An Assessment of AEP's Actions to Mitigate the Economic Impacts of Emissions Policies

August 31, 2004

AEP AMERICAN® ELECTRIC POWER

Contents

1. Introduction

This report has been prepared by a subcommittee of independent directors of the Policy Committee of the American Electric Power Company Board of Directors. This document serves to "assess the actions the company is taking to mitigate the economic impact on our company of increasing regulatory requirements, competitive pressures, and public expectations to significantly reduce carbon dioxide and other emissions." Several owners of AEP common stock proposed to seek shareholder approval of this assessment at the 2004 AEP annual meeting. The company and its Board of Directors concluded that the request was reasonable and agreed to conduct this study. As a result of this commitment, the resolution was withdrawn. *Annex A* contains the correspondence that documents this agreement between the company and the proponents of the shareholder resolution.

In the course of our evaluation, the subcommittee met with twenty-eight individuals having a diversity of views and expertise on the issues of air emissions; *Annex B* lists the interviews we conducted. We also met with company management to understand the actions the company has taken and is taking to address emissions of carbon dioxide and other air emissions. Management also presented to the Policy Committee of the Board a current assessment of the technologies available to the company for reducing these emissions. Finally, the subcommittee requested and reviewed analyses of the costs of several control scenarios. We shared a draft of this report with the AEP Board of Directors in July 2004.

Our findings are presented in the balance of this report in four sections:

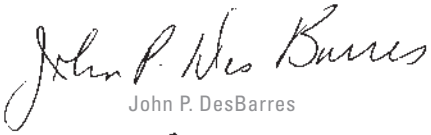
- A discussion of possible scenarios for the regulation of carbon dioxide and other emissions;
- A review of the actions available to the company for controlling these emissions;
- The results of the economic analyses of various control scenarios; and
- Our assessment of the challenges faced by the company and the key actions we believe important in meeting the challenges successfully.

The content of these sections includes, but is not limited to, specific topics that we agreed to address in our discussions with the proponents of the shareholder resolution.

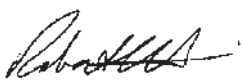
Our assessment concludes that the company has taken and is taking actions that constitute a solid foundation for future efforts to address the intersection between environmental policy and business opportunity. We recognize that there is much still to be done, and we outline measures to guide the company in the path ahead.

The subcommittee is grateful to the proponents of the shareholder resolution, the other stakeholders whom we interviewed, and to management for their advice, information and insights on this important matter.

Donald M. Carlton



John P. DesBarres



Robert W. Fri, Chair

2. Policy Context

The American Electric Power System (AEP) is the largest electric power generator in the United States, with a diverse portfolio of renewable, nuclear, and fossil fuel-fired generation assets. Due to the plentiful coal reserves in the eleven states in which AEP operates, the company relies heavily on coal as the primary energy source to generate a reliable supply of affordable electricity for its customers. The company recognizes the significant responsibility it carries within the power sector, specifically, and U.S. industry, in general, to minimize the economic and environmental impacts of its decisions. Among the most significant economic drivers for coal-based generators are current and future environmental policies, particularly air quality policies and programs.

In particular, limits on currently regulated air emissions are likely to become increasingly stringent and there is the possibility of mandatory controls on the emission of greenhouse gases. With respect to the former, the company's ability to develop a strategy to further reduce air emissions at the lowest cost to its consumers and shareholders over the long term is complicated by uncertainties regarding the nature and scope of currently proposed requirements, and the likelihood and timing of additional future emission reduction requirements. In the U.S., mandatory restrictions on greenhouse gas emissions remain a matter of active public debate. It is impossible to predict when or what form of greenhouse gas regulations might be imposed. At the same time, proposed legislation to require relatively modest initial reductions in greenhouse gas emissions appears to be attracting increasing bipartisan Congressional interest. The extent to which other manufacturing countries join in efforts to reduce greenhouse gases will affect the likelihood of Congressional passage of such measures.

As a result, there are significant business issues when it comes to mitigating the economic impacts associated with environmental issues. To address these business issues in the public policy context, the subcommittee examined several scenarios for the regulation of both currently regulated air emissions and greenhouse gases. These scenarios were developed by Van Ness Feldman, are summarized here and described with greater detail in *Annex C:*

Currently Regulated Emissions

- Current Administration Regulatory Policy
  - *Currently proposed Clean Air Interstate Rule, Utility Mercury Reduction Rules*
  - *State regulatory programs to address remaining local non-attainment areas*
  - *Potentially adverse outcome in NSR litigation*
- Litigation and Piecemeal Implementation
  - *EPA rulemakings invalidated by D.C. Circuit Court*
  - *Accelerated SO_2, NOx, and mercury reduction timetables*
  - *Increased mercury control stringency; no mercury emissions trading*
  - *State regulatory programs to address remaining local non-attainment areas*
  - *Potentially adverse outcome in NSR litigation*
- Governmental Policy Change
  - *Change in Administration*
  - *Accelerated SO_2, NOx, and mercury reduction timetables*
  - *Increased mercury control stringency; no mercury emissions trading*
  - *State regulatory programs to address remaining local non-attainment areas*
  - *Potentially adverse outcome in NSR litigation*

