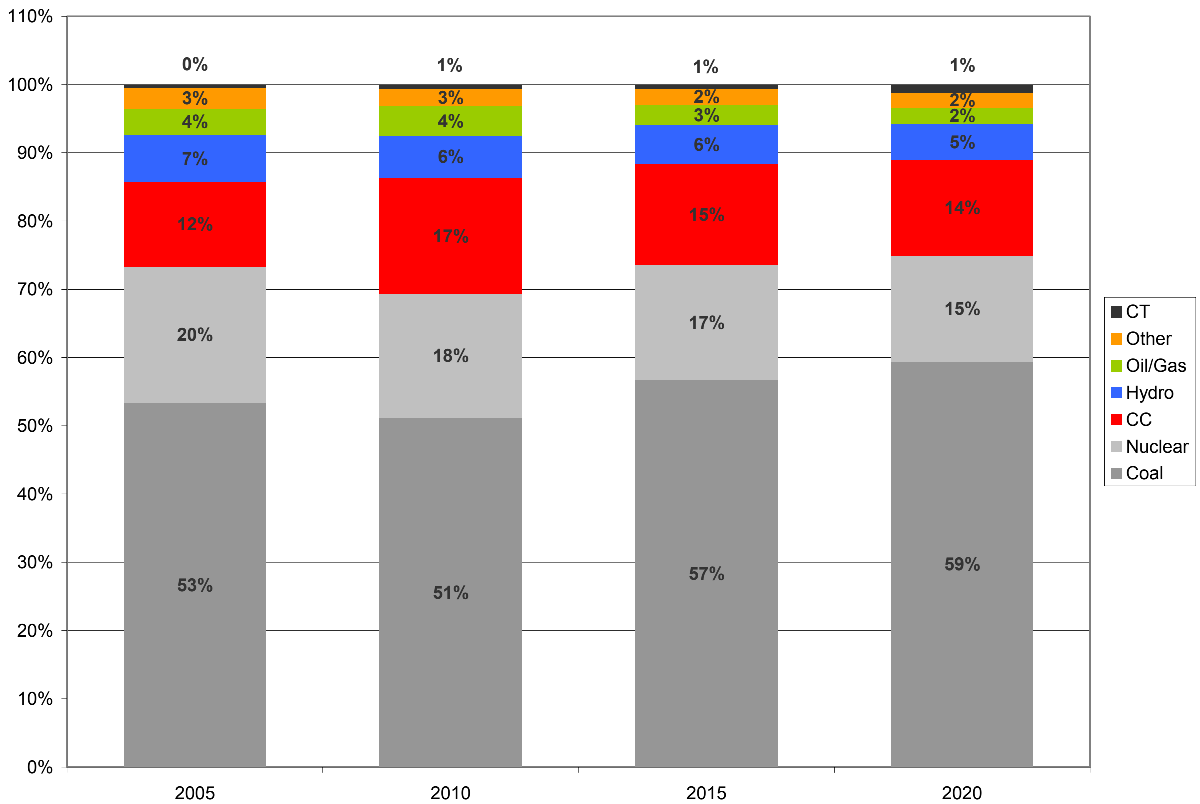


OTC Scenario 3EIA Generation Mix

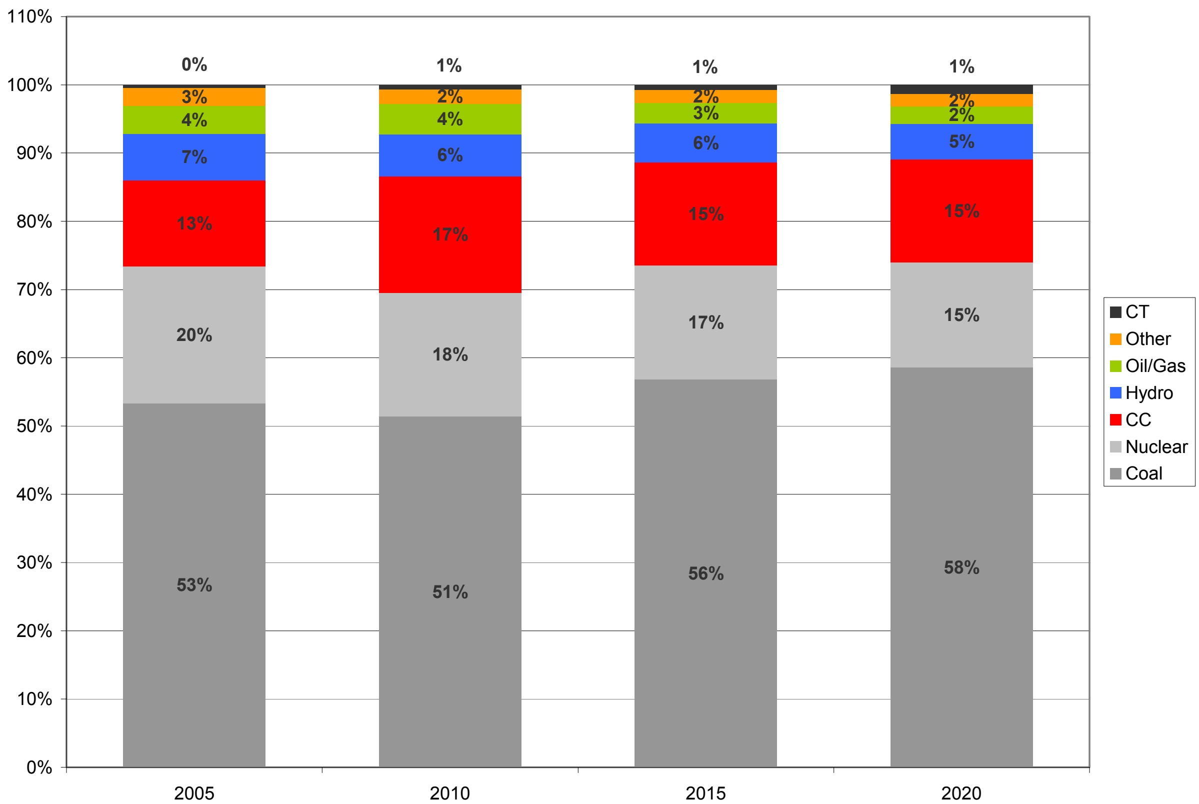



EPA Base Case^EIA Generation Mix
110%
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
2005
2010
2015
2020
0%
3%
4%
7%
12%
20%
54%
1%
2%
4%
6%
17%
18%
51%
1%
2%
3%
6%
15%
17%
57%
1%
2%
2%
5%
14%
15%
59%
CT
Other
Oil/Gas
Hydro
CC
Nuclear
Coal

EPA Clear Skies[EIA] Generation Mix



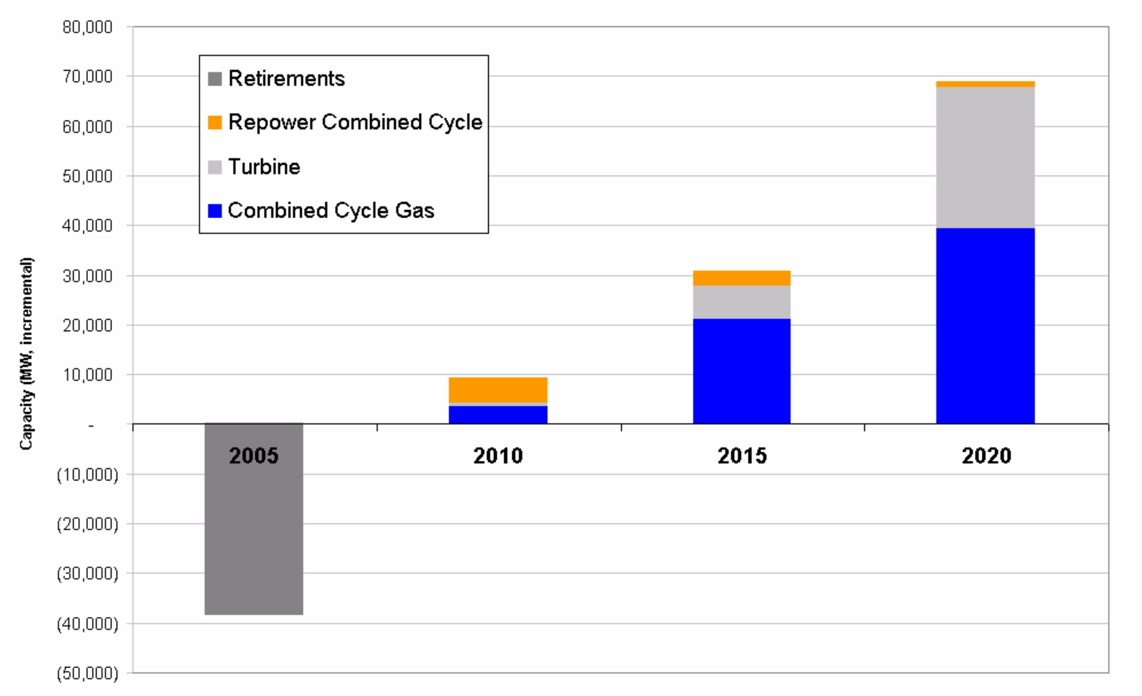
IAQR Proxy^EIA Generation Mix



