Exhibit BEB-2

Taking Climate Change into Account in Utility Planning: Zero is the Wrong Carbon Value

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Executive Summary

The earth's climate is determined by concentrations of greenhouse gases in the atmosphere. International scientific consensus, expressed in Third Assessment Report of the Intergovernmental Panel on Climate Change, is that climate will change due to anthropogenic emissions of greenhouse gases. Projected changes include temperature increases, changes in precipitation patterns, increased climate variability, melting of glaciers, ice shelves and permafrost, and rising sea levels. These changes have already been observed and documented in a growing body of scientific evidence. All countries will experience social and economic consequences, with disproportionate negative impacts on countries least able to adapt.

The prospect of Global Warming and changing climate has spurred international efforts to work towards a sustainable level of greenhouse gas emissions. These international efforts are embodied in the United Nations Framework Convention on Climate Change. The Kyoto Protocol, a supplement to the UNFCCC, establishes legally binding limits on the greenhouse gas emissions of industrialized nations and economies in transition.

Despite being the single largest contributor to global emissions of greenhouse gases, the United States remains one of a very few industrialized nations that have not signed the Kyoto Protocol. Nevertheless, individual states, regional groups of states, shareholders and corporations are making serious efforts and taking significant steps towards reducing greenhouse gas emissions in the United States. Efforts to pass federal legislation addressing carbon, though not yet successful, have gained ground in recent years. These developments, combined with the growing scientific understanding of, and evidence of, climate change, mean that establishing federal policy requiring greenhouse gas emission reductions is just a matter of time.

In this scientific and policy context, it is imprudent for decision-makers in the electric sector to ignore the cost of future carbon reductions or to treat future carbon reduction merely as a sensitivity case. Treating carbon emissions as zero cost emissions could result in investments that prove quite costly in the future.

Regulatory uncertainty associated with climate change clearly presents a planning conundrum; however, it is not a reason for proceeding as if no costs will be associated with carbon emissions in the future. The challenge is to forecast a reasonable range of expected costs based on analysis of the information available. This report identifies many sources of information that can form the basis of reasonable assumptions about the likely costs of meeting future carbon reduction requirements. Available sources include market transactions, values used in utility planning, and modeling analyses.

Carbon markets associated with implementation of the Kyoto Protocol as well as voluntary emissions reductions have emerged. In the carbon markets, carbon traded in January 2005 at a range of $30-63/metric ton carbon ($8-17 per ton CO_2).

Some utilities in the United States are already incorporating carbon values into their resource planning. The values range from $4-44/metric ton carbon ($1-12 per ton CO_2). In December 2004, the California Public Utilities Commission directed utilities to include carbon at a value between $30-93/metric ton carbon ($8-25 per ton CO_2) in their long term resource planning.

There are numerous studies that estimate the possible costs of carbon allowances under various policy scenarios, many of which are identified in this report. Projections of carbon costs for the year 2010 range from $4/metric ton carbon to $401/metric ton carbon ($1 and $99/ton CO_2) under different policy scenarios. Projections for carbon costs between 2020-2025 range from $27/metric ton carbon to $486/metric ton carbon ($7 and $120/ ton CO_2). Modeling results are sensitive to several factors including (1) the emissions reduction target; (2) projections of future emissions in the absence of a greenhouse gas reduction target; (3) geographic scope of trading; and (4) flexibility mechanisms such as offsets and allowance banking.

The sensitivity of the carbon price levels to the emissions reduction target can be seen by grouping the results for 2010 into two groups based upon the level of the target. For studies that analyze the costs associated with returning to the emissions levels of the year 2000 by the year 2010 or thereabouts, costs in 2010 are projected to be between $4/metric ton carbon and $179/metric ton carbon ($1/ton CO_2 and $44/ton CO_2). Studies that analyze the costs associated with a somewhat more aggressive goal of reducing emissions to near 1990 levels reveal costs in 2010 between $4/metric ton carbon and $401/metric ton carbon ($1/ton CO_2 and $99/ton CO_2).

These sources of information permit a broad assessment of potential carbon allowance prices. Indeed, incorporating reasoned assessment of future costs associated with greenhouse gas emissions is likely to be an increasingly important component of corporate success.

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1. Introduction

A 2002 report from the investment community identifies climate change as representing a potential multi-billion dollar risk to a variety of U.S. businesses and industries.[1] Addressing climate change presents particular risk and opportunity to the electric sector. Because the electric sector (and associated emissions) continue to grow, and because controlling emission from large point sources (such as power plants) is easier than small disparate sources (like automobiles), the electric sector is likely to be a prime component of future greenhouse gas regulatory scenarios. The report states that "climate change clearly represents a major strategic issue for the electric utilities industry and is of relevance to the long-term evolution of the industry and possibly the survival of individual companies. Risks to electric companies include the following:

- Cost of reducing greenhouse gas emissions and substantial investment in new, cleaner power production technologies and methodologies;
- Higher maintenance and repair costs and reliability concerns due to more frequent weather extremes and climatic disturbance; and
- Growing pressure from customers and shareholders to address emissions contributing to climate change.[2]

A subsequent report, "Electric Power, Investors, and Climate Change: A Call to Action," presents the findings of a diverse group of experts from the power sector, environmental and consumer groups, and the investment community. Participants in this dialogue found that greenhouse gas emissions, including carbon dioxide emissions, will be regulated in the U.S.; the only remaining issue is when and how. Participants also agreed that regulation of greenhouse gases poses financial risks and opportunities for the electric sector.[3] Managing the uncertain policy environment on climate change is identified as "one of a number of significant environmental challenges facing electric company executives and investors in the next few years as well as the decades to come."[4] One of the report's four recommendations is that investors and electric companies come together to quantify and assess the financial risks and opportunities of climate change.

Climate policy is likely to have important consequences for power generation costs, fuel choices, wholesale power prices and the profitability of utilities. Even under conservative scenarios additional costs could exceed 10% of 2002 earnings, though there are also significant opportunities. While utilities have many options to deal with the impact of increasing prices on CO_2 emissions, doing nothing is the worst option. By making astute

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[1] Innovest Strategic Value Advisors; "Value at Risk: Climate Change and the Future of Governance;" The Coalition for Environmentally Responsible Economies; April 2002.

[2] Ibid., pages 45-48.

[3] CERES; "Electric Power, Investors, and Climate Change: A Call to Action;" September 2003.

[4] Ibid., p. 6

changes to the fuel mix and investments to refurbish existing assets, profits may also increase.[5]

Increased air emissions from fossil-fired power plants will not only increase environmental damages, they will also increase the costs of complying with future environmental regulations, costs that are likely to be passed on to all customers. Power plants built today can generate electricity for as long as 60 years or more into the future.[6] Many trends in this country show increasing pressure for a federal policy requiring greenhouse gas emissions reductions. Given the strong likelihood of future carbon regulation in the United States, and the contributions of the power sector to our nation's greenhouse gas emissions, and the long lives of power plants, utilities should be including carbon cost in all resource planning.

The purpose of this report is to identify a reasonable basis for evaluating the likely cost of future mandated carbon reductions. Section 2 and 3 discuss the role of greenhouse gases in climate. Section 4 presents information on U.S. carbon emissions. Section 5 describes international efforts to address the threat of climate change. Section 6 summarizes various initiatives at the state, regional, and corporate level to address climate change. Finally, section 7 presents information that can form the basis for forecasts of carbon allowance prices for use in utility planning.

2. The earth's climate is determined by concentrations of greenhouse gases in the atmosphere.

The earth's atmosphere serves as a kind of greenhouse. Radiation from the sun passes through the atmosphere, is absorbed by the earth, and is converted to heat. The heat causes the emission of long wave radiation back to the atmosphere. Concentrations of certain gases in the atmosphere determine how much of the long wave radiation escapes through the atmosphere. These gases are known as "greenhouse gases"; they include carbon dioxide, methane, nitrous oxide and others. Such gases have always been part of the atmosphere; however, since the industrial revolution in the 1700's concentrations of greenhouse gases in the atmosphere have risen, gradually at first and steeply since about 1850. These rising levels are due to human activities such as burning fossil fuels, deforestation, and others. Greater concentrations of greenhouse gases reduce the amount of heat that passes through the atmosphere, leading to warming of the earth (Global Warming). This warming can also cause associated changes in the earth's climate (Climate Change).

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[5] Innovest Strategic Value Advisors; "Power Switch: Impacts of Climate Change on the Global Power Sector;" WWF International; November 2003

[6] Biewald et. al.; "A Responsible Electricity Future: An Efficient, Cleaner and Balanced Scenario for the U.S. Electricity System;" prepared for the National Association of State PIRGs; June 11, 2004.

3. The earth's climate is changing due to human activities

International scientific consensus is that the world is warming, the climate system is changing in other ways, and that most of the warming observed over the past 50 years is due to human activities (primarily fossil fuel combustion).[7] For more than twenty years scientists from around the world have studied the potential effects on climate of the change in atmospheric greenhouse gas concentrations. These efforts are described in the next section of this report. In the past 15 years scientific consensus has emerged that increasing concentrations of greenhouse gases in the atmosphere will lead to a general warming of the earth's climate, that this general warming pattern can distort natural patterns of climate, and – most recently – that there is ample evidence that global warming is occurring.

While there are sporadic reports and articles disputing climate change, denying human contributions to climate change, or stating that global warming and climate will bring benefits, these viewpoints are outside the scientific mainstream. "Among those with the training and knowledge to penetrate the relevant scientific literatures, the debate about whether global climate is now being changed by human-produced greenhouse-gases is essentially over. Few of the climate-change "skeptics" who appear in the op-ed pages of *The Washington Times* and *The Wall Street Journal* have any scientific credibility at all."[8]

The scientific consensus is expressed in a report issued in 2001 by the Intergovernmental Panel on Climate Change (IPCC). The World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) established the IPCC in 1988. The purpose of the IPCC is to serve as an objective source of the most widely accepted scientific, technical and socio-economic information available about climate change, its environmental and socio-economic impacts including costs and benefits of action versus inaction, and possible response options. These international organizations determined that, because the stakes are so high and the system complex, policymakers cannot rely on popular interpretations of the evidence or on the views of an individual expert. The Panel does not conduct new research or monitor climate-related data. Its mandate is to assess, on a comprehensive, objective, open and transparent basis, the scientific, technical and socio-economic information on climate change that is available around the world in peer-reviewed literature, journals, books and, where appropriately documented, in industry

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[7] Y. Ding, J.T. Houghton, et al. editors, Climate Change 2001: The Scientific Basis (Contribution of Working Group I to the Third Assessment Report of the IPCC). Intergovernmental Panel on Climate Change. 2001. Available at: http://www.grida.no/climate/ipcc_tar/wg1/index.htm

[8] Professor John P. Holdren, "Risks from Global Climate Change. What do we know? What should we do?" Presentation to the Institutional Investors Conference on Climate Risk, November 21, 2003.

literature and traditional practices. Hundreds of scientists from around the world participate in preparing the IPCC's periodic reports.[9]

The first IPCC report, issued in 1990, confirmed that climate change is a threat and served as the basis for negotiating the overall framework for intergovernmental efforts to address climate change-the United Nations Framework Convention on Climate Change (UNFCCC).[10] The Second Assessment Report, Climate Change 1995, provided key input to the negotiations that led to the adoption of the Kyoto Protocol to the UNFCCC in 1997. The Third Assessment Report, described below, was issued in 2001. The Fourth Assessment Report is anticipated in 2007.

In 2001 the IPCC issued its Third Assessment Report (TAR). The Report reaches a number of important conclusions regarding forecasted and observed climate change. The TAR states that:

The earth's climate will change:

- Climate will change more rapidly than previously expected.
- Global mean surface temperatures are projected to increase by 1.4–5.8 degrees C by 2100 (the fastest rate of change since end of the last ice age).
- Global mean sea levels are expected to rise by 9–88 cm by 2100.
- Rainfall patterns will change.
- Variability of the climate will increase—resulting in greater threat of extreme weather events.
- Extreme events that are likely to increase include maximum temperatures, precipitation events, drying and drought, cyclone intensity, and precipitation intensities.
- Possibility of threshold events and irreversible events (changing Gulf Stream, collapse of large ice sheets, and others)exists
- Stopping growth in greenhouse gas emission concentrations is expected to lead to different equilibrium temperatures, depending on the stabilization level. For example, stabilization of atmospheric greenhouse gas concentrations at 450ppm is likely to lead to equilibrium temperature increases from 1990 levels of between 1.5 ^{o}C and 3.9 ^{o}C. Stabilization at 1000ppm is would lead to equilibrium temperature increases from 1990 levels of 3.5 ^{o}C and 8.7 ^{o}C. Stabilization at these levels requires a reduction from 1990 emission levels within a few decades or two centuries, respectively. The greater the global temperature rise, the greater will be the impacts on climate as a whole, not just temperatures.

