

Greenhouse Gas Emission Credits and Other Competitive Strategies for Electric Utilities

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Editor's Note: This article contains information from presentations and keynote addresses delivered at the Electric Utilities Environmental Conference held in Tucson, AZ, January 11–13, 1999. Portions



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were excerpted from press coverage of the conference as reported by Alec Zacaroli in the January 15, 1999, issue of the Environment Reporter, published by the Bureau of National Affairs, Inc., Washington, DC. The conference, organized and chaired by Dr. Prabhu Dayal, was attended by nearly 600 environmental professionals.

INTRODUCTION

The Electric Utilities Environmental Conference, in its third incarnation, has gained national recognition and credibility among environmental professionals and experts from the industrial, government, consulting, academia, and regulatory sectors. The previous two conferences, sponsored by the Air & Waste Management Association, called Acid Rain & Electric Utilities, were held in January 1995 and 1997 in Scottsdale, AZ. This year's conference was cosponsored by the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), Electric Power Research Institute, Edison Electric Institute, Electric Power Supply Association, National Association of Environmental Professionals, Troutman Sanders, WEST Associates,

and Tucson Electric Power Company.

More than 160 technical presentations were made during the three-day program. Technical papers were presented on emerging new regulations, impacts, solutions, practical examples, and case histories. The topics covered fell into one of three areas: (1) impact of emerging new requirements on the electric utility industry for the control of greenhouse gas (GHG) that affect global climate change, (2) new regulations for air pollution control and continuous emission monitor requirements, and (3) electric utility divestiture implications and impacts from new regulations (new source review, visibility, toxic release reporting requirements, and other regional issues). Provided below is a synopsis of the implications of the Kyoto Protocol and the impact of impending GHG reduction requirements on fossil generation-dependent electric utilities.

GHG IMPLICATIONS AND MANAGEMENT STRATEGIES

A number of industry representatives cited the basic problems the industry and the nation will face in making the adjustments needed to cut GHG emissions by 7% from 1990 levels—the U.S. commitment under the Kyoto Protocol. Experts cited the nation's heavy reliance on coal, the potential for over-reliance on natural gas, and the vast uncertainties surrounding renewable fuels as some of the major obstacles on the road to meeting Kyoto targets. Many utility officials

and industry analysts noted the difficulty, costs, and timing constraints for the U.S. electric utility industry to achieve massive emission reductions by the Kyoto Protocol's 2008–2012 first budget period. At a November 1998 meeting in Buenos Aires, Argentina, governments agreed that they would not make final decisions until late 2000 on issues such as international emission trading that will implement the Kyoto Protocol.

Dirk Forrister, chair of the White House Task Force on Global Climate Change, stated in his keynote address the need for U.S. electric utilities and other companies responsible for GHG emissions to spend the next two years preparing for climate change initiatives rather than await the fate of international efforts to combat the problem. Specific details for implementing the Kyoto Protocol, such as agreements on emission limits and guidance for trading and verification, are not expected to be finalized within



In his keynote address, Dirk Forrister, chair of the White House Task Force on Global Climate Change, told attendees that the next two years offer companies a great opportunity to position themselves as active participants in the effort to combat global climate change.

the next two years. Companies that delay preparation could find themselves at a competitive disadvantage in the future, and the coming two years offer companies a great opportunity to position themselves as active participants in efforts to combat climate change. He stressed the importance of early action, pointing out that the climate change issue is real and emission reductions will be eventually implemented. He added that as utility restructuring takes place, companies will find themselves branded by consumers based on the position they take on climate change.

Thomas Jensen of the law firm of Troutman Sanders, L.L.P., explained why utilities that engage in "carbon management" today might be in a better position to take advantage of future domestic and international regulatory regimes related to GHG emission credits and trades. Jensen also described proposed legislation encouraging early reduction of GHG emissions by awarding credit to companies for reductions made prior to 2008. John Varholy, also of Troutman Sanders, explained why companies involved in projects overseas, or who are upgrading or retrofitting facilities at home, should consider and address the issues of how best to allocate both the risks inherent in an immature market for GHG credits and the potential benefits of credit ownership among the project's sponsors from the beginning of their negotiations.

Companies in the Lead

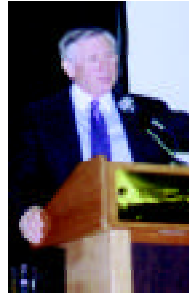
Many companies already have decided to take action, Forrister said. For instance, British Petroleum and Shell Oil Co. pledged to reduce their GHG emissions by 10% in coming years and United Technologies pledged to boost its energy efficiency by 25%. "All of these are global companies," Forrister said, suggesting that some companies view taking early action as a market advantage. The pressure to act, in most instances, is not necessarily coming from the United States.