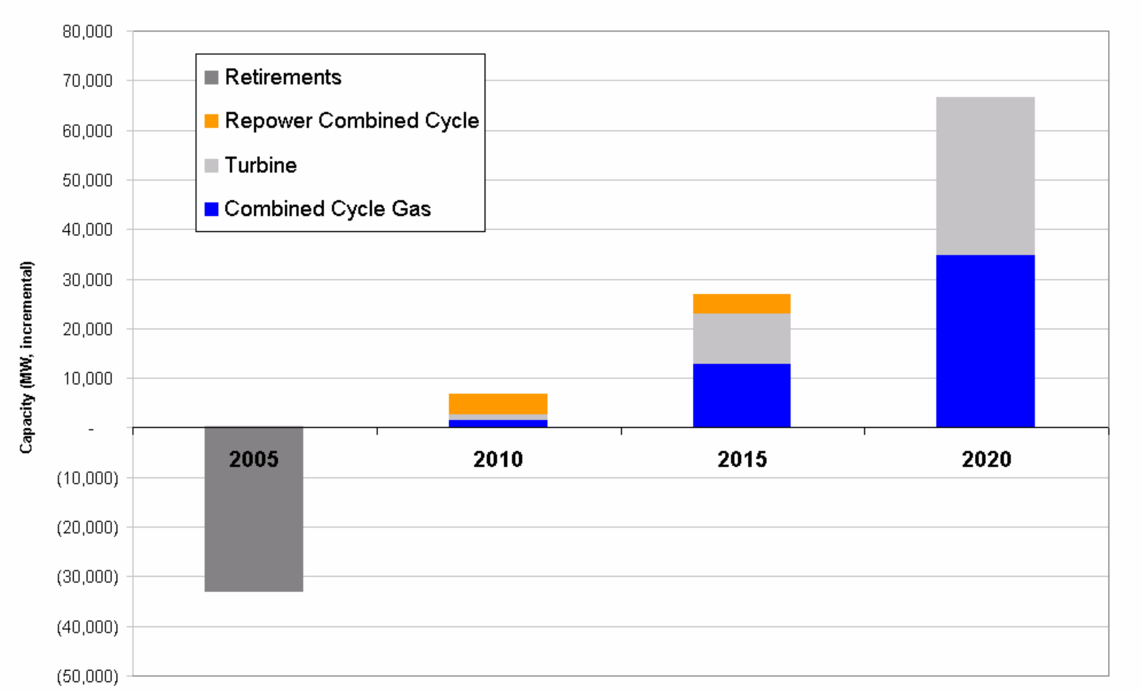
VI. Capacity Additions

In addition to the total system fuel mix, the IPM model provides a projection of capacity changes, including new power plant construction, repowering of existing facilities, and retirements. We compare the OTC modeling scenarios with EPA's scenarios in the charts that follow. We only present the major capacity changes. For example, we exclude renewable capacity additions which generally account for a small share of the new capacity.