Climate change is already evident

- Global average surface temperature has increased 0.6^{o}C (±0.2°C) in the last century.

[9] Intergovernmental Panel on Climate Change, "Introduction to the Intergovernmental Panel on Climate Change." 2003 edition. Available at www.ipcc.ch/about/beng.pdf. See also, "16 Years of Scientific Assessment in Support of the Climate Convention." IPCC. December 2004. Available at http://www.ipcc.ch/about/anniversarybrochure.pdf

[10] The United States ratified the UNFCC in 1992.

- The 1990s was the warmest decade and 1998 the warmest year in the instrumental record, which began in 1861.
- Snow cover and ice extent, both polar and in glaciers, have decreased.
- Global average sea level has risen.
- Most of the warming observed over the last 50 years is attributable to human activities.
- Other aspects of climate that have changed in certain areas of the globe include increased precipitation, increased frequency of heavy precipitation events, increase in cloud cover, and increases in the frequency and intensity of droughts in parts of Asia and Africa.
- Observed changes in regional climate have affected many physical and biological systems, and there are preliminary indications that social and economic systems have been affected.

Climate change will lead to greater cost and suffering than benefits. Poorer people and countries are the most vulnerable.

- Humans will be directly affected by climate. Increasing rain, temperature, storms, and climate variability will all affect individual lives as well as socio-economic systems.
- Humans will be indirectly affected by climate change through changes in ranges of disease, water-borne pathogens, water quality, and air quality.
- Humans will be affected by changes in food availability and quality, crop yields, water shortages and disruption of ecosystems.

Since the release of the IPCC's Third Assessment Report in 2001, additional scientific evidence has provided further evidence of global warming. Last year, 2004, was the fourth warmest year in the temperature record since 1861 just behind 2003. 1998 is the warmest year. With the exception of 1996, the years from 1995-2004 were among the warmest 10 years on record.[11] NASA has determined that 2004 was the fourth-warmest year since temperature measurement began in the 19th century, marked by particularly warm weather in Alaska, the Caspian Sea region and the Antarctic Peninsula. According to NASA, last year's temperatures continued a 30-year rise that is caused primarily by increasing greenhouse gases in the atmosphere.[12] Other reports indicate that:

- The percentage of Earth's land area stricken by serious drought more than doubled from the 1970s to the early 2000s.[13]
- The arctic is warming almost twice as fast as the rest of the world.[14]

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[11] World Meteorological Organization, "Global Temperature in 2004 Fourth Warmest," December 15, 2004. Press release on occasion of WMO annual Statement on the Status of the Global Climate in 2004.

[12] NASA Global Temperature Trends: 2004 Summation. Released February 8, 2005. Available at: http://www.nasa.gov/vision/earth/lookingatearth/earth_warm.html

[13] National Center for Atmospheric Research – National Science Foundation, "Climate change major factor in drought's growing reach" January 10, 2005 press release.

[14] Arctic Council – "Impacts of a Warming Arctic – Arctic Climate Impact Assessment" November 2004.

- Storm & flood damages are soaring.[15] While some of this is known to be due to increasing construction in flood plains and beach fronts, insurers more and more frequently identify climate change as a major risk factor in property damage.

Other observed changes include: evaporation and rainfall are increasing; more of the rainfall is occurring in downpours; permafrost is melting; corals are bleaching; glaciers are retreating; sea ice is shrinking; sea level is rising; and wildfires are increasing[16]

Taken together, the TAR, and subsequent scientific analyses indicate a clear pattern of global warming and on-going climate change. According to results of climate modeling, these changes are only the beginning of things to come. The TAR emphasizes that decision making must "deal with uncertainties including the risk of non-linear and/or irreversible changes, entails balancing the risks of either insufficient or excessive action, and involves careful consideration of the consequences (both environmental and economic), their likelihood, and society's attitude towards risk."[17]

4. U.S. carbon emissions.

The United States contributes more, by far, to global greenhouse gas emissions than any other nation on both a total and a per capita basis. The United States contributes 23% of the world CO_2 emissions from fossil fuel consumption, but has only 4.6% of the population.

Table 2: U.S. Population and CO_2 emissions for 2002

	World	United States
CO_2 Emissions (million metric tons)	24,533	5,749
U.S. percentage of world emissions	23.4%	
Population	6,417,784,929	287,941,220
U.S. percentage of world population	4.5%	
Per capita CO_2 emissions	3.93	19.97

Sources: EIA International Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels 1980-2002, 2004;[18] *US Census Bureau population estimate for 2002.*

[15] See, e.g. Munich Re, *Topics Geo*, "Annual Review of Natural Catastrophes 2003," stated that economic losses due to natural hazards in 2003 rose to over $65 billion (up from $55 billion in 2002).

[16] The Natural Resources Defense Council has a useful compilation of scientific studies organized by date at www.nrdc.org/globalWarming/

[17] IPCC; "Climate Change 2001: Synthesis Report – Summary for Policy Makers;" 2001. Page 3.

[18] EIA Table H.1co2 World Carbon Dioxide Emissions from the Consumption and Flaring of Fossil Fuels, 1980-2002 (posted June 9, 2004).

In 2002 the U.S. electric sector emitted 2,256.4 million metric tons CO_2.[19] These emissions represent 39% of U.S. total CO_2 emissions. Coal-fired power plants were responsible for 83% of US electric sector emissions.

Recent analysis has shown that in 2002, power plant CO_2 emissions were 25 percent higher than they were in 1990.[20] Furthermore, while the carbon intensity of the U.S. economy fell by 12 percent between 1991 and 2002, the carbon intensity of the electric power sector held steady. Carbon efficiency gains from the construction of efficient and relatively clean new natural gas plants has been offset by increasing reliance on existing coal plants. Since federal acid rain legislation was enacted in 1990, the average rate at which existing coal plants are operated increased from 61 percent to 72 percent. Power plant air emissions are concentrated in states along the Ohio River Valley and in the South. Five states -- Indiana, Ohio, Pennsylvania, Texas, and West Virginia -- are the source of 30 percent of the electric power industry's NOx and CO_2 emissions, and nearly 40 percent of its SO2 and mercury emissions.

5. Governments worldwide have agreed to respond to climate change by reducing greenhouse gas emissions

The prospect of global warming and associated climate change has triggered one of the most comprehensive international treaties on environmental issues.[21] The First World Climate Conference was held in 1979. In 1988, the World Meteorological Society and the United Nations Environment Programme created the Intergovernmental Panel on Climate Change to evaluate scientific information on climate change. Subsequently, in 1992 countries around the world, including the United States, adopted the United Nations Framework Convention on Climate Change.

The United Nations Framework Convention on Climate Change has almost worldwide membership (including the U.S.); and, as such, is one of the most widely supported of all international environmental agreements. Parties to this Convention agree that "The Parties should protect the climate system for the benefit of present and future generations of humankind, on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities."[22] The Convention establishes an objective and principles, and includes commitments for different groups of countries

[19] EIA; "Emissions of Greenhouse Gases in the United States 2003;" Energy Information Administration; December 2004. Table 11.

[20] Goodman, Sandra; "Benchmarking Air Emissions of the 100 Largest Electric Generation Owners in the U.S. - 2002;" CERES, Natural Resources Defense Council (NRDC), and Public Service Enterprise Group Incorporated (PSEG); April 2004.

[21] For comprehensive information on the UNFCC and the Kyoto Protocol, see UNFCC, "Caring for Climate: a guide to the climate change convention and the Kyoto Protocol," issued by the Climate Change Secretariat (UNFCC) Bonn, Germany. 2003. This and other publications are available at the UNFCCC's website: http://unfccc.int/.

[22] From Article 3 of the United Nations Framework Convention on Climate Change.

according to their circumstances and needs.[23] Industrialized nations and Economies in Transition, known as Annex I countries in the UNFCCC, agree to adopt climate change policies to reduce their greenhouse gas emissions. Industrialized countries that were members of the OECD (Organization for Economic Cooperation and Development) in 1992, or Annex II countries, have the further obligation to assist developing countries with emissions mitigation and climate change adaptation.

After over two years of negotiations through the Conference of Parties (COP), Parties to the UNFCCC adopted the Kyoto Protocol on December 11, 1997. The Kyoto Protocol supplements and strengthens the Convention; the Convention continues as the main focus for intergovernmental action to combat climate change. The Protocol establishes legally-binding targets to limit or reduce greenhouse gas emissions.[24] The Protocol also includes various mechanisms to cut emissions reduction costs. Specific rules have been developed on emissions sinks, joint implementation projects, and clean development mechanisms. The Protocol envisions a long-term process of five-year commitment periods. Negotiations on targets for the second commitment period (2013-2017) are due to start in 2005.

The Kyoto targets are shown below, in Table 1. Only Parties to the Convention that have also become Parties to the Protocol (i.e. by ratifying, accepting, approving, or acceding to it), are bound by the Protocol's commitments, upon its entry into force in February 2005.[25] The individual targets for Annex I Parties add up to a total cut in greenhouse-gas emissions of at least 5% from 1990 levels in the commitment period 2008-2012.

Only a few industrialized countries have signed the Kyoto Protocol; these countries include the United States, Australia, and Monaco. Of these, the United States is by far the largest emitter with 36.1% of Annex I emissions in 1990; Australia and Monaco were responsible for 2.1% and less than 0.1% of Annex I emissions, respectively. The United States did not sign the Kyoto protocol, stating concerns over impacts on the U.S. economy and absence of binding emissions targets for countries such as India and China. Many developing countries, including India, China and Brazil have signed the Protocol, but do not yet have emission reduction targets. Still others have already demonstrated success in addressing climate change.

[23] For example, one of obligations of the U.S. and other industrialized nations is to submit National Report describing actions it is taking to implement the Convention

[24] Greenhouse gases covered by the Protocol are CO_2, CH_4, N_2O, HFCs, PFCs and SF_6.

[25] Entry into force requires 55 Parties to the Convention to ratify the Protocol, including Annex I Parties accounting for 55% of that group's carbon dioxide emissions in 1990. This threshold was reached when Russia ratified the Protocol in November 2004. The Protocol entered into force February 16, 2005.

Table 1: Emission reduction targets under the Kyoto Protocol[26]

Country	**Target**: reductions from 1990** levels by 2008/2012
EU-15*, Bulgaria, Czech Republic, Estonia, Latvia, Liechtenstein, Lithuania, Monaco, Romania, Slovakia, Slovenia, Switzerland	-8%
US***	-7%
Canada, Hungary, Japan, Poland	-6%
Croatia	-5%
New Zealand, Russian Federation, Ukraine	0
Norway	+1%
Australia***	+8%
Iceland	+10%

** The EU's 15 member States will redistribute their targets among themselves, as allowed under the Protocol. The EU has already reached agreement on how its targets will be redistributed.*
*** Some EITs have a baseline other than 1990.*
**** The US and Australia have indicated their intention not to ratify the Kyoto Protocol.*

6. State governmental agencies, shareholders, and corporations are working to reduce greenhouse gas emissions from the U.S.

The Federal Government in the United States has failed to act with regard to climate change, despite this country's disproportionate contribution to greenhouse gas emissions. There have been some initiatives at the federal level to adopt carbon reduction goals; however they have not yet had sufficient support within the Administration and Congress. Landmark legislation that would regulate carbon was introduced by Senators McCain and Lieberman in 2003 -- the Climate Stewardship Act (S.139). This legislation received 43 votes in the Senate in 2003. A companion bill was introduced in the House by Congressmen Olver and Gilchrest. The bill was reintroduced in the 109th Congress on February 10, 2005. As currently proposed, the Act would create a national cap and trade program to reduce CO_2 to year 2000 emission levels over the period 2010 to 2015. Legislation proposed by the Bush Administration, that would set a national cap on emissions of sulfur dioxide, nitrogen oxides, and mercury (titled "Clear Skies"), has met with stiff resistance due to its failure to address carbon dioxide.