2. Policy Context

Greenhouse Gases

- Federal Voluntary Policy; Regulatory Programs in Certain States
  - *Continuation of Administration's voluntary greenhouse gas programs*
  - *State-level greenhouse gas regulations and renewable portfolio standards*
- Multi-Emissions Program with CO_2 regulation
  - *Enactment of a program with limits on SO_2, NOx, mercury, and CO_2 based on Senator Carper's proposed Clean Air Planning Act of 2003*
- Economy-wide Greenhouse Gas (GHG) Cap-and-Trade Program
  - *Enactment of an economy-wide greenhouse gas cap-and-trade program based on the amendment proposed by Senator McCain and Senator Lieberman that is a modification of their Climate Stewardship Act of 2003, S. 139*
- More Stringent Economy-wide GHG Cap-and-Trade Program
  - *The McCain-Lieberman proposal with a 1990 target and then a declining cap*

For currently regulated air emissions, it appears that future regulatory programs will require substantial reductions in the company's emissions of SO_2, NOx, and mercury from its coal-fired fleet over the next 15 years. Whether the programs that are ultimately implemented reflect the Administration's current regulatory proposals, litigation and piecemeal implementation, or governmental policy change, including new legislation, emission limitations are nearly certain to become increasingly stringent. However, the economic impacts on the company resulting from any of these plausible policy scenarios depend on the inherent variability in costs and performance of new generation and pollution control technologies, the variability in future fuel prices, and in large part on five major environmental and regulatory policy factors:

- The stringency of emissions reduction requirements;
- The timetable for emissions reductions;
- The availability of trading of emission reduction credits;
- The methodology of allowance allocation, if there is trading; and
- The interaction with policies governing greenhouse gas emissions.

The near-term costs to the company for compliance with the Administration's currently proposed regulatory programs have been estimated at approximately $3.5 billion by 2010. In the mid-to-long-term, however, future compliance costs are uncertain for all of the reasons described above. Worst-case assumptions that significantly increase compliance costs include the adoption of programs that: *(i)* mandate unit-specific control requirements, reduce the flexibility and cost-effectiveness of trading programs, and restrict the use of associated allowances; *(ii)* impose uncoordinated compliance schedules for currently regulated air emissions that would eliminate or curtail "co-benefits"[1] from control technology investments; and, *(iii)* conventional control technology investments that become stranded[2] by the later adoption of even more stringent emission limitations and/or greenhouse gas emission controls that would force premature retirement of these assets before the end of their economic lives.

[1] *The term "co-benefits" describes reductions in emissions that are obtained through the combined use of different pollution control technologies. For example, the installation of both selective catalytic reduction (SCR) to reduce NOx emissions and flue gas desulfurization (FGD) systems to control SO_2 emissions could also reduce mercury emissions at little to no additional cost.*

[2] *The term "stranded" here refers to assets that are forced into premature retirement before their capital costs can be recovered, due to unforeseen greenhouse gas emissions restrictions that render existing plants inoperable.*

2. Policy Context

With regard to global climate change policy, the immediate future of greenhouse gas regulations remains highly uncertain, but mandatory carbon constraints in the long-term appear probable. Although the understanding of the science underlying the global climate system continues to evolve, the absence of a foreseeable precipitating event and past reluctance by Congress to consider mandatory restrictions on U.S. emissions in the absence of comprehensive and coordinated global action makes it difficult to expect rapid emergence of the near-term political consensus that could motivate a major policy-level response to global climate change. Consequently, the likelihood for costly, mandated reductions in carbon emissions in the next few years appears small, although interest and awareness in the topic are likely to continue to grow. This report considers the three greenhouse gas policy scenarios listed on the preceding page to represent the most plausible outcomes on this topic in the near-to-mid term.[3]

Driven by AEP's long-term planning obligations, the company's position statement on global climate change states that "enough is known about the science and environmental impacts of climate change for us to take actions to address its consequences." The company has demonstrated this commitment by developing and implementing a broad portfolio of actions to reduce, avoid or sequester greenhouse gas emissions, beginning in 1995. The company also has contributed and continues to contribute to the development of low/no-carbon energy technologies and has been proactive in the policy debate to establish the framework for international and domestic policies aimed at ultimately stabilizing atmospheric greenhouse gas concentrations.

A key challenge facing the company lies in determining the extent to which it can increase its voluntary greenhouse gas abatement investments since unilateral actions will yield little in terms of demonstrable environmental benefits and could place the company and possibly its commercial and industrial customers at a competitive disadvantage.

The interaction between policies governing currently regulated air emissions and greenhouse gases also merits close attention. While additional reductions of currently regulated emissions contribute to improved air quality, it is worth noting that such pollution control equipment uses energy that reduces the efficiency of power generation stations, thereby raising greenhouse gas emission rates. Furthermore, large-scale investments in pollution control can only be undertaken prudently if there is little risk of such investments becoming "stranded" by future environmental or economic mandates, including carbon constraints. Hence, clean air policies interact with global climate change policies in ways that are complex. The strategic options that should be considered by the company are those that will optimize its ability to respond flexibly and cost-effectively to developments on both fronts.