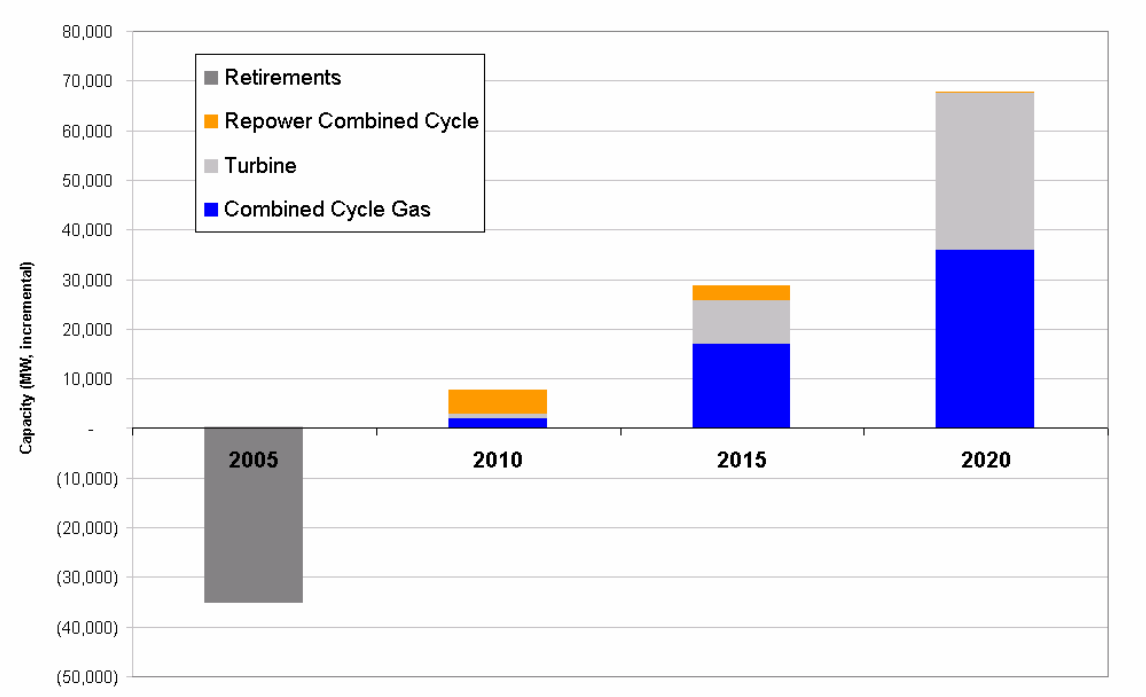
Scenario 1^EPA Major Capacity Changes



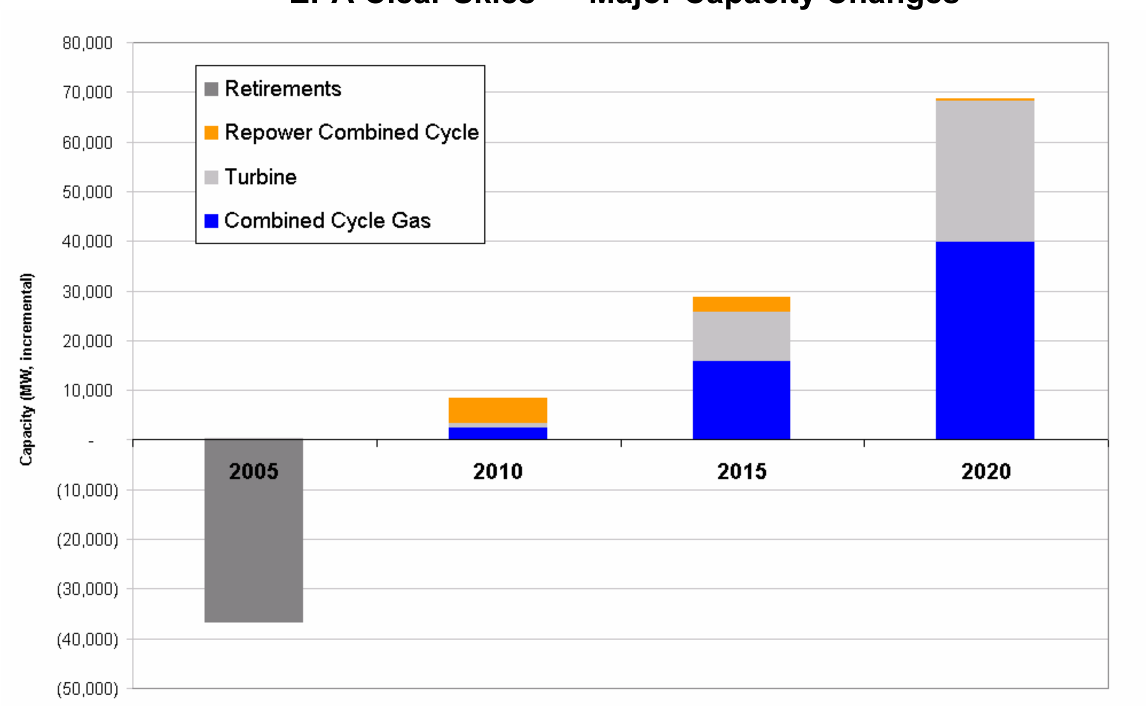
EPA Base Case^EPA Major Capacity Changes