As of February 16, 2005, when the Kyoto Protocol went into effect, U.S.-based companies that have subsidiaries in the EU are "subject to CO_2 emissions caps, but cannot take advantage of low-cost emission reductions at their facilities in the United States or elsewhere."[27] American companies that are consequently disadvantaged in the EU may start to put pressure on the Administration for a national greenhouse gas policy.

[26] Background information at: ttp://unfccc.int/essential_background/kyoto_protocol/items/3145.php

[27] Fontaine, Peter, "Greenhouse –Gas Emissions: A New World Order," Public Utilities Fortnightly, February 2005.

Some individual states and regions, however, are leaders on this policy issue and are adopting greenhouse gas mitigation policies. Many corporations are also taking initiative in the form of shareholder resolutions and corporate policies, in anticipation of mandates to reduce emissions of greenhouse gases. These efforts are described below.

6.1 State and regional policies

In the absence of Federal initiative on climate change, individual states in this country have been the leaders on climate change policies:

- In July 2002, **California** Governor Gray Davis signed a first-of-a-kind law (AB 1493) to limit the emissions of CO_2 from new cars and trucks sold in the state. The law requires the California Air Resources Board to write regulations to achieve the maximum feasible reduction in CO_2 emissions from cars and trucks, beginning with the 2009 model year. Since that time, New York, New Jersey, Rhode Island, Connecticut, Massachusetts, Maine, and Vermont have each agreed to adopt this standard.
- In 2001 **Massachusetts** was the first state to establish a cap on CO_2 emissions from fossil fueled power plants. The Massachusetts Department of Environmental Protection issued "Emissions Standards for Power Plants" (310 CMR 7.29) in April 2001. This multi-pollutant legislation requires emission reductions including CO_2 reductions from the six highest emitting power plants in the state. The CO_2 standard of 1,800 lbs/MWh by 2006 represents a 10 percent reduction from the historic baseline (1997-1999). Facilities are allowed to meet their reduction requirements through offsite CO_2 reductions, subject to DEP approval. The compliance deadline is extended to October 2008 for any facility that undergoes repowering. In addition to this legislation, the state's Energy Facilities Siting Board requires *new* power plants with a capacity greater than 100 MW to offset 1% of the facility's CO_2 emissions for the next 20 years, as long as the cost of offsets does not exceed $1.50 per ton.
- In 1997 **Oregon** established the first formal standard for CO_2 emissions from new electricity generating facilities in North America.[28] The standard holds any proposed new or expanded power plant to a CO_2 emissions rate of 0.675 pounds per kWh, which is 17 percent less than the most efficient natural gas-fired plant currently operating in the U.S. At the same time, the state also created a non-profit corporation known as the Climate Trust to implement CO_2 offset projects with funds provided by the electric generating industry. A generator can choose to either meet the emissions standard or donate funds to the Climate Trust. The donation level was originally set at $0.57 per ton of CO_2, but is subject to change based on the actual cost of CO_2 offsets.
- The **New Hampshire** "Clean Power Act" (HB 284), approved in May 2002, requires CO_2 reductions from the three existing fossil-fuel power plants in the

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[28] Anne Egelston, "Oregon, Massachusetts Lead the Way in GHG Reductions," *Environmental Finance*, July-August 2001.

state. The law requires the plants to stabilize their CO_2 emissions at 1990 levels (which is approximately three percent below their 1999 levels) by the end of 2006. This CO_2 emission reduction is consistent with the Climate Change Action Plan adopted by the New England Governors and Eastern Canadian Premiers (see below). Plants have the option to reduce their emissions on site or to purchase emissions credits from outside of the state.

- In **New Jersey**, the Department of Environmental Protection released the New Jersey Sustainability Greenhouse Gas Action Plan in April 2000. The Plan provides a framework for reducing greenhouse gas emissions to 3.5 percent below their 1990 levels by 2005. Under the Plan, Public Service Enterprise Group, the state's largest utility, pledged to reduce total emissions from all of its fossil fuel-based plants by 15% below 1990 levels by 2005. This would require its fossil fuel-fired units to limit their CO_2 emissions to 1450 lbs/MWh in 2005, compared to 1706 lb/MWh in 1990. If PSEG fails to achieve the goal, it must pay the DEP $1 per pound/MWh it falls short of its goal, up to $1.5 million. The fund will be used to support CO_2 reduction projects within New Jersey.
- The state of **Washington** recently passed a law requiring that new power plants either mitigate or pay for a portion of their carbon emissions. Representative Jeff Morris, the bill's primary sponsor, said "Washington State is not going to solve global warming, but we are doing our part."[29]
- The **New York** Greenhouse Gas Task Force was created by Governor Pataki in June 2001. The purpose of the Task Force is to develop recommendations for ways to significantly reduce the state's emissions of greenhouse gases, and New York is currently considering whether to adopt the recommendations of the Greenhouse Gas Task Force. The 2002 State Energy Plan also recommends that the state commit to a goal of reducing greenhouse gas emissions by 5 percent below 1990 levels by 2010, and 10 percent below 1990 levels by 2020.[30]
- In addition to the regulations and programs described above, 25 states are working with the U.S. Environmental Protection Agency ("EPA") to develop **climate action plans** that identify cost-effective options for reducing greenhouse gas emissions at the state level. At least 19 states have completed an action plan to date.
- Many states have other policies such as renewable portfolio standards and energy efficiency programs that serve to reduce CO_2 emissions from the electricity sector.

Action by individual states has been seconded by several regional initiatives to reduce greenhouse gas emissions:

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[29] Washington House of Representatives Press Release, *Governor Signs Morris Bill to Clean Up Air Pollution,* March 31, 2004.

[30] New York State Energy Research and Development Authority, *2002 State Energy Plan and Final Environmental Impact Statement*, June 2002.

- **Nine Northeast and Mid-Atlantic states** (DE, ME, MA, NH, NJ, NY, RI, VT) have formed "The Regional Greenhouse Gas Initiative" (RGGI) in a cooperative effort to discuss the design of a regional cap-and-trade program initially covering CO_2 emissions from power plants in the region. Collectively, these states contribute to 9.3% of total US CO_2 emissions and together rank as fifth highest CO_2 emitter in the world. Pennsylvania, Maryland, the District of Columbia, the Eastern Canadian Provinces, and New Brunswick are official "observers" in the RGGI process. A Model Rule is scheduled to be issued in April 2005. In this process, CO_2 emissions from fossil fuel fired electricity generating units will be capped at specific levels.[31]
- In September 2003, the Governors of **California, Washington, and Oregon** established the West Coast Governor's Climate Change Initiative, stating that "global warming will have serious adverse consequences on the economy, health, and environment of the west coast states, and that the states must act individually and regionally to reduce greenhouse gas emissions and to achieve a variety of economic benefits from lower dependence on fossil fuels."[32] Emissions in these three states are comparable to those of the RGGI states. And in fact, RGGI and the West Coast Governors' Initiative have been communicating with regard to potentially linking their cap and trade programs.[33]
- **California**'s Governor Schwarzenegger and **New Mexico**'s Governor Richardson proposed that 18 western states generate 30,000 MW of electricity from renewable source by 2015. This proposal was unanimously adopted in June 2004.[34]
- In July 2004, **California, Connecticut, Iowa, New Jersey, New York, Rhode Island, Vermont, and Wisconsin** filed a suit against five utility companies, which together, emit 10% of the nation's annual CO_2. This suit seeks emissions reductions rather than financial penalties.[35]
- In August 2001, in the first action of its kind in North America, the **New England Governors and Eastern Canadian Premiers** signed an agreement for a comprehensive regional Climate Change Action Plan.[36] The plan centers on three main goals. The short-term goal of the Plan is to reduce regional greenhouse gas emissions to 1990 levels by 2010. The mid-term goal is to reduce regional GHG emissions by at least 10% below 1990 levels by 2020,

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[31] Information on this effort is available at www.rggi.org

[32] See letter from the California Energy Commission and the California Environmental Protection Agency to interested parties, April 16, 2004, at: ttp://www.energy.ca.gov/global_climate_change/westcoastgov/.

[33] Fontaine, Peter, "Greenhouse –Gas Emissions: A New World Order," *Public Utilities Fortnightly*, February 2005.

[34] Jacobson, Sanne, Neil Numark and Paloma Sarria, "Greenhouse – Gas Emissions: A Changing US Climate," *Public Utilities Fortnightly*, February 2005.

[35] Id.

36 New England Governors and Eastern Canadian Premiers, *Climate Change Action Plan: 2001*, August 2001.

and establish an interactive, five-year process, starting in 2005, to adjust the goals if necessary and set future emission reduction goals. The long-term goal of the Plan is to reduce regional greenhouse gas emissions in proportions consistent with reductions necessary worldwide to eliminate any dangerous threat to the climate, which recent science suggests will require reductions of 75-85% below current levels. The Plan also provides for the establishment of a regional standardized inventory and registry of greenhouse gas emissions.

Actions by cities: Many cities are also adopting climate change policies. The Cities for Climate Protection Campaign (CCP), begun in 1993, is a global campaign to reduce the emissions that cause global warming and air pollution. By 1999, the campaign had engaged in this effort more than 350 local governments, who jointly accounted for approximately 7 percent of global greenhouse gas emissions.[37] Over 150 cities in the U.S. have adopted plans and initiatives to reduce emissions of greenhouse gases, setting emissions reduction targets and taking measures within municipal government operations. Climate change is expected to be a major issue at the annual U.S. Conference of Mayors convention in June.[38]

All of these recent activities demonstrate that there has been growing pressure within the U.S., to adopt regulations to reduce the emissions of greenhouse gases, particularly CO_2. This pressure is likely to increase further over time, as climate change issues and measures for addressing them become better understood by the scientific community, by the public, and particularly by elected officials.

6.2 Investor and corporate action

Many investors are demanding that companies take seriously the risks associated with carbon emissions. Shareholders have filed a record number of global warming resolutions for 2005 for oil and gas companies, electric power production, real estate firms, manufacturers, financial institutions and auto makers.[39] The resolutions request financial risk disclosure and plans to reduce greenhouse gas emissions. Four electric utilities-AEP, Cinergy, TXU and Southern-all agreed to shareholder requests in 2004 by promising climate risk reports. Only Southern's report has yet to be completed.

Investors are gradually becoming aware of the financial risks associated with climate change, and there is a growing body of literature regarding the financial risks to electric companies and others associated with climate change. State and city treasurers, labor pension fund officials, and foundation leaders have formed the Investor Network on Climate Risk (INCR). The INCR issued a 10-point "Call for Action" at the Institutional Investor Summit on Climate Risk at the United Nations Headquarters on Nov. 21, 2003.

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[37] Information on the Cities for Climate Protection Campaign, including links to over 150 cities that have adopted greenhouse gas reduction measures, is available at http://www.iclei.org/projserv.htm#ccp

[38] Kathy Mulady, *Seattle Post-Intelligencer*, Feb. 17, 2005.

[39] "US Companies Face Record Number of Global Warming Shareholder Resolutions on Wider Range of Business Sectors," CERES press release, February 17, 2005.

It urges pension and endowment trustees, fund managers, securities analysts, corporate directors and government policymakers to increase their oversight and scrutiny of the investment implications of climate change.[40] This report cites analysis that indicates modest greenhouse gas controls could reduce the market capitalization of many coal-dependent U.S. electric utilities by 5 to 10 percent.[41] Under a more stringent Kyoto regulatory scenario, such companies could face a 10 to 35 percent reduction in market value. The report recommends, as one of the steps that company CEOs should pursue, integrating climate policy in strategic business planning to maximize opportunities and minimize risks.

Institutional investors have formed The Carbon Disclosure Project (CDP), which is a coordinating secretariat for collaboration regarding climate change. Its mission is to inform investors regarding the significant risks and opportunities presented by climate change; and to inform company management regarding the serious concerns of shareholders regarding the impact of these issues on company value. In 2003, the first Carbon Disclosure Project report (CDP1) gathered the support of 35 institutional investors representing some $4.5 trillion in managed assets.