[3] *While this assessment did not seek to quantify the probabilities of various policy scenarios, it should be noted that the greenhouse gas scenarios do not, in the view of the subcommittee and many of the experts consulted, share equal likelihood of becoming reality. In particular, it is felt that greenhouse gas policy scenarios #1 and #3 appear more plausible than scenario #2. Furthermore, recognition of these scenarios as possible does not constitute endorsement of any of these hypothetical outcomes.*

3. Strategic Options

In this complex and uncertain public policy environment, the company can pursue four broad strategies for controlling emissions — installing control technologies on existing power plants, changing the composition of the generation fleet, managing its demand profile, and seeking emission reductions off-system. All of these strategies are actively employed in meeting current and foreseeable control requirements. While the same strategies would be expected to apply to less certain future requirements, these tools are not as fully developed in terms of addressing greenhouse gas emissions as they are for currently regulated air emissions.

Control Technologies

Emission control technologies involve the retrofitting of complex chemical-based systems onto existing power plants to capture and remove targeted pollutants, thus reducing emissions of these substances. The effectiveness of these technologies varies depending on the particular pollutants being addressed. Flue gas desulfurization (FGD) systems and selective catalytic reduction (SCR) systems have been demonstrated to achieve very high levels of removal for SO_2 and NOx, respectively. However, capture and removal of mercury presents unique challenges. The combined operation of FGDs and SCRs with certain coal types can result in significant "co-benefit" mercury control. Very high levels of mercury control or reductions at facilities that do not have both FGDs and SCRs likely will require stand-alone mercury control technologies that U.S. EPA and U.S. DOE have indicated are not commercially available nor have been demonstrated in large-scale operation on the full spectrum of coals.

The most formidable challenges are presented by carbon capture, since carbon is an integral component of fossil fuels. Capturing carbon dioxide emissions requires complex, expensive, and energy-intensive technologies for existing pulverized coal plants. Next-generation fossil-fuel-based power plants that are better suited for carbon capture are nearing the point of commercial feasibility. However, the efficacy of permanent, ecologically safe disposal of carbon dioxide in geologic formations has not yet been proven.

Fleet Composition

Changing the composition of AEP's generation fleet represents another option for addressing the company's air emissions. In 2000, American Electric Power merged with Central and South West Corporation, achieving significant diversification in the fuel mix of power generation assets. Prior to the merger, AEP generated its electricity using 90% coal, 9% nuclear, and 1% hydroelectric power. After the merger, these figures changed to 65% coal/lignite, 7% nuclear, 26% gas, and 2% hydroelectric and other. While fuel diversification merits attention for many reasons, experience has shown that markets rather than policies are more efficient instruments to guide investment decisions for new generation capacity additions. Indeed, as AEP's existing generation assets approach the latter stages of their economic lives, potential changes in the composition of the company's fleet will become a major consideration. The company faces significant

challenges and opportunities in maximizing the value of existing assets while also managing the retirement and replacement of these facilities.

New technologies will be needed in the future as AEP seeks to both replace aging capacity and meet growing demand in a cost-effective, sustainable manner. Leading options for new generation include systems based on fossil fuels and renewable energy. Nuclear power also holds potential, although it faces considerable challenges. Additional, complementary technological considerations include the potential roles of distributed resources, storage technologies, and carbon capture and sequestration. These technologies are discussed in greater detail in *Annex D*.

As a major operator of low-cost baseload power plants, the company has new fossil-fuel-based generation options under consideration that include *advanced pulverized coal* facilities, which have been the traditional technology used to convert coal into electricity in the absence of CO_2 constraints; *circulating fluidized bed* plants, which work best with low-BTU coals; *natural gas combined cycle* plants, which involve the least up-front capital but are vulnerable to high gas prices, as currently is the case, as well as gas price volatility; and *integrated gasification combined cycle* systems, which appear to be approaching commercial viability.

Integrated gasification combined cycle (IGCC) is of particular interest to AEP, in light of the abundance, accessibility, and affordability of high rank coals for the company. IGCC also appears well-positioned for integration of carbon capture and sequestration technologies, which will be a critical measure in mitigating greenhouse gas emissions. While technology risks, performance uncertainties, and capital costs remain formidable at this early stage in IGCC's development, AEP also recognizes sizable operational, policy, and economic benefits that this technology potentially could deliver as the next generation of power generation assets. Weighing these costs and benefits, the company has committed to emerging as a leader and first-mover in advancing IGCC into the mainstream of power generation.

Renewable energy systems represent a key component of the portfolio of options considered by the company. In the near term, biomass co-firing in coal-fired power plants and wind energy are the primary options for generating electricity on a large scale from renewable energy, delivering attractive CO_2 benefits in a potentially carbon-constrained policy environment. Already, the company ranks among the leading generators of wind power in the United States. While renewable energy technologies continue to achieve impressive improvements in performance and cost, resource availability in terms of capital and land could become a limiting factor for large-scale deployment of biomass and wind technologies both in the AEP fleet and in the country as a whole.