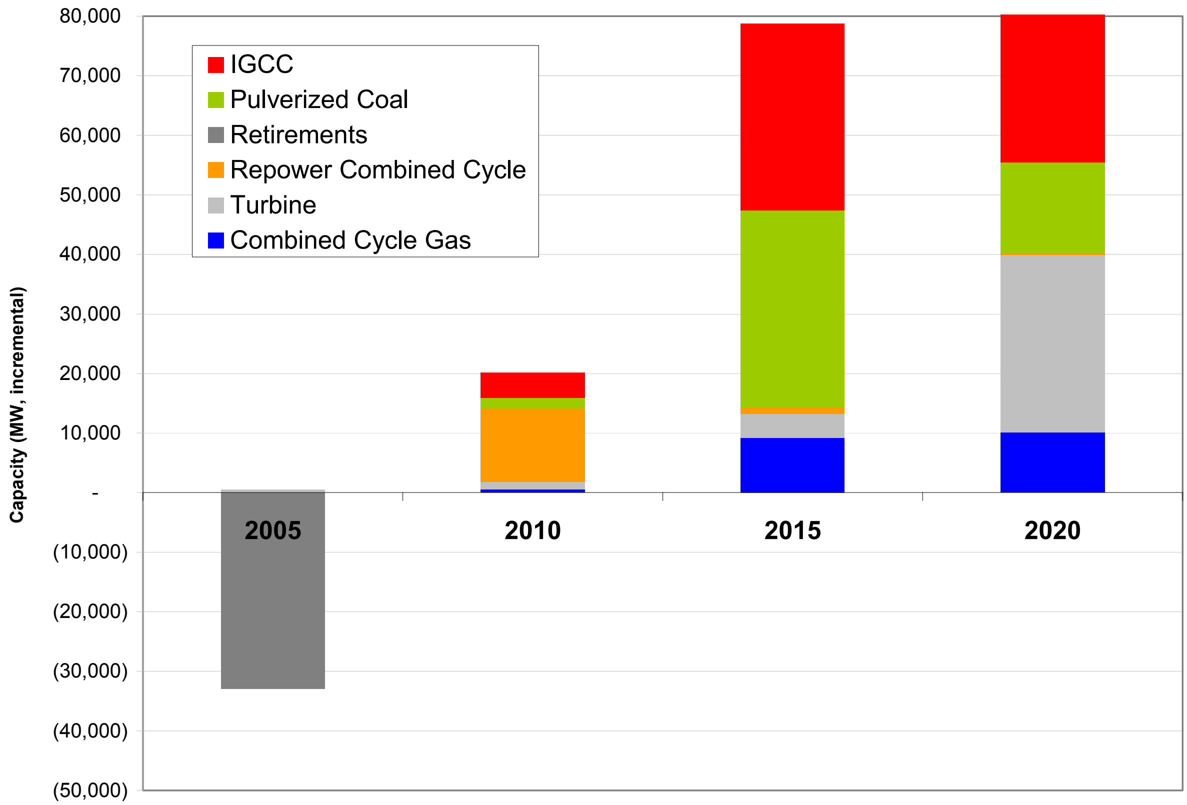
EPA IAQR Proxy[EPA] Major Capacity Changes



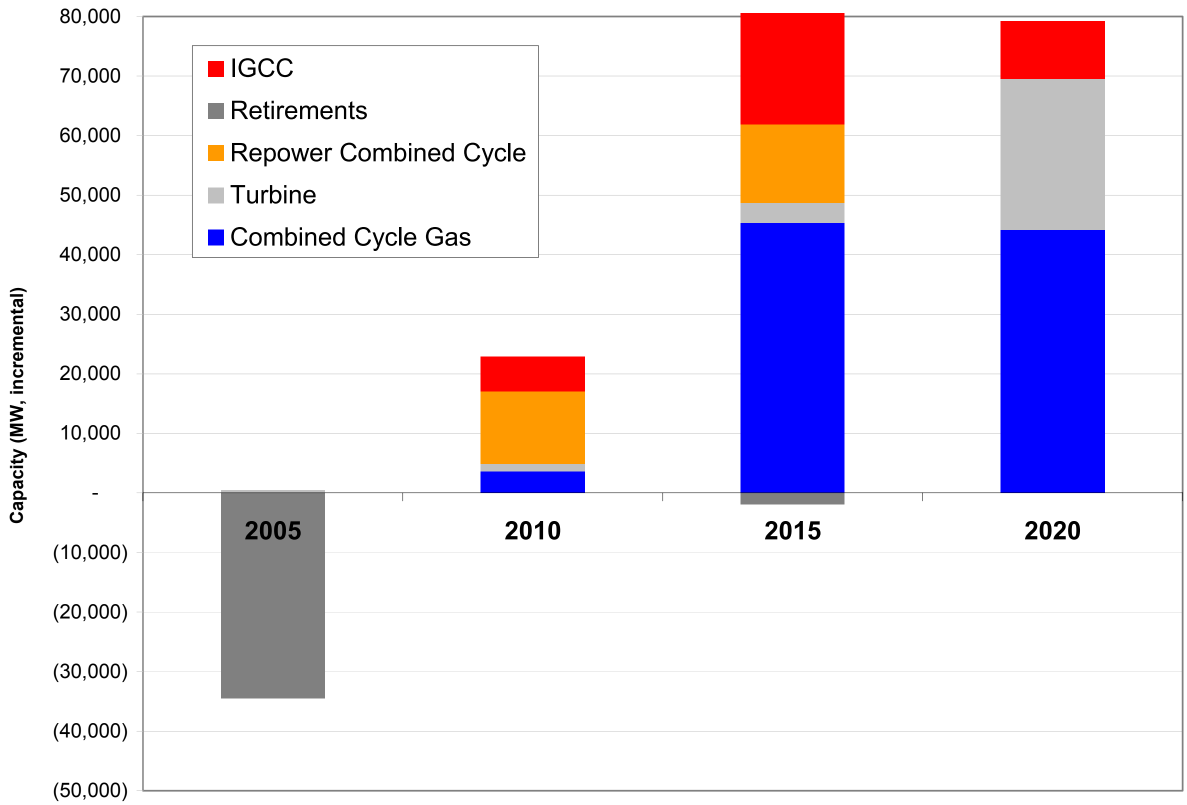
EPA Clear Skies[EPA] Major Capacity Changes