The release of the second report (CDP2), in 2004, reflected even greater participation with signatories from Africa, Asia, Europe and North America. Signatories now represent over $10 trillion in assets, and total emissions from operations reported to CDP across all sectors were roughly 13% of all emissions from fossil fuel combustion worldwide. The CDP2 report indicated the escalation in scope and awareness-on behalf of both signatories and respondents-can be traced to an increased sense of urgency with respect to climate risk and carbon finance in the global business and investment community. The report attributes this to developments over the past 18 months that have highlighted the social and economic costs of climate change and the risks and opportunities being created worldwide by emissions reduction policies.[42]

The California Public Employees' Retirement System (CalPERS) announced that it will use the influence made possible by its $183 billion portfolio to try to convince companies it invests in to release information on how they address climate change. The CalPERS board of trustees voted unanimously for the environmental initiative, which focuses on the auto and utility sectors in addition to promoting investment in firms with good environmental practices.[43]

Individual electric companies have also taken steps to reduce greenhouse gas emissions. While these actions are not investor actions, they do reveal increasing initiative in the electric industry for addressing the threat of climate change. Recently, eight US-based

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[40] Cogan, Douglas G.; "Investor Guide to Climate Risk: Action Plan and Resource for Plan Sponsors, Fund Managers, and Corporations;" Investor Responsibility Research Center; July 2004.

[41] Cogan 2004, citing Frank Dixon and Martin Whittaker, "Valuing Corporate Environmental Performance: Innovest's Evaluation of the Electric Utilities Industry," New York, 1999.

[42] Innovest Strategic Value Advisors; "Climate Change and Shareholder Value In 2004," second report of the Carbon Disclosure Project; Innovest Strategic Value Advisors and the Carbon Disclosure Project; May 2004.

[43] *Greenwire*, February 16, 2005

utility companies have joined forces to create the "Clean Energy Group." This group's mission is to seek "national four-pollutant legislation that would among other things… stabilize carbon emissions at 2001 levels by 2013." [44] In addition, Cinergy has been quite vocal on its support of mandatory national carbon regulation. Cinergy's current target is to produce 5% below 2000 levels by 2010 – 2012. AEP has a similar target. FPL Group and PSEG are both aiming to reduce total emissions by 18% between 2000 and 2008.[45]

6.3 Carbon inventories

With increased attention to climate change issues comes an increasing desire and need to quantify and track greenhouse gas emissions. The California Climate Action Registry (the Registry) was established by the California Legislature as a non-profit voluntary registry for greenhouse gas (GHG) emissions.[46] The purpose of the Registry is to help companies and organizations with operations in the state to establish GHG emissions baselines against which any future GHG emission reduction requirements may be applied.

The Registry encourages voluntary actions to increase energy efficiency and decrease GHG emissions. Participants can record their GHG emissions inventory using any year from 1990 forward as a base year. The State of California promises its best efforts to ensure that participants receive appropriate consideration for early actions in the event of any future state, federal or international GHG regulatory scheme.

The Global GHG Register, launched in January 2004, is a web-based platform that allows companies to disclose their worldwide GHG emission inventories and reduction targets. It gives multinational companies the opportunity to show how much greenhouse gases their operations produce, and what they are doing about it.[47] Its structure is based on the California Climate Action Registry.[48]

Other states in the U.S. have GHG registries including New Hampshire, Wisconsin, and New Jersey, and many states have registries under development.[49]

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[44] Jacobson, Sanne, Neil Numark and Paloma Sarria, "Greenhouse Gas Emissions: A Changing US Climate," *Public Utilities Fortnightly*, February 2005.

[45] Ibid.

[46] The California Climate Action Registry (the Registry) was established by SB1771, with technical changes to the statute in SB527. SB 527 was signed by Governor Gray Davis on October 13, 2001, finalizing the structure for the Registry.

[47] For more information see: http://www.weforum.org/site/homepublic.nsf/Content/Global+Greenhouse+Gas+Register

[48] California Climate Action Registry, "California Registry's Online Tool To Serve As Foundation for Global Greenhouse Gas Register," December 9, 2003 press release.

[49] More information on state GHG registries is available at the Greenhouse Gas State Registry Collaborative (Northeast States for Coordinated Air Use Management). http://www.nescaum.org/Greenhouse/Registry/

7. Many sources are available to inform a reasonable estimate of carbon emission reduction costs.

Uncertainty about the form of future greenhouse gas reduction policies poses a planning challenge for entities in the electric sector. Nevertheless, it is not reasonable to assume a carbon cost of $0 in planning decisions. There is clear evidence of climate change, state and regional regulatory efforts are currently underway, investors are increasingly pushing for companies to address climate change, and the electric sector is likely to constitute one of the primary elements of any regulatory plan. In this context and policy climate, utilities must develop a reasoned assessment of the costs associated with potential required emissions reductions.

This is particularly important in an industry where capital stock has a lifetime of 30 or more years. An analysis of capital cycles in the electric sector finds that "external market conditions are the most significant influence on a firm's decision to invest in or decommission large pieces of physical capital stock.[50] Failure to adequately assess market conditions, including the potential cost increases associated with likely regulation, poses a significant investment risk for utilities. It simply doesn't make sense for a company investing in plants in the electric sector, where capital costs are high and assets are long-lived, to ignore policies that are likely in the next twenty years.

Evidence suggests that a utility's overall compliance decisions will be more efficient if its strategy considers several pollutants at once rather than addressing pollutants separately. For example, in a 1999 study EPA found that pollution control strategies to reduce emissions of nitrogen oxides, sulfur dioxide, carbon dioxide, and mercury are highly inter-related, and that the costs of control strategies are highly interdependent.[51] The study found that the total costs of a set of actions is less than a piecemeal approach, that plant owners will adopt different control strategies if they are aware of multiple pollutant requirements, and that combined SO_2 and carbon reduction options lead to further air emission reductions.[52] Similarly, in one of several studies on multi-pollutant strategies, the Energy Information Administration (EIA) found that using an integrated approach to NO_x, SO_2, and CO_2, is likely to lead to lower total costs than addressing pollutants one at a time.[53] While these studies clearly indicate that federal emissions policies should be comprehensive and address multiple pollutants, they also demonstrate the value of including future carbon costs in utility planning.

There are a variety of sources of information that form a basis for developing a reasonable estimate of the cost of carbon emissions for utility planning purposes. Useful

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[50] Lempert, Popper, Resitar and Hart, "Capital Cycles and the Timing of Climate Change Policy." Pew Center on Global Climate Change, October 2002. page

[51] US EPA, *Analysis of Emissions Reduction Options for the Electric Power Industry,* March 1999.

[52] US EPA, *Briefing Report*, March 1999.

[53] EIA, *Analysis of Strategies for Reducing Multiple Emissions from Power Plants: Sulfur Dioxide, Nitrogen Oxides, and Carbon Dioxide*. December 2000.

sources include recent market transactions in carbon markets, values that are currently being used in utility planning, and costs estimates developed through scenario modeling.

7.1 Market transactions

Implementation of the Kyoto Protocol has moved forward with great progress in recent years. Countries in the European Union (EU) are now trading carbon in the first international emissions market, the EU Emissions Trading Scheme (ETS), which officially launched on January 1, 2005. This market, however, has been going strong since before that time – Shell and Nuon entered the first trade on the ETS in February 2003. Traded volumes in the EU ETS totaled approximately 600,000 tons of CO_2 in 2003, with prices ranging from about 5-13 euros per ton CO_2. Most of these trades were on a forward basis with payment on delivery. Trading volumes have increased steadily throughout 2004 and totaled approximately 8 million tons CO_2 in that year. [54]

Eight exchanges and 11 brokerages are planning to take active roles in the acceleration of the carbon market. One financial index for EU allowances (EUA) is called the Carbon Market Index. Figure 1 shows Carbon Market Index data as of January 27, 2005.

Over the last six months, carbon trades have ranged between 6.75 to just over 13 euros per ton CO_2. This is equivalent to approximately $8–17 US. Volume in the carbon market is high-more than 5 million tons were traded in the month of January 2005 alone. Trading volume is most liquid in the near term (2005-2007), yet trades do exist out to the year 2008, priced at approximately 9 euros/ton CO_2 ($11.5 US). [55, 56]

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[54] "What determines the Price of Carbon," Carbon Market Analyst, *Point Carbon*, October 14, 2004.

[55] Andrew, "Point Carbon to launch volume-wieghted EU ETS index," Carbon Market Europe, *Point Carbon*, January 28, 2005.

[56] Conversion as of February 9, 2005, wherein 1 Euro = 1.27 US dollars..

Figure 1. The Carbon Market Index for EU Allowances as of January 27, 2005 – Euros per ton CO_2.[57]

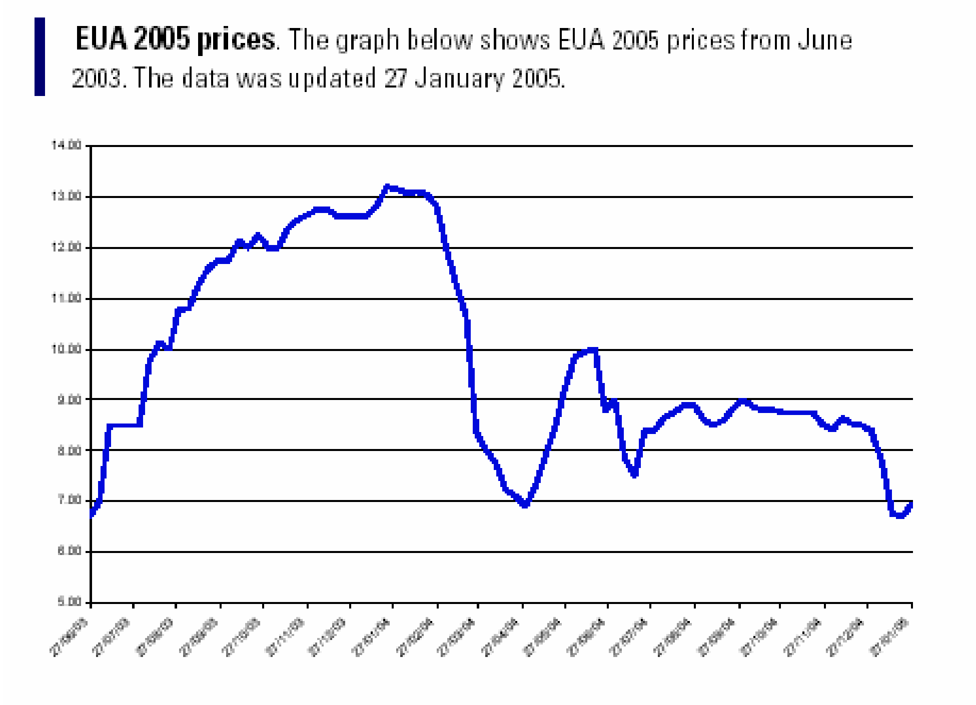

Table 3: Closing prices of CO_2 allowances as of January 27, 2005. [58]

Delivery Date	Last Price
EU 2005	€6.95
EU 2006	€6.98
EU 2007	€7.05

7.2 Values in utility planning

The concept of considering the possible costs of complying with greenhouse gas emission reduction targets is receiving renewed attention in electric utility planning. Most recently, the California Public Utility Commission has directed utilities to determine an appropriate value, within an identified range, for purposes of long term planning. Several utilities have already included a value to reflect the financial risk of future carbon reduction requirements.

The California PUC has developed an imputed cost for GHG emissions, for use in long term utility planning.[59] The Commission's decision requires the state's largest electric

[57] Allan, Andrew, op. cit.

[58] Allan, Andrew, op. cit..

[59] California Public Utilities Commission, Decision 04-12-048, December 16, 2004

utilities (PG&E, SCE, and SDG&E) to factor the financial risk associated with greenhouse gas emissions into new long-term power plant investments, and long-term resource plans. The Commission has told utilities to include a value between $8–25/ton CO_2 in their submissions, and to justify their selection of a number. The PUC is expected to choose a single number in March 2005. In its decision, the Commission cites various estimates of carbon compliance costs submitted in the proceeding. The various estimates, ranging from $8/ton CO_2 in 2004 to a high of $36/ton CO_2 in 2020, are presented in Table 4, below.