Nuclear power holds promise as an option for electric power generation, but also faces significant challenges that must be addressed. Currently accounting for approximately one-fifth of U.S. electricity, nuclear power serves as a critical resource for baseload power. Next-generation reactor designs could offer improvements over the already-high performance of current plants, thus preserving, and perhaps even expanding, the emission-free fleet of nuclear power plants in the country. However, issues of public acceptance, capital costs, and waste storage must be resolved if a nuclear renaissance is to occur in the U.S. The company recognizes nuclear power technologies as an important power generation option and supports a proactive approach from government and industry to addressing the challenges facing nuclear power.

Additional technologies complement these power generation options. Distributed resources and storage technologies offer potential advances in such areas as peak management, asset utilization, power quality, grid stabilization, energy arbitrage, and customer commercial services, but the technological race continues as no clear winners have yet emerged to fill the niches that distributed resources and energy storage could fill. Carbon capture and sequestration, in contrast, would have to be widely deployed eventually if carbon constraints become sufficiently stringent. Yet these technologies remain in the early stages of development and face challenges in terms of technology R&D and societal acceptance before they can reach commercial availability, much less widespread deployment. The high costs of capturing carbon dioxide from flue gases impose major penalties on existing pulverized coal power plants, potentially raising the cost of electricity between 30 and 50 percent. In this context, IGCC promises to be the most conducive technology for carbon capture and sequestration. Alternatively, IGCC flue gas streams also could prove to be amenable to direct sequestration, which would obviate the need for costly carbon capture technologies.

Demand-Side Options

Traditional demand-side options appear limited in their usefulness at AEP for reducing currently regulated emissions and greenhouse gases for two main reasons. First, in the course of the evolution of the policy and market landscape of the power sector over the past few decades, a notable shift away from demand-side management and toward market-driven approaches has occurred. In particular, many regulators on state public service commissions now seem to emphasize harnessing market forces to deliver savings to ratepayers over reducing demand for the same end. The result is that conventional demand-side management programs no longer delivered returns on investment in most cases within AEP's service territory, especially given AEP's abundant supply of low-cost electricity. Second, the advent of wholesale competition and regional transmission integration in the electric power industry has led to the natural evolution of AEP as a low-cost generator into a major player at the wholesale and regional levels. Maximizing generation output from existing assets to participate in wholesale and regional markets means capitalizing on the company's natural comparative advantages to the benefit of shareholders and customers. Improvements in power plant availability also can lead to reductions in emissions per unit of electricity. While this would represent a step forward in efficiency that results in tangible environmental benefits, overall emissions still could increase, as the net increase in generation would make this environmental improvement difficult to discern.

Promising alternatives to traditional direct demand-side measures exist, however, including appliance and building efficiency standards. Although these instruments provide little to no direct benefit to the company, AEP believes that advances in these areas can bring about long-term energy-efficiency gains in the overall structure of the economy that in turn contribute to lower overall rates of both currently regulated and greenhouse gas emissions.

Off-system Reductions

Off-system reductions of greenhouse gas emissions, premised on global trading of greenhouse gas emissions reductions credits, represent an innovative approach to addressing global climate change. Building upon the concept of emissions trading that has proven its efficacy and efficiency through U.S. EPA's acid rain control

program, the company has played a pioneering role in demonstrating the effectiveness of such approaches to mitigate greenhouse gas emissions. Examples of such off-system reductions include enhancing or protecting uptake of carbon dioxide in threatened rainforests or improving the efficiency of power plants in developing countries. While such measures have not been employed in traditional air quality programs, which have a local or more regional focus, off-system reductions of greenhouse gas emissions effectively contribute to the necessary global reductions in carbon emissions and deliver many ancillary benefits in terms of sustainable development and biodiversity protection that complement these projects' cost-effective mitigation of greenhouse gases.

The importance of off-system reductions to the company is represented by AEP's commitment to and participation in the Chicago Climate Exchange (CCX). As a founding member of this pioneering effort in greenhouse gas emissions trading, AEP voluntarily has committed to cap and reduce or offset its total greenhouse gas emissions by 4 percent over four years. These reductions began in 2003 with a 1 percent reduction from baseline emissions (average of 1998-2001) and will continue with an additional 1 percent reduction each year until the company has reduced its greenhouse gas emissions by 4 percent from the baseline in 2006. Through this commitment, the company expects to reduce or offset an estimated 18 million cumulative tons of carbon dioxide or carbon dioxide 'equivalent' emissions, based on current levels of emissions. AEP plans to meet its CCX commitment cost-effectively through a broad portfolio of actions, including both on-system actions such as plant efficiency improvements and off-system projects such as reforestation projects and the purchase of emission reduction credits from other CCX participants. Already, the company is ahead of its 2003 commitment, reflecting the closing and/or mothballing of inefficient gas steam units in Texas, improved operation and utilization of its Cook Nuclear Plant, and continued investments in reforestation projects.