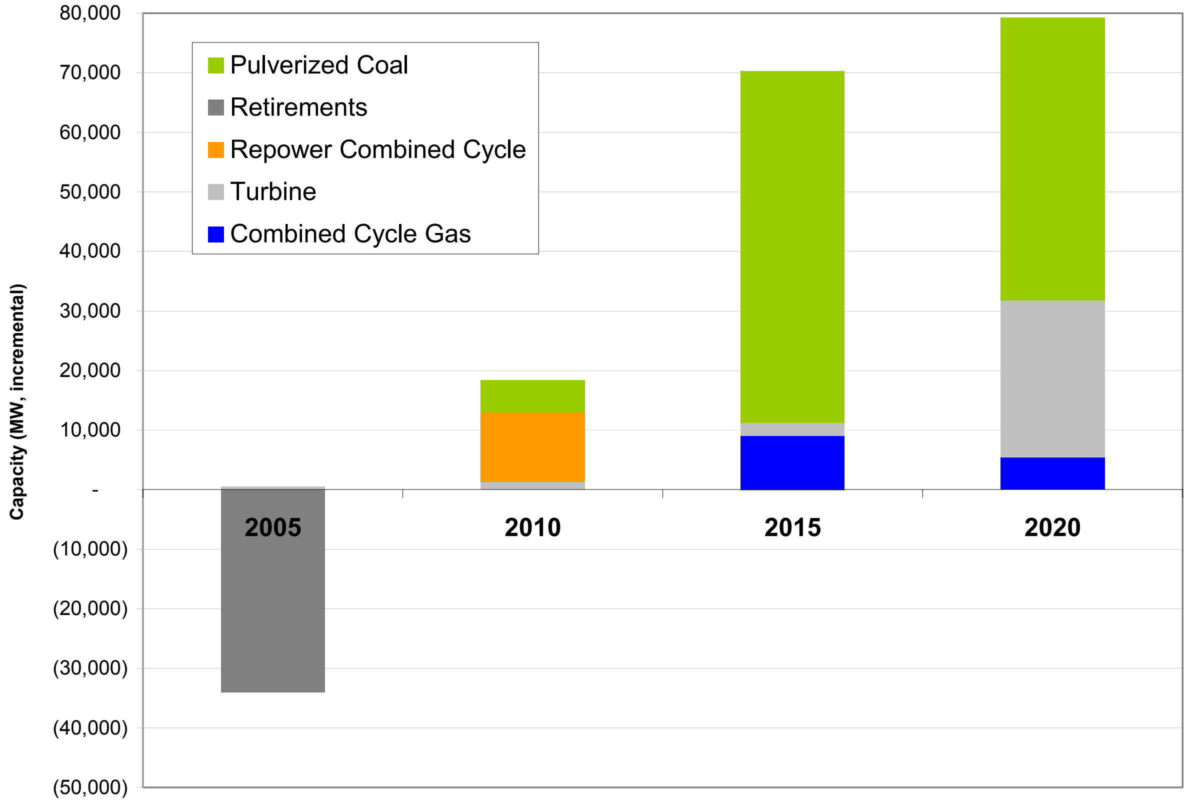
Scenario 2^EIA Major Capacity Changes

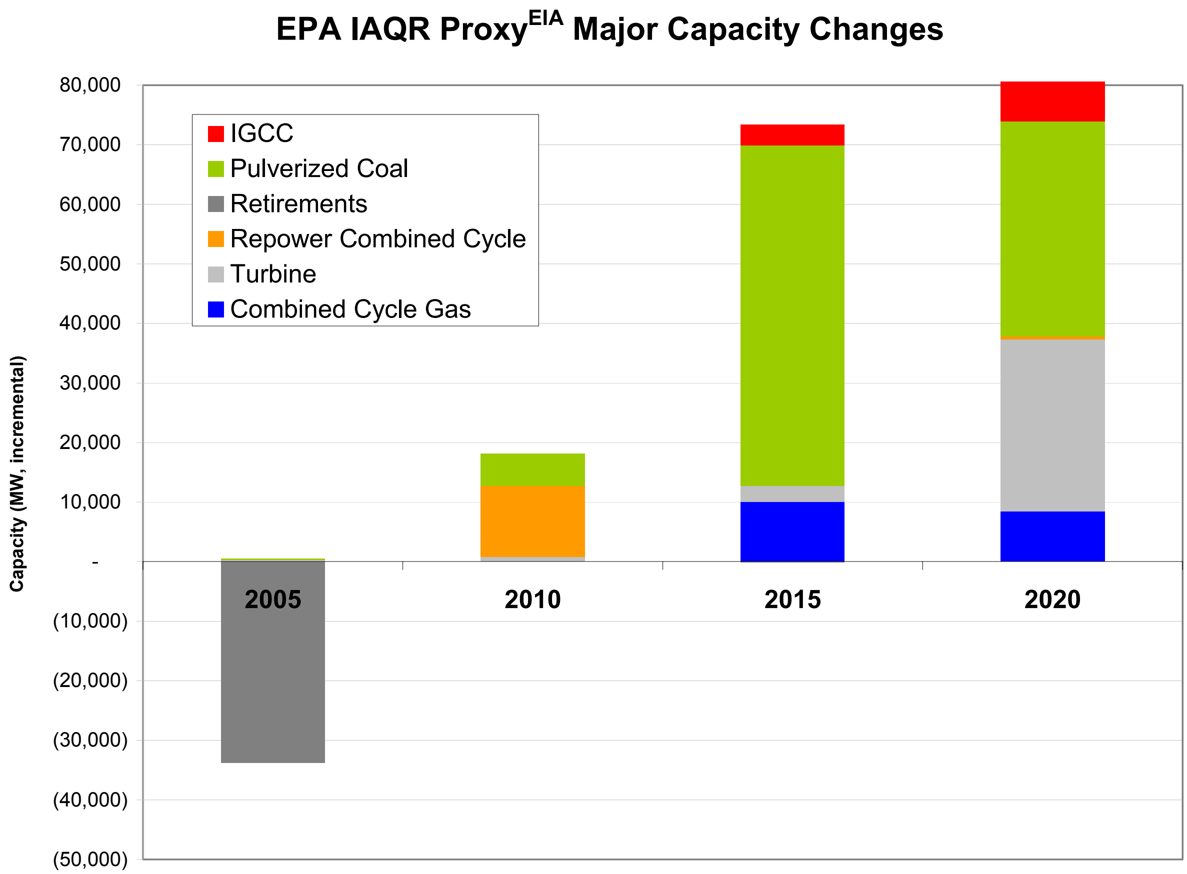


Scenario 3[EIA] Major Capacity Changes



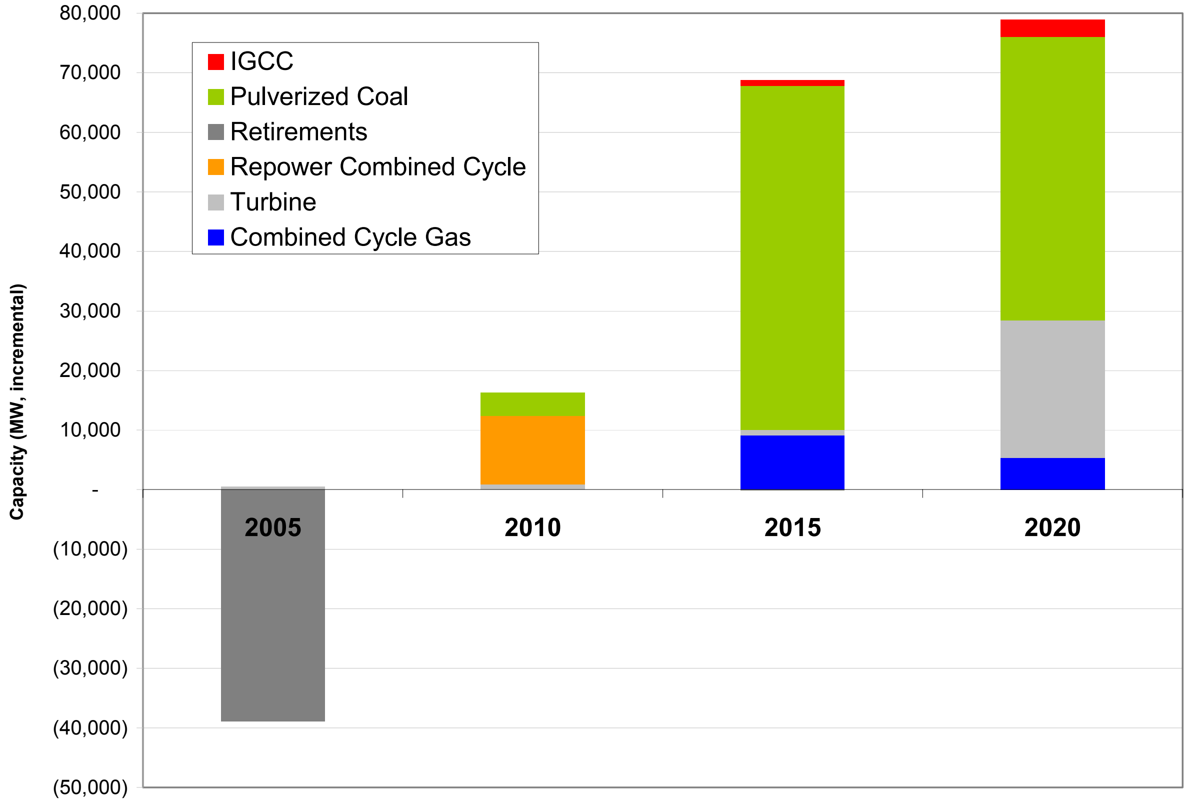
EPA Base Case^{EIA} Major Capacity Changes





EPA IAQR Proxy EIA Major Capacity Changes
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
-
(10,000)
(20,000)
(30,000)
(40,000)
(50,000)
Capacity (MW, incremental)
IGCC
Pulverized Coal
Retirements
Repower Combined Cycle
Turbine
Combined Cycle Gas
2005
2010
2015
2020