Table 4: Values submitted to CPUC for CO_2 in long term planning

Name of source of	Value
Final E3 Avoided Cost Report	$8/ton C02 2004 $12.50 by 2008 $17.50 by 2013
PG&E internal RFO review	$8
PacifiCorp 2003 IRP -	$8
NRDC opening brief -	$12 beginning 2008
Idaho Power Co IRP -	$12.30 beginning 2008
EIA analysis of proposed legislation143	$15-$25 in 2010 $14-$36 in 2020

Several electric utilities and electric generation companies have incorporated assumptions about carbon regulation and costs in their long term planning, and have set specific agendas to mitigate shareholder risks associated with future U.S. carbon regulation policy. Table 5 illustrates the range of carbon cost values, both in $/metric ton C and $/ton CO_2, that are currently being used in the industry for both planning and modeling of carbon regulation policies.

Table 5: CO_2 emissions trading assumptions for various years[60]

Company	CO_2 emissions trading assumptions for various years	$/metric ton carbon
PG&E	$8/ton (2008)	$29
Avista	$1-11/ton (2004-2023)	$5-40
Portland's General Electric	$10/ton (2010)	$37
Xcel	$6-12/ton (2009)	$22-44
Idaho Power	$12.30/ton (2008). Also evaluated scenarios with carbon dioxide at $12.30 per ton and $49.21 per ton.	$45. Highest scenario is $180
Pacificorp – subsidiary of Scottish Power	$8/ton in 2003 IRP, also evaluated scenarios with carbon dioxide at $2, $25, and $40/ton.	$29 up to a high off $147

These early efforts by utilities lay the groundwork for the increased use of carbon value estimates in utility planning and in other elements of corporate strategy in the electric sector.

7.3 Analyses of carbon reduction costs

There have been several studies and analyses that project the cost of reducing carbon emissions to meet various emissions targets. Some of these analyses focus on the Kyoto Protocol, reviewing a 7% reduction from 1990 level emissions in the U.S. Other studies focus on the McCain Lieberman Bill which would require that emissions levels in 2010 be the same as emissions levels in 2000 in the U.S. Another study is designed to analyze the impacts of allowance allocation methods, rather than to project carbon costs of a particular emissions reduction goal. These studies reveal a wide range of estimates. While it is not possible, given current uncertainties about the goal and design of carbon regulation, to pinpoint carbon reduction costs, the studies provide a useful source of information. In addition to establishing ranges of reduction cost, the studies give a sense of which factors affect future costs of reducing carbon emissions.

The Stanford Energy Modeling Forum organized a comparative set of analyses, published in 1999, of the economics and energy sector impacts of the Kyoto Protocol on Climate Change.[61] The objectives of this study, were to (1) identify policy-relevant insights and analyses that are robust across a wide range of models, (2) provide explanations for differences in results from different models, and (3) identify priorities for future research. Nine teams of modelers participated in this effort. Each team ran the same four "core" scenarios, and also ran other scenarios that their models were well suited to explore. The four "core" scenarios were (1) a modeler's reference case (assumptions determined by

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[60] Wiser, Ryan and Mark Bolinger, *An Overview of Alternative Fossil Fuel Price and Carbon Regulation Scenarios*, Lawrence Berkeley National Laboratory, October 2004. See, also, PacificCorp, *Integrated Resource Plan 2003*, pages 45-46.,and Idaho Power Company, *2004 Integrated Resource Plan Draft*, July 2004, page 59.

[61] International Association for Energy Economics, "The Costs of the Kyoto Protocol: A Multi-Model Evaluation," *The Energy Journal*, 1999.

each team), (2) no emissions trading, (3) full Annex I trading, and (4) full global trading. All of the "core" scenarios assumed that the Kyoto targets would be in place for 2010 and beyond.

The studies produced a wide range of estimates for the cost of meeting the Kyoto Protocol emissions reductions targets. This range is due to differing assumptions about the geographical scope of emissions trading as well as other elements of program implementation. The range of estimates is also due to features of the models. One of the major determinants of the cost of achieving reductions in each region in the reference case is the level of emissions projected in the reference case for each region. The variation in projected emissions stems from different assumptions about economic growth, fuel costs, capital stock turnover and other factors.

Most of the reference case runs project a 30% increase in U.S. carbon emissions from 1990 to 2010 (range is 21%-36%). The price projections range from $36-$180/metric ton carbon for scenarios with full global trading ($25/metric ton carbon to $125/metric ton carbon in 1990 dollars). Projections for "no trading" scenarios range from $108 to $585/metric ton carbon ($75-$405/metric ton carbon in 1990 dollars). Virtually all the teams were uncomfortable with the "full global trading" scenario since they considered it an unrealistic outcome of the current negotiation process.

The IPCC Working Group 3, on Mitigation, reviewed the results of hundreds of modeling scenarios in the Third Assessment Report.[62] The global modeling studies reported show national marginal costs to meet the Kyoto targets from about US$20/tC up to US$600/tC without trading, and a range from about US$15/tC up to US$150/tC with Annex B trading.

In 2003, Urs Springer of the University of St. Gallen in Switzerland compiled a summary of results from 25 models of the market for tradable greenhouse gas emission permits under the Kyoto Protocol.[63] Springer provides an overview of the results and methods used in the studies. Results (in USD2000) range from $1 to 22 per ton CO_2 under global trading scenarios where all countries have to meet Kyoto targets in 2010 (rather than on average between 2008 and 2012 – as in the Protocol). Results (in USD2000) range from $3 to $74 per ton CO_2 in scenarios with Annex B CO_2 trading only. (See, e.g. Tables 1 and 2.)

The EIA has performed several studies projecting costs associated with compliance with the Kyoto Protocol. In 1998, EIA performed a study analyzing allowance costs associated with six scenarios ranging from emissions in 2010 at 24 percent above 1990 emissions levels, to emissions in 2010 at 7 percent below 1990 emissions levels. In 1999 EIA performed a very similar study, but looked at phasing in carbon prices beginning in 2000 instead of 2005 as in the original study.

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[62] IPCC, *Third Assessment Report*, Working Group 3, Chapter 2.

[63] Springer, Urs; "The Market for Tradable GHG Permits Under the Kyoto Protocol: a Survey of Model Studies;" *Energy Economics* 25 (2003) 527-551.

There have also been several studies in the U.S. of the costs to comply with legislation proposed by Senators McCain and Lieberman. As originally proposed, the McCain Lieberman legislation would cap 2010 emissions at 2000 levels, and would reduce allowed emissions in 2016 to 1990 levels. In 2003, the Energy Information Administration conducted a study of the McCain Lieberman legislation. EIA ran several sensitivity cases exploring the impact of technological innovation, gas prices, allowance auction, and flexibility mechanisms (banking and international offsets). The current version of the legislation would cap emissions in 2010 at 2000 levels, with no further ratchet. EIA conducted a further analysis of the McCain Lieberman legislation in comparison with the Administration's Clear Skies Act and the Clean Air Planning Act of 2003.[64] The Clean Air Planning Act would cap 2013 emissions at 2001 levels.

The Massachusetts Institute of Technology also analyzed potential costs of the McCain Lieberman legislation in 2003. MIT held emissions for 2010 and beyond at 2000 levels (not modeling the second step of the proposed legislation). Due to constraints of the model, MIT studied an economy-wide emissions limit rather than a limit on the energy sector. A first set of scenarios considers the cap tightening in Phase II and banking. A second set of scenarios examines the possible effects of outside credits. And a final set examines the effects of different assumptions about baseline gross domestic product (GDP) and emissions growth.

The Tellus Institute conducted two studies for the Natural Resources Defense Council of the Climate Stewardship Act and the Climate Stewardship Act Amendment (July 2003 and June 2004).[65] In its analysis of the Climate Stewardship Act, Tellus relied on a modified version of NEMS to model all sectors with Base Case using data from 2003. Tellus then modeled two policy cases. The "Policy Case" scenario included the provisions of the Climate Stewardship Act (S.139) as well as oil savings measures, a national renewable transportation fuel standard, a national RPS, and emissions standards contained in the Clean Air Planning Act. The "Advanced Policy Case" includes a more aggressive oil savings policy that would start at 25 mpg in 2005, increasing to 45 mpg in 2025.

In 2003 ICF was retained by the state of Connecticut to model a carbon cap across the 10 northeastern states. This analysis modeled a carbon cap on electrical generation in a ten-state region in the Northeastern U.S. The cap is set at 1990 levels in 2010, 5 percent below 1990 levels in 2015, and 10 percent below 1990 levels in 2020. The use of offsets is phased in with entities able to offset 5 percent or their emissionsin 2015 and 10 percent in 2020. The CO_2 allowance price, in $US2003, for the 10-state region increases over the forecast period in the policy case, rising from $7.38/metric ton in 2010 to $9.59/metric ton in 2015 to $12.11/metric ton in 2020 (page 3.3-27). This equates to $28/metric ton carbon in 2010 ($US2004) and $48/metric ton carbon ($US2004) (Short ton values:

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[64] EIA, *Analysis of S. 485, the Clear Skies Act of 2003, and S. 843, the Clean Air Planning Act of 2003*, EIA Office of Integrated Analysis and Forecasting, SR/OIAF/2003-03, September 2003.

[65] Bailie et al., *Analysis of the Climate Stewardship Act,* July 2003; Bailie and Dougherty, *Analysis of the Climate Stewardship Act Amendment*, Tellus Institute, June, 2004. Available at http://www.tellus.org/energy/publications/McCainLieberman2004.pdf

projected carbon allowance costs at: $6.70/ton in 2010, $8.70 in 2015 and $11.00 in 2020.)[66]

Other studies have focused on specific issues associated with implementing a carbon cap. Resources for the Future (RFF) analyzed the effect of various allowance allocation methods on the cost of carbon emission trading.[67] Charles River Associates analyzed the McCain Lieberman legislation with a safety valve of $15/metric ton carbon.[68] The Federal Laboratories conducted a study of emissions reductions associated with carbon permit costs of $25 and $50 per metric ton of carbon.

Table 6 presents results for several of these studies in $2004/metric ton Carbon. A similar table in $2004/ton CO_2 is contained in the Appendix to this report.

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[66] Center for Clean Air Policy, *Connecticut Climate Change Stakeholder Dialogue: Recommendations to the Governors' Steering Committee*, January 2004, p. 3.3-27.

[67] Burtraw et. al., *The Effect of Allowance Allocation on the Cost of Carbon Emission Trading*, Resources for the Future, August, 2001. Available at http://www.rff.org/rff/Documents/RFF-DP-01-30.pdf

[68] Smith and Bernstein, *Impacts of Implementing a Carbon Cap with a Safety Valve on Allowance Prices*, Charles River Associates, January, 2004. Available at http://www.cpc-inc.org/library/files/20_smithjan04.pdf

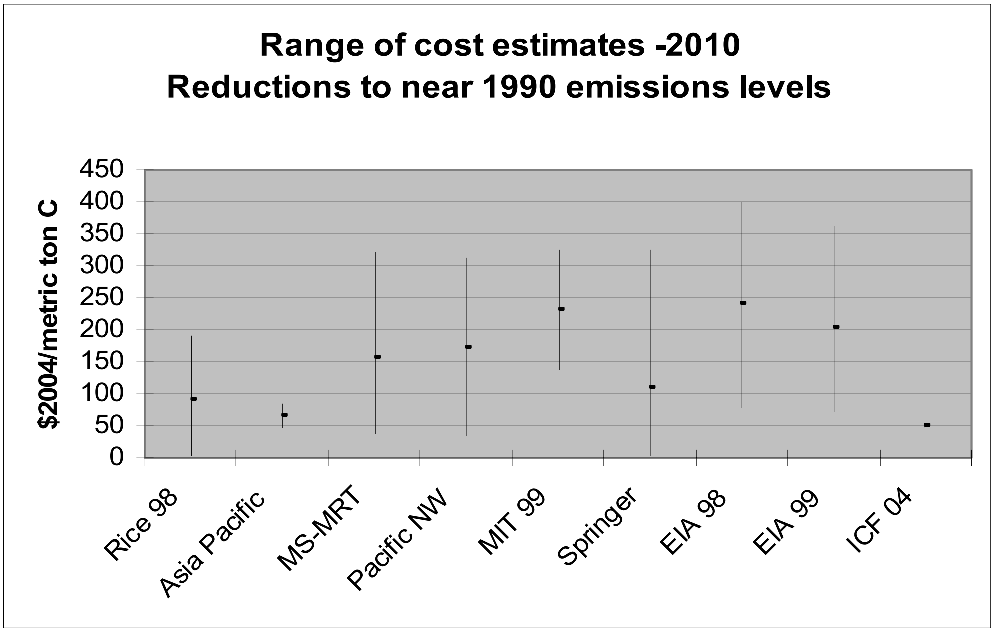
Table 6: Estimates of U.S. Allowance Costs ($US2004/metric ton Carbon)