Because climate change is truly a global challenge that requires a global solution, off-system reductions represent an efficient and effective near-term option for greenhouse gas mitigation. Additionally, off-system reductions also could provide the valuable time necessary for the longer-term, larger-scale technology revolution that will be necessary to decouple energy use from carbon emissions. These conclusions rest on the premises that *(a)* the atmosphere is unable to distinguish between the origins of greenhouse gases and *(b)* the marginal costs of greenhouse gas abatement vary widely between industrialized and developing countries. Furthermore, participation in markets in which greenhouse gas emission credits are traded requires the company to develop data on the internal costs of greenhouse gas reductions, which is an important step toward building the foundation for retrofits, retirements, and replacements within the company's generation fleet. Off-system reductions of greenhouse gas emissions work in the interest of the company's shareholders, customers, and government and community stakeholders as a highly cost-effective instrument for addressing global climate change.

4. Modeling Results

At the request of the subcommittee, management conducted quantitative analyses of the potential costs of currently proposed emissions control regimes. A summary description of these analyses is provided below. A more detailed description of the purpose of the analysis, scenarios examined, analytic results of the study and detail on the assumptions employed and uncertainties evaluated is presented in *Annex E.*

These analyses specifically projected costs associated with compliance with the following combinations of the policy scenarios described earlier in this report:

- The Administration's current proposals on already-regulated pollutants;
- The Administration's policies on conventional pollutants coupled with immediate passage of the McCain-Lieberman amendment, under which AEP's carbon dioxide emissions would be capped at 2000 levels by 2010;
- The Administration's policies followed by enactment of the McCain-Lieberman amendment in 2009 with compliance in 2014; and
- The Carper bill (S. 843) being enacted in lieu of current Administration policy.

Additional sensitivity analyses were completed on the impacts of varying CO_2 permit prices for these scenarios. It should be noted that analysis of these scenarios does not reflect upon the likelihood of any of these proposals becoming legally binding.

A number of important analytical assumptions merit discussion. All scenarios assumed that allowances would be allocated to power plants on a historical basis rather than auctioned. Potential allowance auctions, which have been considered particularly in the case of greenhouse gas limits, could raise enormously AEP's cost of reducing emissions. They also could substantially raise electricity rates for customers in the Midwest. This effect is stated here, and described further in *Annex E,* rather than being included in the quantitative analyses.[4]

Assumptions also were made with regard to future fuel prices, pollution control and new plant costs, and emission rates, but it should be noted that mercury-specific controls have not been demonstrated commercially at coal-fired units and may be technically infeasible by the 2009 date modeled for compliance with the Carper bill. These assumptions are documented in *Annex E.*

The company has developed a robust least-cost plan for meeting the Administration's balanced requirements for SO_2, NOx, and mercury.

Implementing this plan requires an investment of

[4] While the possibility of auctions exists in future legislation, particularly for greenhouse gases, the issue remains highly contentious. In general, countries that are subject to mandatory greenhouse gas reductions under the Kyoto Protocol have opted for small auctions, if at all. For example, the European Union emissions allocation plan for Kyoto compliance limits auctioned allowances to no more than 5 percent of total allocations during 2005-2007 and no more than 10 percent during 2008-2012. Several EU countries, most notably Germany and Spain, have opted not to have allowance auctions at all. Finally, in the U.S., the severe regional distributive consequences to states with extensive coal-based generation in the Midwest and Southeast make passage of a significant auction scheme in new legislation unlikely.

approximately $3.5 billion through 2010, $5 billion through 2020, all with a net present value (NPV) of $2.6 billion, a figure that depends in part on the efficiency of the control regime but represents the base case.[5] Compliance with the greenhouse gas control provisions of the McCain-Lieberman amendment appears possible with existing technologies at net present value costs between $0.5 and $0.9 billion, additional to the base case. The Carper bill would require much higher additional costs, between $3.0 and $6.4 billion. Again, these costs for compliance with greenhouse gas policies depend significantly on the economic efficiency of the control regime that is adopted. *Table 1* summarizes these figures.

NPV of AEP costs above base case,* 2004-2030

	McCain-Lieberman		Carper
Carbon permit price sensitivity	'04 passage	'09 passage	
High	+ $0.9B	+ $0.7B	+ $6.4B
Low	+ $0.5B	+ $0.5B	+ $3.0B

**base case:* EPA Regulatory = $2.6B

Table 1: *Potential compliance costs for greenhouse gas policy scenarios*

Compliance costs with the McCain-Lieberman proposal are relatively unaffected by the timing of its passage and implementation. This can be attributed to the robustness of the investment decisions made over the next 6-8 years to comply with the Administration policies for conventional pollutants in the absence of any carbon constraints as well as across both scenarios involving the McCain-Lieberman amendment. Simply put, the near-term investments in scrubbers, SCRs and other pollution control equipment are being made at the lowest-cost plants, which are the most economic to retrofit and will continue to operate with or without CO_2 constraints under McCain-Lieberman. It is only when more marginal retrofit decisions need to be made *after* this period that the inclusion of a CO_2 constraint would affect these decisions.