In his keynote address, Illinova Corp. Chairman Charles E. Bayless detailed the use of various "flexibility mechanisms" to reduce GHG emissions such as (1) providing technology transfer to developing countries using efficiency projects to lower GHG emissions through joint implementation with developed countries; (2) developing land-use changes or forest sinks that remove GHG; and (3) trading GHG emission reductions and purchasing GHG emission reductions from projects approved under the Clean Development Mechanism.

Forrister outlined a list of activities companies can take to better position themselves for making cost-effective GHG reductions, such as (1) diversifying their portfolios for controlling air pollution by looking at renewable energy sources, efficiency measures, and other technologies; (2) exploring joint implementation pilot projects and making strategic alliances with companies in other countries; and (3) examining the internal GHG trading systems that companies such as BP are setting up.

Developing Country Commitments

In a conversation with Alec Zacaroli, reporter for the Bureau of National Affairs, Forrister reiterated the Clinton Administration's position that it will not seek ratification of the Kyoto Protocol without "meaningful" commitments from developing countries that they will accept binding emission reduction targets. Forrister added that the Clinton Administration is working through a series of bilateral diplomatic efforts to gain commitments from developing



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countries. He described the meetings as "quiet conversations" that mostly involve educating developing nations on available technologies.

EPA, DOE, and Other Perspectives

Other Administration officials, meanwhile, outlined the likely control scenarios utilities will face in attempting to achieve GHG reductions.

Paul Stolpman of EPA said controlling GHG emissions will require the United States to "reconsider how we produce energy." While the future of air pollution regulations for utilities and other companies is uncertain, he said, companies can generally expect EPA to place greater emphasis on the use of emission caps, market-based trading programs, and output-based standards. Jennifer Macedonia, also of EPA, detailed the benefits of "flexible mechanisms" and the "clean development mechanism" utilizing international emission trading as a tool for reducing emissions at lowest cost. EPA's Sarah Dunham illustrated the use of the cap-and-trade program designed to achieve NO_x reductions from large stationary sources in the eastern half of the United States, pursuant to the NO_x State Implementation Plan (SIP) call as an appropriate model for a GHG trading program.

Rita Bajura of DOE's Federal Energy Technology Center (FETC) said that energy efficiency measures and alternative fuel sources alone probably will not provide sufficient carbon dioxide (CO₂) reductions to reverse the course of climate change. Carbon sequestration will have to play a role, she said. There are essentially two methods of sequestration: the first is natural sequestration, which involves using natural sinks such as forests to collect carbon; the second involves removing carbon from the combustion gas flue stream. FETC has a number of ongoing projects that examine the latter option. The projects involve both developing technologies for taking CO₂ out of utility emissions and

determining where to store it once it is removed. FETC is conducting research on storing CO₂ both in geologic formations (such as coal seams that can no longer be mined) and in the ocean. The latter possibility is promising because 30% of the nation's utilities are located within 100 miles of the ocean. Furthermore, she added, the amount of carbon gathered from utilities and deposited deep in the sea would only be a "drop in the bucket" compared to the amount of carbon that is naturally present in the ocean.

U.S. electric utilities' use of coal was

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responsible for emitting more than 400 million tons of carbon in 1990, and these emission levels are growing, according to Daniel E. Klein of Twenty-First Strategies, a McLean, VA, consulting firm. He said that major reductions in U.S. GHG emissions would entail significantly curbing emissions from coal combustion to address the climate change issue. Considering the economics of renewable fuels and the questions surrounding nuclear power, fossil energy can remain the longer-term dominant fuel for the U.S. economy if GHG concerns can be addressed. Klein said that carbon sequestration technologies, when developed, will allow fossil fuel resources to be used to their full potential while reducing GHG emissions.

Robert Reinstein of Reinstein and Associates said that even after implementing all "economically feasible"

measures for curbing carbon emissions in the United States, the country could not get below 1990 levels. Many countries subject to the Kyoto Protocol cannot meet their required reductions by solely domestic measures. He concluded that the Kyoto targets are unrealistic and unachievable in this time frame because it appears that the Kyoto Protocol will not be ratified by the U.S. Senate and therefore will not go into effect given the UN rules governing its implementation. This will force the process to develop a new agreement with new deadlines that have to be further in the future than the protocol's 2008–2012 first budget period. Jerry Golden of TVA discussed strategies for compliance with NO_x and CO₂ regulations and offered some new insights into what kind of early reduction credit program might entice the utility industry to take action to reduce GHG emissions.