Study	2010 Emissions Goal	2010 Allowance Price Range	2020-2025 Allowance Price Range**
		$2004/metrictC	$2004/metrictC
SEMF -Rice 98	7% below 1990 levels 2008-2012	4-191	-
SEMF -Asia Pacific	7% below 1990 levels 2008-2012	48-85	-
SEMF -MS MRT	7% below 1990 levels 2008-2012	36-323	42-369
SEMF - Pacific Northwest	7% below 1990 levels 2008-2012	33-313	-
SEMF -MIT Emissions	7% below 1990 levels 2008-2012	137-325	-
EIA '98	24% above 1990 levels to 7% below 1990 levels 2008-2012	77-401	-
EIA '99	24% above 1990 levels to 7% below 1990 levels 2008-2012	71-364	-
ICF '04	1990 levels in 2010	47-50	79-84
Springer summary of 25 models*	Kyoto targets in 2010	4-324	-
EIA '03	2000 levels 2010, 1990 levels in 2016	43-93	167-314
EIA '04	2000 levels 2010 and beyond	58	113
MIT '03	2000 levels 2010 and beyond	19-184	61-500
Tellus '03	2000 levels 2010, 1990 levels 2016	27-31	58-85
Tellus '04	2000 levels 2010 and beyond	35	81
CRA	2000 levels starting 2010, with safety valve	17	17-28
EIA '03b	2001 emissions in 2013	4-70	27-143
ICF '04b	2000 levels in 2010	13	21
RFF***	6% reduction from BAU scenario, starting 2008	26-41	-

** Springer summary allowance prices are global rather than U.S.*
*** MIT '03, MS MRT, CRA, Tellus, results for 2020; EIA '03, EIA '03b, and '04 results for 2025.*
**** RFF results for 2012. Study focuses relative costs of allocation methods.*

The results of these analyses are presented in graphic form below. The charts below show values in $2004/metric ton carbon. Charts showing the values in $2004/ton CO_2 are included in the Appendix. The first chart presents the estimates for the year 2010 for analyses that examine reductions to near 1990 levels.

Figure 1: Cost estimates for 2010 – reductions to near 1990 levels



The next chart presents the estimates for the year 2010 for analyses that examine reductions to near 2000 levels.

Figure 2: Cost estimates for 2010 – reductions to 2000 levels

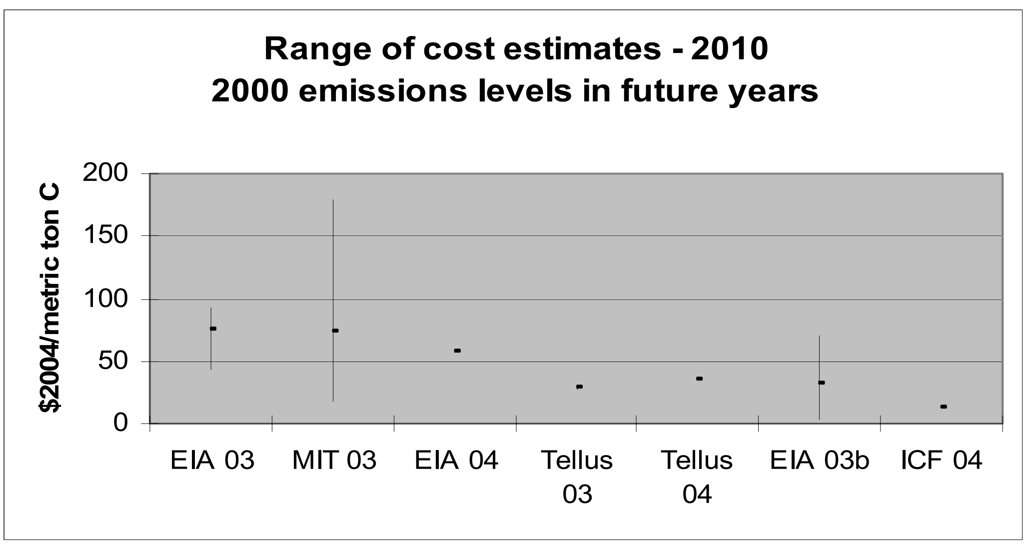
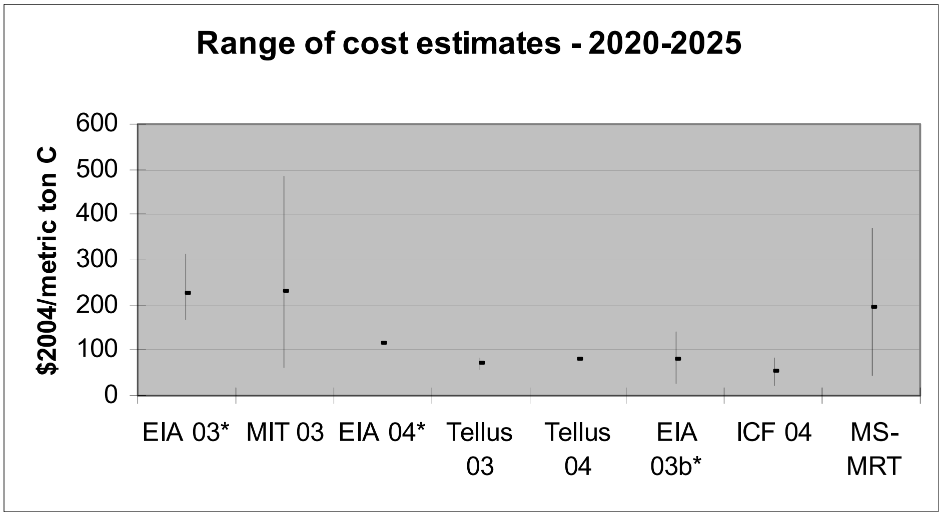


Figure 3 presents estimates for the years 2020-2025 for all emission reduction targets.

Figure 3: Cost estimates for 2020-2025 – all reduction targets



7.4 Other sources of information

National Commission on Energy Policy: A bipartisan group of energy experts from industry, government, labor, academia, and environmental and consumer groups released a consensus strategy, more than two years in the making, to address major long-term U.S. energy challenges. Their report recommends mandatory economy-wide tradeable permits program to limit GHG. Costs would be capped at $7/metric ton of CO_2 equivalent reduction in 2010 with the cap rising 5% annually.[69]

Innovest Strategic Value Advisors study for WWF: This study looks at relative costs of different strategies to reduce carbon emission from a portfolio, including: fuel switching, refiring, refurbishment, retiring coal and replacing it with gas combined cycle generation. The study assesses different carbon "price points" from 4 Euros to 30 Euros, based on "authoritative studies." Based on a review of carbon scenarios in different regions, the report identifies three common carbon price scenarios: $4-5 per ton carbon, $10-15 per ton carbon (for the period 2007/8 and corresponding roughly to an 8% reduction from 2002 emissions levels for specific utilities), and $20-25 per ton carbon (corresponding to a scenario for U.S. utilities where cumulative abatement in 2012 is 23% below 2002 emissions levels).[70]

Researchers at the Lawrence Berkeley National Laboratories: LBL researchers provided an overview of various carbon regulation scenarios for DOE.[71] The purpose of

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[69] National Commission on Energy Policy, *Ending the Energy Stalemate*, December 2004, pages 19-29.

[70] Innovest Strategic Value Advisors; "Power Switch: Impacts of Climate Change on the Global Power Sector;" WWF International; November 2003

[71] Wiser and Bolinger; An Overview of Alternative Fossil Fuel Price and Carbon Regulation Scenarios Prepared for the Office of Planning, Budget, and Analysis; Assistant Secretary for Energy Efficiency and Renewable Energy; U.S. Department of Energy; Ernest Orlando Lawrence Berkeley National

the analysis was to provide input to the Office of Energy Efficiency and Renewable Energy (EERE) and the Office of Fossil Energy (FE) in their exploration of options for evaluating the benefits of their R&D programs under an array of alternative futures. This analysis compares two alternative scenarios being considered by EERE and FE staff—carbon cap-and-trade and high fuel prices—to other scenarios used by energy analysts and utility planners. A Scenarios Working Group has proposed to EERE and FE staff the application of an initial set of three scenarios for use in the Working Group's upcoming analyses: (1) a *Reference Case Scenario*, (2) a *High Fuel Price Scenario*, which includes heightened natural gas and oil prices, and (3) a *Carbon Cap-and-Trade Scenario*. The immediate goal is to use these scenarios to conduct a pilot analysis of the benefits of EERE and FE R&D efforts.

The researchers reviewed several recent studies of carbon policy scenarios. The Working Group's *Carbon Cap-&-Trade Scenario* is found to be less aggressive than many Kyoto-style targets that have been analyzed, and similar in magnitude to the proposed Climate Stewardship Act. The proposed scenario is more aggressive than some other scenarios found in the literature, however, and ignores carbon banking and offsets and does not allow nuclear power to expand. The researchers were "somewhat concerned that the stringency of the proposed carbon regulation scenario in the 2010 to 2025 period will lead to a particularly high estimated cost of carbon reduction.

Canada: Canada has taken action on climate change. The Canadian government recently developed a plan for the country to reach its target under the Kyoto Protocol.[72, 73] The government has established a "safety valve" at $12/metric ton of CO_2.[74] Carbon emission trades in Canada, though light, have taken place. For example, Suncor agreed to buy 100,000 tonnes of CO_2 reductions from Niagara Mohawk with an option to buy an additional 10 million tonnes of emission reductions over 10 years. The purchase was valued at $6 million U.S.

New Brunswick Power is currently assuming that the Canadian Government's Kyoto policy will result in a cap and trade system, and that the costs of allowances will be $10/metric ton for the first compliance period of 2008-2012, and $15/metric ton for the second compliance period of 2013 and beyond. Both of these are assumed to escalate at 2% per year. Environment Canada indicates that $10/metric ton is a reasonable assumption based on international studies, price expectations from international companies, and current international permit trades.[75]

Laboratory; 1 Cyclotron Road, MS 90R4000, Berkeley CA 94720-8136; October 2004. Available at http://eetd.lbl.gov/ea/ems/reports/56403.pdf

[72] According to *Point Carbon*, "the core of the newly designed plan is a $1 billion (€630 million) fund through which the Canadian Government will purchase emissions reductions. This will primarily be through sponsoring domestic emissions reduction projects, but could also be used to purchase emissions reductions from international projects using Canadian technology. This fund is estimated to reduce emissions by a total of 100 Mt CO_2e."

[73] http://www.pointcarbon.com/article.php?articleID=6195&categoryID=147

[74] National Commission on Energy Policy, *Ending the Energy Stalemate*, December 2004, page 27.

[75] http://www.climatechange.gc.ca/english/publications/canadascontribution/concluded.html.

7.5 Factors that affect projections of carbon cost

Results from these studies highlight certain factors that affect projections of carbon reduction costs. While the studies cannot predict exactly what carbon reduction costs will be, they provide insight into the whether the factors increase or decrease expected costs, and to the relationships among different factors. The discussion in this report is qualitative, and not intended as a detailed examination of modeling results and capabilities.[76]

Not surprisingly, two of the most important factors affecting estimates of carbon cost are projected emissions levels in the absence of a policy, and emission reduction targets. In general, higher emissions growth in the base case examined in a study will result in higher estimates of the costs to achieve emissions reductions from that base case relative to a historic year. Thus future scenarios that are optimistic about reducing emissions from the power sector through energy efficiency, higher penetration of renewables, and technology innovation produce lower estimates of carbon reduction costs than those that examine high growth scenarios with little technological innovation. Similarly, aggressive emissions reductions scenarios result in higher cost estimates than scenarios with more lenient reduction requirements.