McCain-Lieberman compliance is expected to require reductions and/or offsets of approximately 10 million tons of CO_2 by 2020. Few, if any, costs are expected to be stranded by delayed implementation of McCain-Lieberman, and this delay, even without foresight of its enactment, actually results in slightly lower costs for carbon compliance, because the costs of meeting the carbon constraints are delayed. Looking beyond 2010 – 12, it is foreseen that the McCain-Lieberman requirements would reduce deployment of scrubbing and carbon injection as the fleet composition shifts to greater reliance on integrated gasification combined cycle (post 2016 to allow for "N*th* of a kind" availability[6]), natural gas combined cycle, and wind power. Of course, it is quite possible that the McCain-Lieberman reduction requirement could be tightened in the future (e.g., in the post 2020 period). This could lead to dramatically higher costs to the company and potentially create a need to recover some of the remaining unamortized portion of the environmental control investments for currently regulated emissions at some AEP power plants. *Figure 1* illustrates the actions that the company is modeled to take in order to comply with currently proposed regulations (EPA's SO_2, NOx, and mercury rules) and the McCain-Lieberman proposal (2009 passage) under both low and high CO_2 price sensitivities.

The Carper bill presents more formidable emission

[5] *Costs in this section refer to fuel, O&M and capital expenditures, new plant capital, retrofit pollution control, and CO_2 permit purchases*

[6] *"Nth of a kind" refers to the assumption that the deployment of several demonstration-scale units reveals technical improvement opportunities that lower the cost of widespread deployment of full-scale generation technologies.*

reduction requirements, on the order of being six to seven times more expensive to the company in a range of $3.0-$6.4 billion in net present value costs. The two major factors driving these costs are: *(1)* the accelerated timing and increased stringency of the Carper bill's requirements for currently regulated emissions, particularly mercury, result in increased expenditures on pollution control equipment; and *(2)* allocating CO_2 allowances based on generation output. In terms of the latter, the Carper bill will provide many more emission allowances to nuclear, gas and hydro units than they will need to comply, allowances which operators of coal-fired units such as AEP will have to purchase. From a national perspective, states that depend on coal-fired generation would effectively subsidize electricity rates for those states that rely more heavily on nuclear, gas and/or hydroelectric power.

AEP's high costs under the Carper bill are driven by the carbon dioxide allocation scheme. In this latter case, although the Carper bill will achieve *fewer* national reductions of greenhouse gases than the McCain-Lieberman amendment (since it singles out the electric utility sector rather than adopting an economy-wide approach), for AEP, it will require approximately 6 times as many reductions. In short, the costs to offset or reduce a very large amount of CO_2 emissions, reaching 58 million tons per year by 2020, result in almost 2/3 of the Carper bill's costs being associated with these purchases and/or offsets. This example demonstrates how the economic impacts of greenhouse gas policies on the company are affected by policy design considerations that are independent of the actual greenhouse gas reduction benefits that would be achieved.

CO_2 Offsets/Reductions in 2002: About 10mm tons

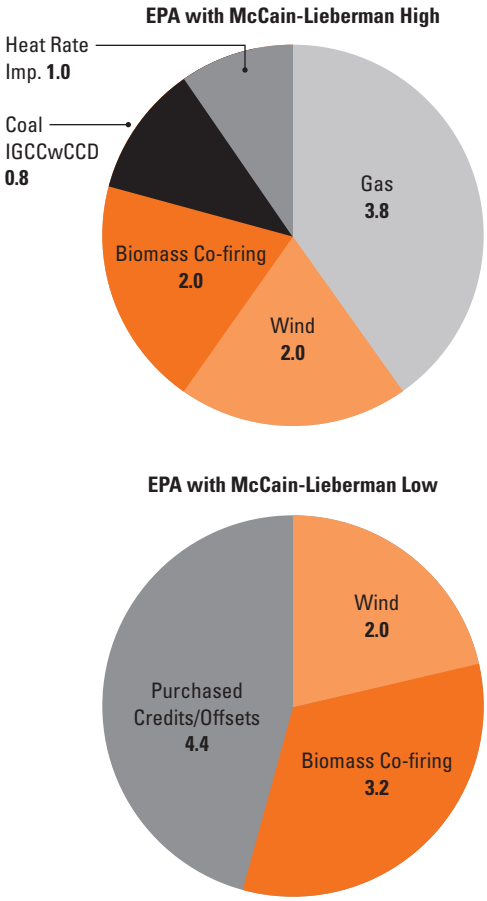


Figure 1: *AEP CO_2 Emission Reductions (MM tons CO_2)*

5. Evaluation

Annex F summarizes the actions that the company has taken and is taking to address the issues of greenhouse gas and other emissions. While the list is impressive, the chief value of these efforts lies in the foundation that has been built for the company's future management of these environmental issues. Accordingly, our evaluation of the company's actions to mitigate the economic impacts of emission controls is prospective: building on this foundation, what should the company do to maintain and enhance overall shareholder value? We begin by describing the challenge the company faces as it invests significant capital in these controls over the next few years. We then identify the responses we believe are essential to meeting these challenges.

The Challenge

The central challenge the company faces is that of making decisions about large investments in long-lived assets in a setting of uncertain public policy and rapidly evolving technology. The dilemma is that requirements and technology that can change fairly rapidly increase the risk of making an investment that fails to remain productive over its useful life. For the reasons summarized below, we believe that this situation is likely to persist for a considerable time.

The near-term requirements for the control of SO_2 and NOx are reasonably well known. The exact requirement for controlling mercury emissions is less clear and remains controversial. The need for even more stringent future controls on currently regulated air emissions from power plants is speculative at this point. However, because AEP must plan for the long-term, experience suggests that the company should expect to make further reductions of these emissions over time.