Coal, however, is responsible for 55% of the nation's electric generation, according to John McManus of Ohio-based American Electric Power Co. Coal, combined with nuclear energy and hydroelectric plants, account for 85% of total U.S. electric generation. With natural gas supplying most of the remaining generation, there is significant diversity in the supply of electricity. "That generation literally took decades to install," he said. Moving away from it will take far longer than the 10 or so years envisioned under the Kyoto Protocol. It is not realistic to expect nuclear or hydro to replace coal, as both are currently in disfavor with the public and regulators.

Looking for Substitutes to Coal

Finding substitutes for coal presents perhaps the most vexing problem for the utility industry. Whereas power companies were able to meet previous air pollution regulations through the use of low-sulfur coal or add-on technologies, cutting carbon emissions calls for an entirely different approach, McManus said. "You're going to see more things

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like shutting down power plants," he said. In addition, there will be a tremendous shift to the use of natural gas, which is seen as the only feasible, large-scale substitute for coal. American Electric Power analyses predict natural gas will surpass coal as the most heavily used fuel in power generation. McManus said the company, which itself currently burns coal at 90% of its facilities, expects natural gas eventually will capture upwards of 75% of the market if Kyoto Protocol-like carbon restrictions have to be met. This, in and of itself, raises concerns about the nation's reliance on a single fuel source for all power generation. Commenting on the nation's current reliance on coal, which accounts for 55% of generation today, McManus said there is far greater pressure on natural gas reserves. Although reserves are expected to meet all demand through at least 2030, the addition of power-supply demands to the existing uses for the fuel are likely to ultimately result in fuel shortages. McManus emphasized the importance of diversity in meeting the U.S. demand for electricity, but noted that keeping coal in the fuel mix will require significant improvements in coal-burning technology.

CO₂ Trading Strategies

Anne Smith and Paul Bernstein of Charles River Associates presented a paper detailing an analysis of the cost-effectiveness of CO₂ trading with different implementation approaches. Binding national commitments to reductions of GHG emissions are an increasingly likely prospect, and the leading form of implementation discussed within the United States is emissions trading. Emissions trading is now a widely accepted method for achieving emissions targets in a cost-effective manner, but complexities associated with the number and variety of sources imply that emissions trading to meet GHG targets will be difficult, if not impossible, to implement in its purest form. As plans for actual implementation of GHG trading are adjusted to

be more administratively or politically feasible, much of the cost-effectiveness attributed to emissions trading is eroded. Ronald Shiflett of the International Utility Efficiency Partnership identified international projects that reduce, sequester, or limit GHG emissions for trading carbon offsets. James Young of

and 2010. This will put such emissions 33% (445 million metric tons) above 1990 levels and more than 43% (539 million metric tons) above the Kyoto Protocol's GHG emissions target. All of the analyses agree that to meet the protocol's target the mix of fuels used in this country will have to change significantly, and that

All of the analyses agree that to meet the protocol's target the mix of fuels used in this country will have to change significantly, and that limitations to international permit trading will significantly increase the amount of change required.

Southern California Edison presented the process employed for a CO₂ emission trade with Ontario Hydro.

Price of Carbon

The Clinton Administration's analysis of the Kyoto Protocol indicates a carbon price of \$25 per ton (1997 carbon permit price) for a 10% reduction in coal consumption compared to a carbon price of \$200 per ton using 75% reduction in coal consumption in the United States. The 10% coal reduction in coal consumption is based on the reliance of international trade to drive the price of carbon down. John McManus estimated a 70% reduction in coal consumption will be required by 2030 to meet the Kyoto Protocol. In his analysis, John Wooten of Peabody Coal estimates the permit price of carbon between \$38 per ton and \$177 per ton under three different scenarios based on the degree of international trade. Smith and Bernstein estimated the cost of carbon reductions at \$277 per ton under a scenario with no international trading, compared to \$32 per ton using global trading.

Carbon Emission Estimates

DOE's Energy Information Administration (EIA) estimates energy-related carbon emissions are expected to increase 22% (328 million metric tons) between now

limitations to international permit trading will significantly increase the amount of change required. Most important will be reduced coal use in the production of electricity. Generation from coal plants currently accounts for more than half of the electricity produced in this country and nearly one-third of energy sector carbon emissions. Companies are expected to turn to natural gas and, to a lesser extent, renewable fuels such as biomass and wind and, if possible, nuclear life extension to reduce their carbon emissions. Consumers must also lower their carbon emissions by reducing their use of carbon-intensive fuels and investing in more efficient equipment. Depending on the level of domestic emissions reduction required (the amount of the required reduction that cannot be met by emissions offsets, carbon sinks, or international trading), the price of fuels could rise significantly. The higher energy costs would also be expected to dampen economic growth, but the economy is still expected to grow. The potentially high costs could be reduced in the long run if new technologies evolve more rapidly than expected, but the need for capital adjustments will limit the degree to which cost reductions would be experienced prior to about 2010 or 2015. Though existing coal plants are a major source of carbon, they are also very economical and

they will remain so unless a significant carbon fee is imposed.