Other factors that affect carbon costs include geographic scope of trading and flexibility mechanisms (including banking and offsets). Various studies have looked at scenarios that involve global trading of allowances or permits, trading only among Annex B parties, trading only among OECD members, or no trading at all. As we see in Table 7, which shows results from one study, carbon regulation costs decrease with increased global participation. When global competition is not allowed, different regions see different carbon trading prices. Annex 1 trading lowers permit prices for most all Annex 1 regions. The inclusion of non-annex 1 countries, or global trading, further lowers prices for Annex 1 regions, but raises permit and energy prices for non-annex 1 regions. Increased trade generally helps industrial countries, but can have a negative impact on developing countries as terms of trade worsen due to higher energy costs in industrialized nations.[77]

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[76] Meta-analyses do exist. See, *e.g.*, Carolyn Fischer and Richard D. Morgenstern, *Carbon Abatement Costs: Why the Wide Range of Estimates?* Resources for the Future, September, 2003. Available at http://www.rff.org/Documents/RFF-DP-03-42.pdf

[77] Wiser, Ryan and Mark Bolinger, *An Overview of Alternative Fossil Fuel Price and Carbon Regulation Scenarios*, Lawrence Berkeley National Laboratory, October 2004.

Table 7: Carbon policy has a large impact on carbon regulation costs.

Policy Assumption	$/Metric ton Carbon (1990$)
Global Trading Allowed	17
Annex 1 Trading allowed	57
No trading between countries	127

Assumptions here are from the Rice 98 Model.[78]

8. Conclusion

The earth's climate is determined by concentrations of greenhouse gases in the atmosphere. International scientific consensus, expressed in Third Assessment Report of the Intergovernmental Panel on Climate Change, is that climate will change due to anthropogenic emissions of greenhouse gases. Scientists expect increasing atmospheric concentrations of greenhouse gases to cause temperature increases of 1.4 – 5.8 degrees C by 2100 (the fastest rate of change since end of the last ice age). Such global warming is also expected to cause a wide range of climate impacts including changes in precipitation patterns, increased climate variability, melting of glaciers, ice shelves and permafrost, and rising sea levels. These changes have already been observed and documented in a growing body of scientific evidence. All countries will experience social and economic consequences, with disproportionate negative impacts on countries least able to adapt.

The prospect of Global Warming and changing climate has spurred international efforts to work towards a sustainable level of greenhouse gas emissions. These international efforts are embodied in the United Nations Framework Convention on Climate Change. The Kyoto Protocol, a supplement to the UNFCCC, establishes legally binding limits on the greenhouse gas emissions of industrialized nations and economies in transition.

Despite being the single largest contributor to global emissions of greenhouse gases, the United States remains one of a very few industrialized nations that have not signed the Kyoto Protocol. Nevertheless, individual states, regional groups of states, shareholders and corporations are making serious efforts and taking significant steps towards reducing greenhouse gas emissions in the United States. Efforts to pass federal legislation addressing carbon, though not yet successful, have gained ground in recent years. These developments, combined with the growing scientific understanding of, and evidence of, climate change, mean that establishing federal policy requiring greenhouse gas emission reductions is just a matter of time. The question is not whether the United States will develop a national policy addressing climate change, but when and how. The electric sector will be a key component of any regulatory or legislative approach to reducing greenhouse gas emissions both because of this sector's contribution to national emissions and the comparative ease of controlling emissions from large point sources.

In this scientific and policy context, it is imprudent for decision-makers in the electric sector to ignore the cost of future carbon reductions or to treat future carbon reduction

[78] William Nordhaus and Joseph Boyer, "Requiem for Kyoto: An Economic Analysis," *The Energy Journal*, 1999.

merely as a sensitivity case. Treating carbon emissions as zero cost emissions could result in investments that prove quite costly in the future. The cost of mitigating greenhouse gas emissions, particularly carbon dioxide, must be accounted for in utility planning. For example, decisions about building new power plants, reducing other pollutants or installing pollution controls, portfolio management, avoided costs for efficiency or renewables, and retirement of existing power plants all can be more sophisticated and more efficient with appropriate consideration of potential future costs of carbon emissions mitigation. These concerns are important for all states, although the challenge may be different and more complicated in those states that have restructured and no longer have utility-owned plants.

Regulatory uncertainty associated with climate change clearly presents a planning conundrum; however, it is not a reason for proceeding as if no costs will be associated with carbon emissions in the future. The challenge is to forecast a reasonable range of expected costs based on analysis of the information available. This report identifies many sources of information that can form the basis of reasonable assumptions about the likely costs of meeting future carbon reduction requirements. Available sources include market transactions, values used in utility planning, and modeling analyses.

Carbon markets associated with implementation of the Kyoto Protocol as well as voluntary emissions reductions have emerged. In the carbon markets, carbon traded in January 2005 at a range of $30-63/metric ton carbon ($8-17 per ton CO_2).

Some utilities in the United States are already incorporating carbon values into their resource planning. The values range from $4-44/metric ton carbon ($1-12 per ton CO_2). In December 2004, the California Public Utilities Commission directed utilities to include carbon at a value between $30-93/metric ton carbon ($8-25 per ton CO_2) in their long term resource planning.

There are numerous studies that estimate the possible costs of carbon allowances under various policy scenarios, many of which are identified in this report. Projections of carbon costs for the year 2010 range from $4/metric ton carbon to $401/metric ton carbon ($1 and $99/ton CO_2) under different policy scenarios. Projections for carbon costs between 2020-2025 range from $27/metric ton carbon to $486/metric ton carbon ($7 and $120/ ton CO_2). Modeling results are sensitive to several factors including (1) the emissions reduction target; (2) projections of future emissions in the absence of a greenhouse gas reduction target; (3) geographic scope of trading; and (4) flexibility mechanisms such as offsets and allowance banking.

The sensitivity of the carbon price levels to the emissions reduction target can be seen by grouping the results for 2010 into two groups based upon the level of the target. For studies that analyze the costs associated with returning to the emissions levels of the year 2000 by the year 2010 or thereabouts, costs in 2010 are projected to be between $4/metric ton carbon and $179/metric ton carbon ($1/ton CO_2 and $44/ton CO_2). Studies that analyze the costs associated with a somewhat more aggressive goal of reducing emissions to near 1990 levels reveal costs in 2010 between $4/metric ton carbon and $401/metric ton carbon ($1/ton CO_2 and $99/ton CO_2).

These sources of information permit a broad assessment of potential carbon allowance prices. Indeed, incorporating reasoned assessment of future costs associated with greenhouse gas emissions is likely to be an increasingly important component of corporate success.

Appendix: Conversion and Values in $2004/ton CO2

A-1: Conversions

Original dollars were converted using Gross Domestic Product Implicit Price Deflator.

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0.754	0.780	0.798	0.817	0.834	0.851	0.867	0.882	0.891	0.904	0.924	0.946	0.962	0.979	1.000

The following conversions were also used:

1 metric ton = 1.102 short tons

1 short ton = 0.907 metric tons

There are 12 g of carbon in 44 g of carbon dioxide

A-2: Allowance cost estimates in $2004/ton CO_2

Table A-1: Estimates of U.S. Allowance Costs ($US2004/ton CO_2)

Study	2010 Emissions Goal	2010 Allowance Price Range	2020-2025 Allowance Price Range**
		$2004/ton CO_2	$2004/ton CO_2
SEMF -Rice 98	7% below 1990 levels 2008-2012	1-47	-
SEMF -Asia Pacific	7% below 1990 levels 2008-2012	12-21	-
SEMF -MS MRT	7% below 1990 levels 2008-2012	9-80	10-91
SEMF - Pacific Northwest	7% below 1990 levels 2008-2012	8-77	-
SEMF -MIT Emissions	7% below 1990 levels 2008-2012	34-80	-
EIA '98	24% above 1990 levels to 7% below 1990 levels 2008-2012	19-99	-
EIA ‘99	24% above 1990 levels to 7% below 1990 levels 2008-2012	18-90	-
ICF ‘04	1990 levels in 2010	12	19-21
Springer summary of 25 models*	Kyoto targets in 2010	1-80	-
EIA '03	2000 levels 2010, 1990 levels in 2016	11-23	167-314
EIA '04	2000 levels 2010 and beyond	14	28
MIT '03	2000 levels 2010 and beyond	4-44	15-120
Tellus ‘03	2000 levels 2010, 1990 levels 2016	7-8	14-21
Tellus ‘04	2000 levels 2010 and beyond	9	20
CRA	2000 levels starting 2010, with safety valve	4	4-7
EIA ‘03b	2001 emissions in 2013	1-8	7-35
ICF ‘04b	2000 levels in 2010	3	5
RFF***	6% reduction from BAU scenario, starting 2008	6-10	-

** Springer summary allowance prices are global rather than U.S.*
*** MIT '03, MS MRT, CRA, Tellus, results for 2020; EIA '03, EIA ‘03b, and ‘04 results for 2025..*
**** RFF results for 2012. Study focuses relative costs of allocation methods.*