Some initial mandatory reductions of greenhouse gas emissions are likely in the next decade, although the stringency and the timing of such reductions are difficult to estimate with any confidence. Beyond this initial step, we cannot predict the timing, stringency, or structure of a program that would be needed to reduce greenhouse gas emissions to a level consistent with maintaining an acceptable concentration of greenhouse gases in the atmosphere. Nevertheless, the possibility of such requirements is real and needs to be taken into account in making long-term investment decisions.

The technological response to these requirements is uncertain, as well. AEP has considerable experience with designing and operating technology to control SO_2 and NOx. It expects to invest $3.5 billion to meet near- term control requirements. The cost of reducing these emissions is increasing, however. The cost of additional emissions reductions is expected to grow, in part, because the marginal costs of removing the next increment of emissions tends naturally to rise. In addition, physical space limitations, parasitic load demands, and other engineering factors are also contributing to the increasing cost — particularly for smaller and older units in the AEP generation fleet. Technology for reducing mercury emissions is less well developed, and its costs could be considerable. And if more stringent controls of these currently regulated emissions do indeed come into being several years hence, we cannot dismiss the possibility that the least-

cost response would be to shift to a new generation of control technology.

Responding to climate change is even more problematic. Analyses developed for this report show that the company could likely make modest reductions in greenhouse gas emissions and could do so anytime within the next several years without significant risk to its investment in pollution control technology for currently regulated emissions. However, to go beyond this first step would require the extensive deployment of new technologies, including Integrated Gasification Combined Cycle (IGCC) generation from coal and renewable sources such as wind, solar power and biomass fuels.

The Response

The company's goals are to comply with mandated emission requirements; to maintain its competitive position as a low-cost, reliable supplier of electricity; and to attract the necessary capital for these purposes. The economic impact of controlling greenhouse gas and other emissions thus depends on the company's ability to meet these goals in a fluid business setting. We believe that the actions the company has taken in anticipation of the control requirements described above have put it in a position to manage effectively their associated economic impact. The company should build on this foundation to fashion an action program to that end. We outline below the key elements of this program as we see them.

Design of control regimes: The design of environmental regulatory programs profoundly affects the cost of meeting the emission reduction requirements. For example, cap-and-trade programs, such as the one in place for SO_2 controls, provide opportunities to seek out the most efficient controls. Similar program designs are economically efficient for all regulated emissions, but are even more crucial for greenhouse gas control programs. The company emits carbon dioxide by burning coal, natural gas and fuel oil in its generating fleet. However, the lowest-cost and most-effective controls of greenhouse gases may occur elsewhere — in reducing other kinds of greenhouse gases (such as methane), by enhancing or protecting carbon sequestration resources, or by cutting carbon emissions outside the AEP System. We believe that flexible and comprehensive control regimes of this sort should be a major tool in mitigating the economic impact of greenhouse gas and other emission reduction programs.

Through its actions to date, the company has accumulated a significant amount of experience in the design of programs that would minimize the cost of compliance with reductions of greenhouse gases and other emissions. Notable among this experience are the company's leadership and participation in the Chicago Climate Exchange and the International Emissions Trading Association, its demonstrations of terrestrial sequestration projects and of cooperative projects with other countries, and its support of research by the U.S. Department of Energy, Pew Center for Global Climate Change, the Electric Power Research Institute, and other organizations. We believe that the company is particularly well positioned to build on this experience to advocate effectively in policy and regulatory forums for the most efficient program designs, not only for the environmental benefits, but also for the benefits to its customers over the long-term.

Of special interest is the design of a program for greenhouse gases. At some point in the future, governments around the world are likely to agree upon initial implementation of a modest mandated constraint on greenhouse gas emissions. Analyses prepared for this report suggest that AEP could meet a reasonable constraint at significant but manageable costs

— provided that the program was efficiently designed.[7] However, it also appears that the timing of this initial program has little effect on the cost to the company of proceeding now to invest in control equipment to meet new requirements for controlling other regulated emissions.

The intricate design details of greenhouse gas control programs bear significant influence on the cost borne by the company, and therefore its customers, to comply. Important to the company will be persuasive, proactive advocacy of positive policy positions that ensure that the rules governing such programs will operate in a transparent, fair, and cost-effective manner that works in the interests of the company's shareholders, customers, and stakeholders, as well as the U.S. economy vis-á-vis the world.

Technology leadership: The central technology challenge for AEP is to preserve its ability to burn coal economically while meeting increasingly stringent emission control requirements. Management has closely followed the development of technologies of this type for several years. Based on assessments prepared by company and other analysts, IGCC technology appears to have the greatest potential for meeting AEP's long-term goals. During the course of our evaluation, the company concluded that accelerating IGCC technology development to reach commercial availability by 2015 or before must become a high priority for AEP. As a result, the company has committed to being the industry leader in developing IGCC technology and already is forging ahead to develop partnerships and agreements to make IGCC a viable option for AEP's next generation of new power plants. We strongly support this initiative.