Price of Electricity

The impact on the price of electricity will vary with the share of the U.S. carbon reduction requirement that comes from the domestic energy sector. At one extreme, where the entire reduction comes from the U.S. energy sector, the carbon price in 2010 could be as much as \$348 per ton and electricity prices could be more than 85% higher than otherwise expected. On the other hand, if contributions from international emissions trading, carbon sinks, or offsets from other gases are large, accounting for 78% of the required reduction, the carbon fee could be as low as \$67 per ton and electricity prices would only be 20% higher (only 4% above current prices), according to Mary Hutzler and A. Beamon of DOE.

Carbon Tax

In preliminary modeling analysis, Dallas Burtraw and coauthors from Resources for the Future find that a tax of \$10 per metric ton of carbon imposed over the next decade could yield carbon emission reductions equivalent to more than 539 million metric tons. This amounts to one full year of expected reductions for the whole economy under the most stringent scenario (no international trading and no carbon sinks) in the EIA's recent study of the Kyoto Protocol. Equivalently, were credit granted for early emission reductions the United States could postpone more dramatic measures by one year. With a tax of \$25 per metric ton, preliminary analysis indicates the United States could achieve reductions equivalent to nearly four years obligation for the whole economy under the EIA's stringent scenario.

Impact of Kyoto Protocol and Competition in Utility Divestiture

As utilities prepare for competition in the industry, the choice of many to sell their generation capabilities is creating a "feeding frenzy" among potential buyers,

according to Steven M. Wheeler of Snell and Wilmer. Over the past 18 months, 35,000 MW of generation capacity have exchanged hands for roughly \$16.5 billion. Along with this burst of activity, however, a number of pre-purchase due diligence issues have surfaced. One of the most formidable is the obstacle for accurate valuation of generation assets presented by new EPA regulations. A host of upcoming initiatives, including requirements for cutting nitrogen oxide emissions, sulfur dioxide, and possibly mercury, are driving up the costs power generators are likely to face in the future. Add to this the potential of climate change regulations under the Kyoto Protocol and future tightening of pollution requirements under EPA's New Source Review program, and the costs are formidable. One EPA estimate found that in a worst-case scenario an average coal-fired plant generating 500 MW of capacity could face capital costs of up to \$154 million and annual operating costs of up to \$10 million, as a result of future control requirements for NO_x, SO₂, mercury, and GHG.

Where regulatory uncertainty provides anxiety and headaches for some, however, it may provide opportunities for others, according to Wheeler. Buyers with a level of comfort in their ability to manage costs associated with environmental regulations may be able to take advantage of the fears that are driving many companies to sell off their generation capabilities. The most important step a potential buyer must take, however, is to conduct thorough due diligence reviews of any generation assets it is considering purchasing—reviewing potential environmental regulations, labor agreements, and state regulations, among other things. Wheeler noted that foreign investors are increasingly joining investor-owned utilities, municipal entities, and independent power producers in buying up assets. Further, the ultimate profitability of these transactions remains speculative. An analysis recently conducted

by PriceWaterhouseCoopers estimated that 60% of the agreements reached in 1998 will be "strategic failures," while only 20% are expected to generate returns in excess of costs.

Carbon Sequestration through Forestry by Utilities

Several major electric utilities have taken proactive measures and made substantial investments to reduce GHG emissions in international and domestic carbon sequestration projects. UtiliTree Carbon Company, a consortium of 41 electric utility companies, demonstrates that forest sequestration projects can be a credible and effective way to offset GHG emissions. Jim Smithson of Illinois Power detailed how UtiliTree funded five projects that will sequester more than 2.4 million tons of CO₂. Eric Kuhn of Cinergy Corp. described how Utilitree and four U.S. electric companies invested in a carbon sequestration project in Belize that combines forest conservation and sustainable forest management in a way that benefits the global climate, tropical habitat, biodiversity, and local communities. Other successful carbon sequestration project experiences presented by Don Jones of COPEC, Louis Coakley of Florida Power & Light, Randy Williams of Entergy, and Jeff Atkin of Sustainable Forestry Systems were reduced-impact logging in Malaysia, carbon sequestration through forest restoration in Florida, coastal wetland creation in the Mississippi River Valley, and sustainable forestry management in South America.