EPA Clear Skies^{EIA} Major Capacity Changes

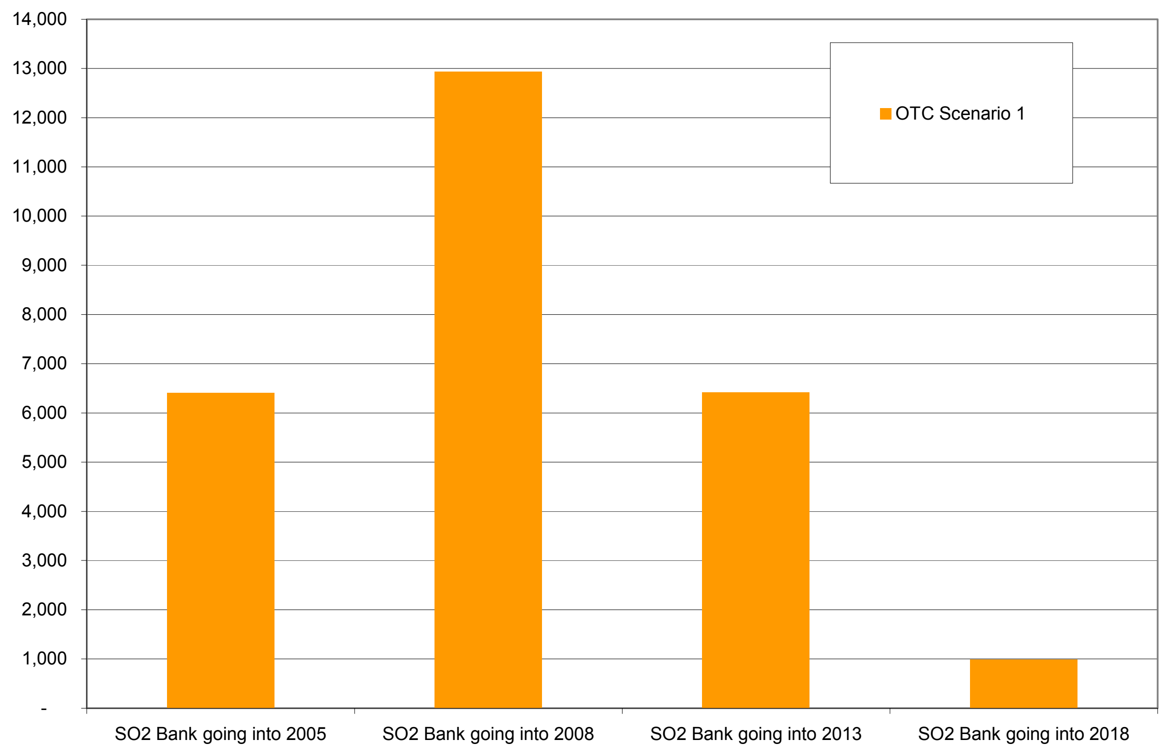


VII. Allowance Transactions

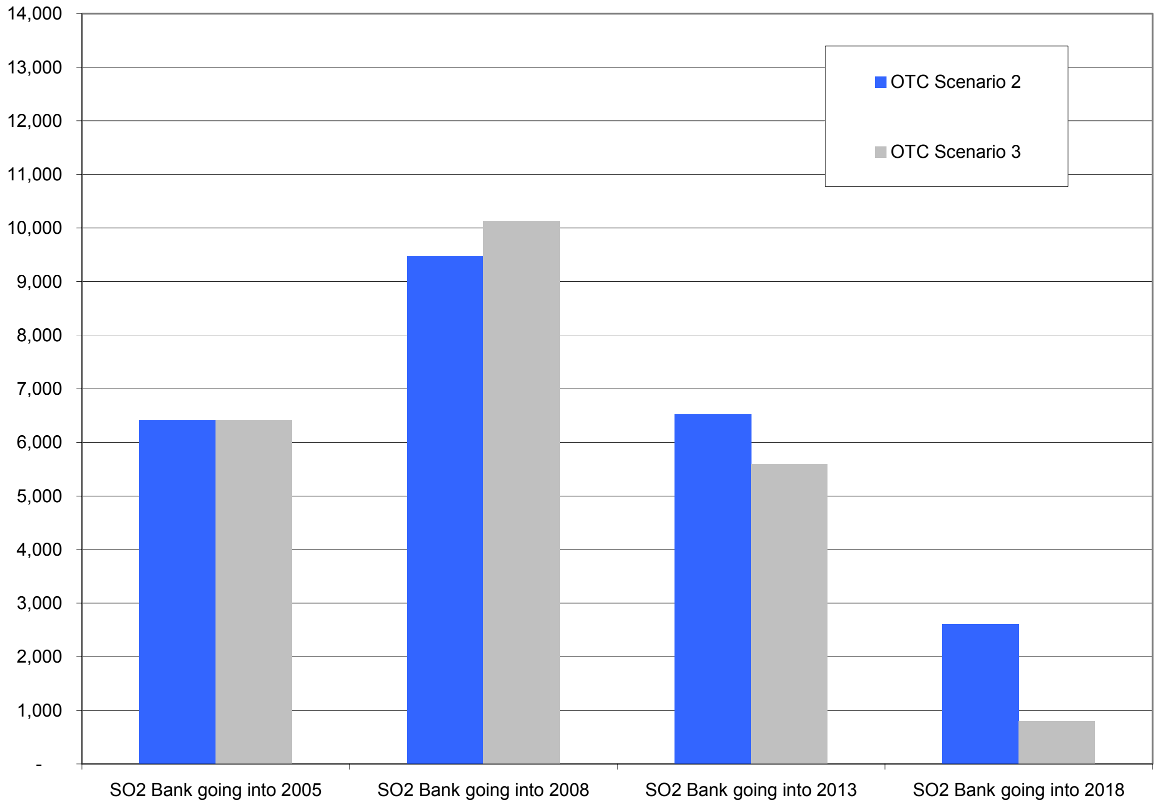
Under Scenario 1^{EPA} a large number of banked allowances are accumulated prior to 2008 (almost 13 million tons worth). These allowances are consumed as a more restrictive SO_2 cap comes into effect.