IGCC technology has advantages both economically and for the control of regulated emissions that, in our opinion, justify this ambitious program. However, the technology would also be highly desirable in a carbon-constrained world, since its carbon dioxide stream should be much easier, and therefore less costly, to capture than one from a pulverized coal plant. As part of its IGCC development program, the company should therefore actively encourage research that would investigate and, if feasible, demonstrate the capture and disposal of carbon dioxide emissions from IGCC technology. AEP has supported research into the management of carbon dioxide, notably in the sequestration research that is being conducted at its Mountaineer plant, and in doing so, has positioned itself well to help shape a national program on this subject.

Excellence in plant operations: The ability to efficiently operate large power plants with complex emission control equipment is an important strength. Achieving highly reliable and efficient operation of such equipment also has the benefit of maximizing the availability of retrofitted power plants to sell excess generation into wholesale markets. But consistently operating emission-controlled plants at high capacity factors is difficult at best, requiring mastery of not only traditional power plant operations but also the management of complex chemical reactions at very high mass flows. Similarly, as systems become more complex, the challenges of information processing grow as well. The company has considerable experience in plant operations, but will need to refine its capabilities as the complexity of the control technology multiplies. AEP must be open to acquiring skills not common to utility operations, such as chemical engineering and advanced system control software. Such efforts should help to achieve cost-effective solutions to these important challenges.

[7] Note the large difference in the costs of meeting the different control scenarios discussed in the previous section.

Sophisticated decision-making tools: A variety of options are available to the company for complying with emission limits of both currently regulated and greenhouse gas emissions. These include investment in control technology at AEP power plants, the purchase of allowances and other off-system emission reductions, changes in fuel mix, and the retirement and/or replacement of elements of the generation fleet. The company must, therefore, engage in an exceedingly complex decision-making process to identify the mix of options that will minimize the cost to the consumer while at the same time being robust with respect to the uncertainty in the regulatory process.

We believe that one of the company's most important accomplishments has been the development of the Multi-Emission Compliance Optimization Model (MECO). This proprietary model is a sophisticated analytic tool that allows the company to systematically weigh the costs and risks of a wide variety of options. Our non-technical review of the model and its application in decision-making at AEP leads us to believe that the development of MECO is a distinctive strength for the company. As such we encourage its continued use as a guide to the company's major investment decisions, as well as its ongoing refinement to ensure its relevance to the evolving structure of the electric power industry.

While MECO serves as the company's principal analytic tool for environmental policy analysis, it faces the same limitations encountered by other quantitative tools. Recognizing the inherent constraints posed by models that work only within defined parameters, the company employs a diversity of computer models to corroborate and complement the analyses of MECO. AEP also considers the output of these systems as just one of many inputs, both quantitative and qualitative, that factor into the complex decision-making process that is used to evaluate strategic options and determine courses of action.

Transparency: Both the public policy and technology settings in which AEP operates are complex to the point of obscurity. Yet regulators, investors, legislators, government officials, customers, and other stakeholders need to have a clear idea of what AEP is doing to control emissions efficiently, and why it has adopted its chosen approach. While the company has been open in its actions to date, we believe that efforts to make its actions transparent and understandable to stakeholders will be critical going forward.

For example, the decision-making tools and associated decision-making processes must be credible to, and accepted by, a variety of stakeholders — especially those who regulate the company's rates. Certain tools, like MECO, are proprietary and highly technical, making it difficult for stakeholders to judge their merits. We believe the company should consult with these stakeholders to identify the steps it should take to build the necessary understanding and acceptance of these tools, including appropriate protections of the company's investment and the commercial advantage inherent in the development of sophisticated proprietary models like MECO.[8]

Partnerships: We are convinced that AEP is venturing into new territory as it works out options to control

[8] *The development of the MECO model and its use by the company to evaluate long-term capital investments for planning purposes represents a significant improvement over other commercially available models. Therefore, public disclosure of the model's inputs, codes and other technical details would unfairly deprive the company of a significant competitive advantage and is not necessary in order to gauge the value of its use as one element in the company's overall decision-making process.*

greenhouse gas and other emissions. We strongly urge the company not to go it alone in this venture, but to find partners along the way. One reason is that many of the skills necessary to succeed are not native to utility operations. We have noted the need for chemical engineering skills in operating equipment to control regulated emissions. The same need for new skills is present in the IGCC initiative described above. Finding ways to partner with those who already have these skills seems to us more effective than developing them in house.

Another need for partnership lies in the crafting of emission control programs. In this case, everyone necessary to make the program work needs to be involved. As an example, state regulators must be convinced that off-system investments in greenhouse gas emissions abatement in other countries, assuming they are verifiable, make economic sense to their ratepayers. Such cooperation will be necessary to ensure that economically-efficient measures maximize value for shareholders and minimize costs to ratepayers.

In summary:

We conclude that the actions that AEP has taken over the last decade constitute a solid foundation for the company's future efforts to address the intersection between environmental policy and business opportunities. The challenge now is to build on this foundation in a way that makes economic sense in a setting of policy uncertainty and change. Forceful and serious advocacy of highly efficient control programs, proactive leadership in technology development and operation, discipline in capital allocation decisions, openness to partnerships in technology and policy, and continued transparency of action are, we believe, the essential elements of the path ahead.