John Kinsman of Edison Electric Institute and Anne Smith of Charles River Associates detailed how emission trading and carbon sequestration are among the most important tools providing flexibility and cost savings when managing air and GHG emissions. Successful real-world applications of emissions trading to achieve emissions goals date back more than 15

years, but many challenges exist for highly effective implementation of GHG emissions trading. Flexibility to make use of carbon sinks, which can be used to manage more than one billion tons of carbon annually, is a unique challenge to address in setting up a GHG emissions trading program. Experts have determined that GHG benefits can be accurately quantified for most types of forestry projects. However, uncertainties for forestry projects that were created by the Kyoto Protocol will take several years to resolve, with a special mid-2000 report

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from the Intergovernmental Panel on Climate Change regarding land use change and forestry playing a major role.

CONCLUSION

Based on reviews by the various stakeholders involved in the GHG debate, it appears that there is a narrow window of opportunity for large fossil-dependent electric utilities to lock in cost-effective GHG emissions credits. Many large electric utilities have made substantial investments in international carbon sequestration projects to provide a competitive advantage and hedge against future adverse economic impacts if a cap-and-trade policy were imposed for GHG reductions. In addition to GHG reduction, electric utilities are faced with impending competition, divestiture requirements, and new environmental regulations for SO₂, NO_x, ozone, and mercury. Considering the alternatives available, it appears that costs of carbon sequestration in some international

projects below \$5 per ton may represent effective carbon offset opportunities. However, investments for carbon credits need to include a due diligence evaluation of projects related to certification, monitoring and verification requirements of domestic and international bodies like EPA and CDM.

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FOR MORE INFORMATION

Proceedings of the Electric Utilities Environmental Conference on CD-ROM can be ordered through the conference Web page at <http://www.EUEC.com>. Hardcopy proceedings can be obtained by contacting A&WMA at (412) 232-3444. To receive copies of the final program and abstract booklet listing 160 technical abstracts and 500 names and addresses of conference participants, contact Prabhu Dayal by e-mail at pdayal@tucsonelectric.com.

REFERENCES

The following references are from the *Proceedings of the Electric Utilities Environmental Conference*, Tucson, AZ, January 11–13, 1999.

1. Smith, A.E.; Bernstein, P. "Cost-effectiveness analysis of alternative methods for implementing domestic CO₂ trading."
2. McManus, J.M. "Energy policy implications to address emissions from U.S. fossil-fired electric generating units."
3. Wooten, J.M. "The impact of meeting the Kyoto Protocol on energy markets and the economy."
4. Burtraw, D.; Palmer, K.; Paul, A. "The opportunity for short-run carbon mitigation in the electricity sector."
5. Macedonia, J. "Emission trading and the flexible mechanisms under the Kyoto Protocol."
6. Dunham, S.; LaCount, R. "NO_x trading program as a model for international greenhouse gas trading."
7. Golden, J. "Multi-pollutant control strategies: When does early CO₂ mitigation make sense?"
8. Reinstein, R.A. "Kyoto Protocol: Emissions outlook & flexibility mechanisms."
9. Hutzler, M.; Beamon, A. "Impacts of the Kyoto Protocol on U.S. energy markets and economic activity."
10. Wheeler, S. "Divestiture/acquisition of generating assets."
11. Klein, D.E.; Kane, R.L. "Fossil energy-related GHG control strategies and associated environmental benefits."
12. Shiflett, R.C. "International efficiency projects for trading carbon offsets."
13. Young, J.R.; Chupa, D.; Gollay, H.; Salter, G. "SCE/Ontario Hydro pilot CO₂ emissions trade: Lessons learned."
14. Jensen T.C. "Domestic legislative and policy developments in GHG management."
15. Varholly, J. "Structuring a GHG emissions credit transaction."
16. Kinsman, J.; Smith, A. "Flexibility mechanisms for dealing with air and climate change—Emissions trading and carbon sequestration."
17. Smithson, J.; Kaster, G. "UtiliTree Carbon Company—Overall accomplishments and C sequestered."
18. Kuhn, E. "Rio Bravo Carbon Sequestration Program, Belize."
19. Coakley, L. "FPL Mechanical & Vegetative Carbon Sequestration Project."
20. Williams, J.R. "Addressing global warming and biodiversity through forest restoration and coastal wetland creation."
21. Jones, D.J.; Salleh, M.N.; Dayal, P. "Reduced impact logging techniques for carbon sequestration in Malaysia."
22. Atkin, J.; Dayal, P. "Carbon sequestration using sustainable forestry management in South America."

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