SO_2 emissions under Scenario 1^{EPA} gradually decline as the tighter caps come into effect and the pre-2010 banked allowances are consumed. Under Scenario 1^{EPA}, ICF reports emissions of 7.4 million tons in the 2005 run year, and emissions of 4.3 million tons in the 2010 run year.

Banked SO_2 Allowances: Scenarios Based on EPA Assumptions



Banked SO_2 Allowances:
Scenarios Based on EIA Assumptions



VIII. Coal Production

This section summarizes the projected coal production under the various scenarios. For the OTC scenarios, we report coal production by type, including bituminous, subbituminous, and lignite.

- Bituminous coal, which has high Btu content, is generally mined in eastern states.
- Subbituminous coal, which has a lower heating value and lower sulfur content than bituminous coal, is generally found in western states and Alaska.
- Lignite is produced in Texas, Montana, and North Dakota. The EPA modeling results only provide total coal production.

Table 8.1 summarizes the results for the scenarios based on EPA demand growth and natural gas price assumptions. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case^{EPA}.

Table 8.1 Coal Production (TBtu)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 1^{EPA}				
Bit	12,951	15,214	15,989	16,210
Lig	683	876	777	681
Sub	6,142	4,855	4,335	4,163
Total	**19,776 (-4%)**	**20,945 (-3%)**	**21,100 (-4%)**	**21,053 (-9%)**
EPA Scenarios				
Base Case^{EPA}	20,557 (NA)	21,542 (NA)	21,988 (NA)	23,244 (NA)
Clear Skies^{EPA}	20,270 (-1%)	21,084 (-2%)	21,453 (-2%)	21,427 (-8%)
IAQR Proxy^{EPA}	20,247 (-2%)	21,322 (-1%)	21,696 (-1%)	21,738 (-6%)

Table 8.2 summarizes the results for the scenarios based on EIA demand growth and natural gas price assumptions. In parentheses for each scenario we report the percentage difference relative to EPA's Base Case^{EIA}. Scenario 2^{EIA} results in a modest reduction in coal production (which is assumed to be equivalent to coal consumption) relative to Base Case^{EIA}. Scenario 3^{EIA} results in a much larger shift in coal production with the addition of the five ton mercury cap. ICF reports that the mercury allowance prices under Scenario 3^{EIA} are extremely high; it appears this result is driven by a marginal unit that is controlling for mercury by installing an ACI system.

Table 8.2 Coal Production (TBtu)

Scenario	2005	2010	2015	2020
OTC Scenarios				
Scenario 2^{EIA}				
Bit	13,639	16,172	19,083	20,528
Lig	953	1,032	999	964
Sub	6,240	4,870	5,691	6,558
Total	**20,832 (-2%)**	**22,074 (-2%)**	**25,773 (-3%)**	**28,050 (-5%)**
Scenario 3^{EIA}				
Bit	13,530	16,231	17,402	17,818
Lig	935	929	95	66
Sub	6,207	4,387	3,087	3,090
Total	**20,672 (-2%)**	**21,546 (-4%)**	**20,585 (-22%)**	**20,973 (-29%)**
EPA Scenarios				
Base Case^{EIA}	21,152 (NA)	22,459 (NA)	26,467 (NA)	29,547 (NA)
Clear Skies^{EIA}	20,879 (-1%)	22,189 (-1%)	26,152 (-1%)	29,207 (-1%)
IAQR Proxy^{EIA}	20,823 (-2%)	22,357 (-0.5%)	26,308 (-1%)	28,983 (-2%)

IX. Electricity Price Impacts

A key question for policymakers is the electricity price impact of the alternative policy scenarios, and again we seek to compare the modeling of the OTC scenarios with the EPA modeling results. The OTC modeling runs provide estimates of wholesale electricity prices (in $/megawatthour). EPA's IPM modeling outputs do not report either wholesale or retail price impacts; however, it is possible to estimate the relative scale of the impact based on the results reported in our earlier discussion of total system costs. For example, we can assume that a five percent difference in the cost of producing electricity (i.e., in the total system costs) will translate to roughly a five percent difference in the wholesale electricity prices.[2] To test the reliability of this assumption we first compare the percentage differences in the projected total system costs and wholesale electricity prices for the scenarios for which these outputs are known. The results of this comparison are summarized in Table 9.1. Based on these comparisons, we conclude that differences in total system costs are a reliable metric for estimating differences in wholesale prices across scenarios, particularly in the out years (2015 and 2020).

Table 9.1 Comparison of Total System Costs and Wholesale Price Projections: EIA

Scenario	**2005**	**2010**	**2015**	**2020**
OTC Scenarios				
Percentage Difference in Total System Costs for Scenario 3^{EIA} vs. Scenario 2^{EIA}	+ <1%	+ <1%	+6%	+5%
Percentage Difference in Wholesale Prices for Scenario 3^{EIA} vs. Scenario 2^{EPA}	+1%	+2%	+6%	+4%

Based on this logic, we project that Scenario 1^{EPA} will result in a +4% difference in wholesale electricity prices in 2015 and a +4% difference in wholesale prices in 2020, as compared to the IAQR $Proxy^{EPA}$. We project that Scenario 2^{EIA} will result in a +5% difference in 2015 and a +4% difference in 2020, as compared to the IAQR $Proxy^{EIA}$. Finally, $Scenario3^{EIA}$ is projected to result in a +11% difference in 2015 and a +8% in 2020, as compared to CSA^{EIA}. Retail price impacts will be lower (on a percentage basis) in all cases.

[2] Retail electricity price impacts will be smaller on a percentage basis than the wholesale price impacts reported in our discussion because retail prices reflect both the electricity costs as well as the cost of delivering the electricity. With only a portion of the total product cost impacted by the policy, in this case the electricity portion of the customer's bill, the percentage difference is effectively diluted by the delivery charge, which remains the same under all of the policies.