Figure A-1: Cost estimates for 2010 – reductions to near 1990 levels

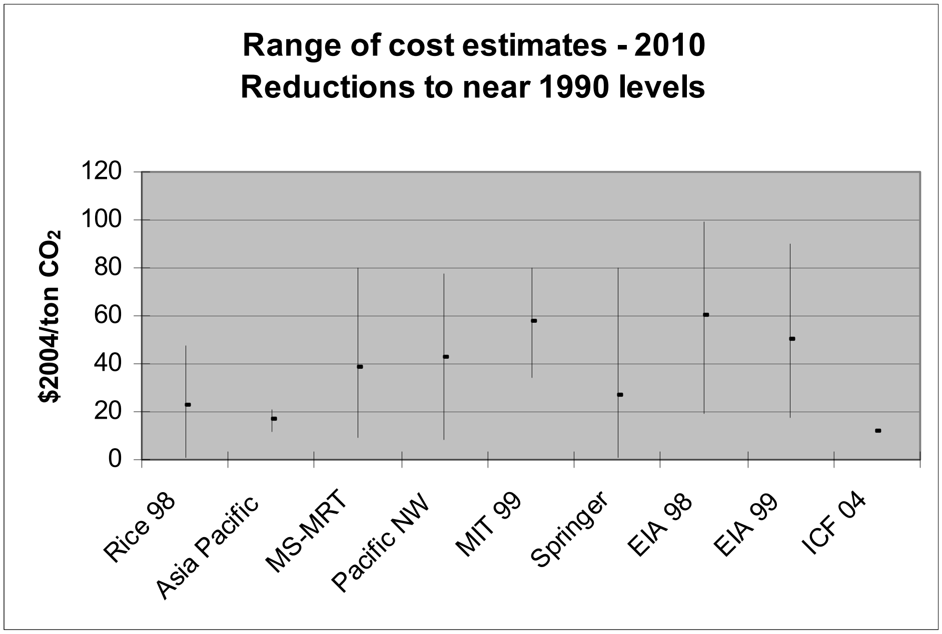


Figure A-2: Cost estimates for 2010 – reductions to 2000 levels

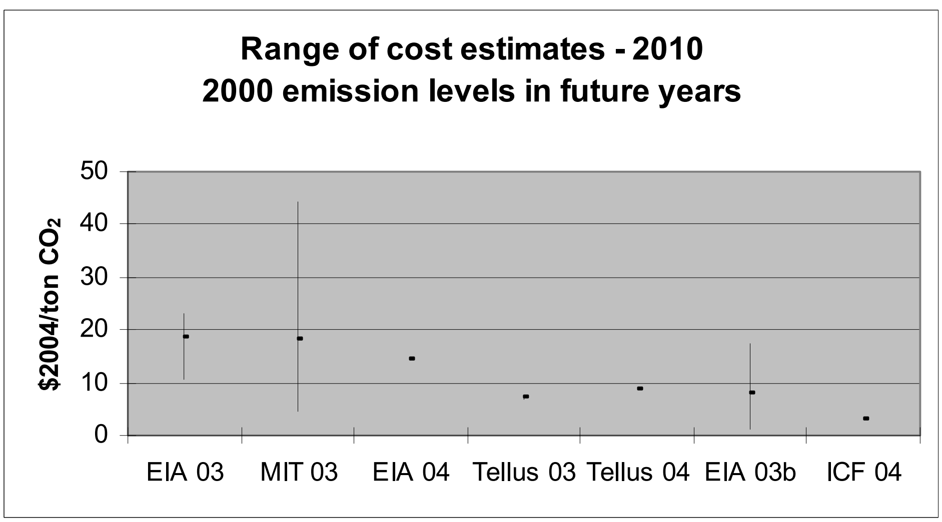
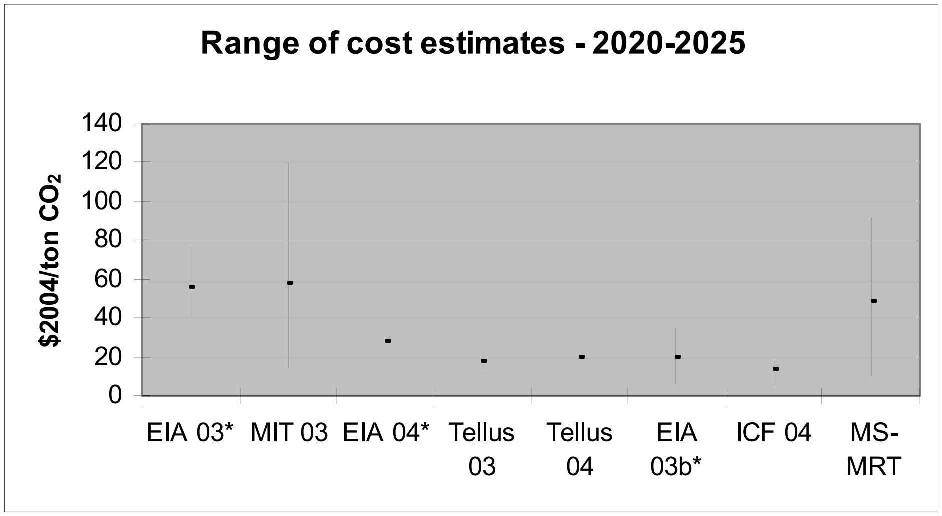
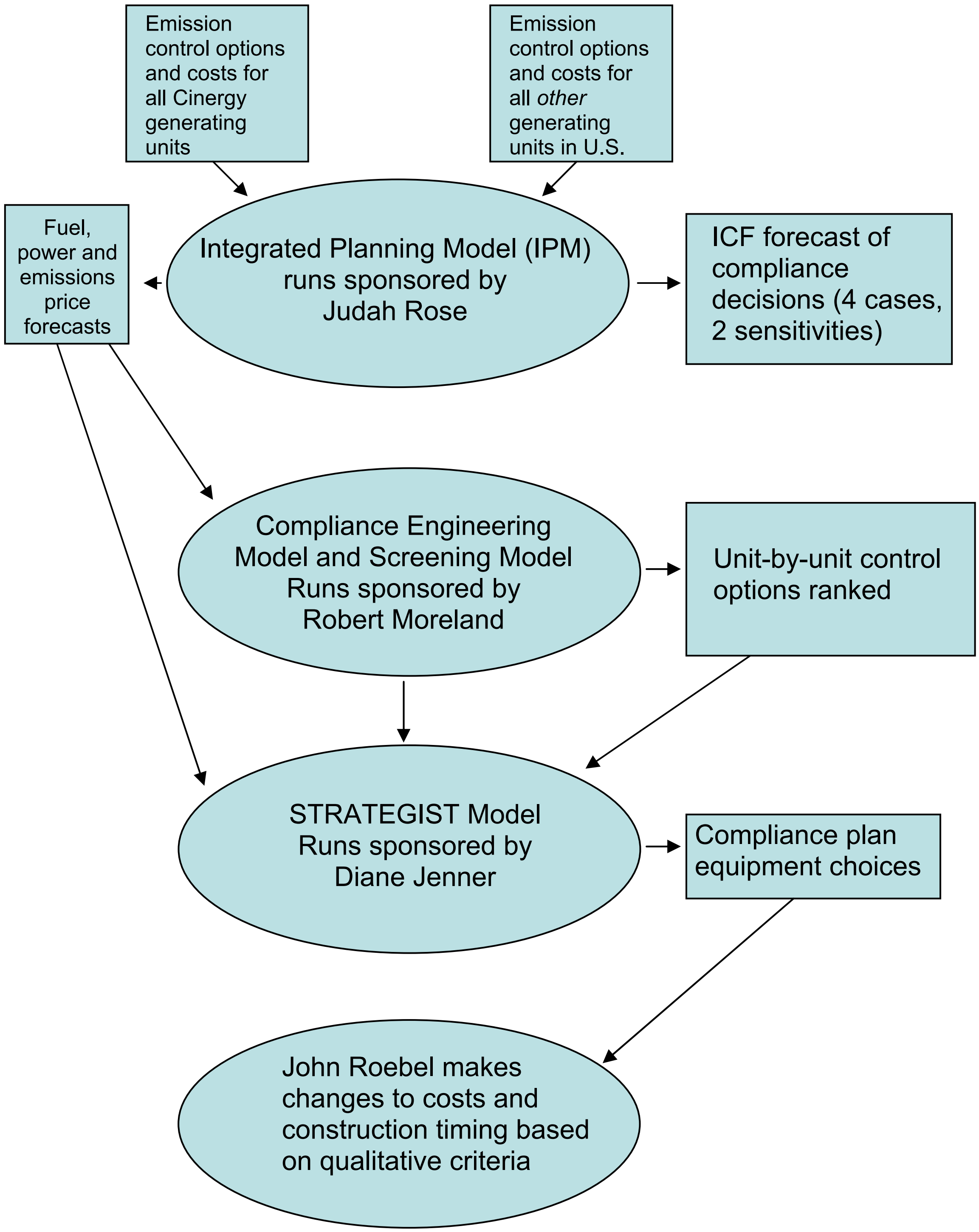


Figure A-3: Cost estimates for 2020-2025 – all emission reduction targets



Summary Diagram of Cinergy Compliance Model Data Flow



Summary of Control Cost Estimates for PSI Units

Phase I Plan	**Capacity (MW)**	**Cinergy - Cost Recovery ($1000s)**	**Cinergy - S&L ($1000s)**	**ICF - IPM ($1000s)**	**Cinergy - Engineering Model ($1000s)**	**Cinergy - IPM ($1000s)**	**EIA ($1000s)**	**Lime Associa-tion ($1000s)**
Cayuga Station								
Unit 1 FGD	500	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$103,000	$86,000
Unit 2 FGD	495	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$101,970	$85,140
Gallagher Station								
Unit 1 ACI Baghouse	140	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 2 ACI Baghouse	140	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 3 ACI Baghouse	140	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 4 ACI Baghouse	140	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Gibson Station								
Unit 1 FGD	630	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$129,780	$108,360
Unit 2 FGD	630	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$129,780	$108,360
Unit 3 FGD	630	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$129,780	$108,360
Unit 4 FGD Upgrades	622	[redacted]	[redacted] *	[redacted] *	[redacted] *	[redacted] *		
Unit 5 FGD Upgrades	620	[redacted]	[redacted] *	[redacted] *	[redacted] *	[redacted] *		
Phase II Plan								
Cayuga Station								
Unit 2 SCR	495	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	$48,015	
Edwardsport Station								
ACI Baghouse	75	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Wabash River Station								
Unit 2 ACI Baghouse	85	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 3 ACI Baghouse	85	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 4 ACI Baghouse	85	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 5 ACI Baghouse	85	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 6 ACI Baghouse	318	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
Unit 6 Dry FGD	318	[redacted]	[redacted]	[redacted]	[redacted]	[redacted] *		$51,834
Other Costs		$56,923	$56,923	$56,923	$56,923	$56,923		
Total Cost		$1,395,600	$996,111	$872,450	$1,201,503	$1,227,313		
*No data available, so value is from Exhibit G-1								

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Summary of Control Cost Estimates for PSI Units

Phase I Plan	**Capacity (MW)**	**Cinergy-Cost Recovery ($/kW)**	**Cinergy-S&L ($/kW)**	**ICF - IPM ($/kW)**	**Cinergy - Engineering Model ($/kw)**	**Cinergy - IPM ($/kw)**	**EIA ($/kW)**	**Lime Association ($/kW)**
Cayuga Station								
Unit 1 FGD	500	[redacted]					$206	$172
Unit 2 FGD	495	[redacted]					$206	$172
Gallagher Station								
Unit 1 ACI Baghouse	140	[redacted]						
Unit 2 ACI Baghouse	140	[redacted]						
Unit 3 ACI Baghouse	140	[redacted]						
Unit 4 ACI Baghouse	140	[redacted]						
Gibson Station								
Unit 1 FGD	630	[redacted]					$206	$172
Unit 2 FGD	630	[redacted]					$206	$172
Unit 3 FGD	630	[redacted]					$206	$172
Unit 4 FGD Upgrades	622	[redacted]			[redacted]			
Unit 5 FGD Upgrades	620	[redacted]			[redacted]			
Phase II Plan								
Cayuga Station								
Unit 2 SCR	495	[redacted]					$97	$172
Edwardsport Station								
ACI Baghouse	75	[redacted]						
Wabash River Station								
Unit 2 ACI Baghouse	85	[redacted]						
Unit 3 ACI Baghouse	85	[redacted]						
Unit 4 ACI Baghouse	85	[redacted]						
Unit 5 ACI Baghouse	85	[redacted]						
Unit 6 ACI Baghouse	318	[redacted]						
Unit 6 Dry FGD	318	[redacted]						$163

Gibson Unit 3 FGD (630 MW)

Source	$/kW	Millions of $	Ratio Company/Other	Date	Comments
Cinergy – Cost Recovery	[redacted]	[redacted]	[redacted]	1/21/05	Revised Confidential Exhibit G-1, as spent dollars
Cinergy – Conceptual Cost Estimate	[redacted]	[redacted]	[redacted]	12/15/04	CAC 4.9-A, does not include AFUDC, 2003$
Cinergy – Engineering Model	[redacted]	[redacted]	[redacted]	03/13/04	CAC 1.1-M, 2000$
Cinergy - S&L	[redacted]	[redacted]	[redacted]	10/24/03	CAC 2.16, includes retrofit factor of [redacted], 2000$
Cinergy – IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, 2000$, Reference Scenario
ICF – IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, based on the capital cost equation for Wet FGD, 2000$, Reference Scenario
EIA	202	127.3	[redacted]	8/25/04	From AEO 2004 for a 500 MW unit
Lime Association	172	108.4	[redacted]	1/22/03	Prepared by Sargent & Lundy for the Lime Association, for a 500 MW unit, S&L attaches an accuracy of +/- 20%

Cayuga Unit 2 SCR (495 MW)

Source	$/kW	Millions of $	Ratio Company/Other	Date	Comments
Cinergy – Cost Recovery	[redacted]	[redacted]	[redacted]	1/21/05	From Revised Confidential Exhibit G-1 sponsored by Mr. Roebel, as spent dollars
Cinergy – Conceptual Cost Estimate	[redacted]	[redacted]	[redacted]	4/8/02	CAC 4.9, 4.11, 4.12, for Cayuga Unit 1, 2002$, no AFUDC
Cinergy - Sargent & Lundy	[redacted]	[redacted]	[redacted]	10/31/02	CAC 2.16, from the SCR (S&L) cost equation in Exhibit 1, 2002$
Cinergy – Engineering Model	[redacted]	[redacted]	[redacted]	03/12/04	CAC 1.1-M, 2000$
Cinergy - IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, 2000$, Reference Scenario
ICF – IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, based on the capital cost equation for SCR, 2000$, Reference Scenario
EIA	97	48.0	[redacted]	8/25/04	From AEO 2004 for a 500 MW unit

Gallagher Unit 3 ACI Baghouse (140 MW)

Estimate Source	$/kW	Millions of $	Ratio Company/Other	Date	Comments
Cinergy – Cost Recovery	[redacted]	[redacted]	[redacted]	1/21/05	From Revised Confidential Exhibit G-1 sponsored by Mr. Roebel, as spent dollars
Cinergy – Initial Budget Estimate	[redacted]	[redacted]	[redacted]	7/6/04	CAC 4.9-D, includes 3% overhead and 6.8% AFUDC, cost is for Units 3 & 4 and was assigned to Unit 3 on a capacity proportional basis, 2004$
Cinergy – Engineering Model	[redacted]	[redacted]	[redacted]	3/13/04	CAC 1.1-M, 2000$
Cinergy - Sargent & Lundy	[redacted]	[redacted]	[redacted]	10/31/02	CAC 2.16, from the ACI+FF to CESP capital cost equation, 2002$
Cinergy - IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, 2000$, Reference Scenario
ICF – IPM	[redacted]	[redacted]	[redacted]	1/11/05	CAC 2.3-A, based on the capital cost equation for ACI + PBH, 2000$, Reference Scenario

Technology Options for Reducing Air Emissions (capital costs)

	Low ($/kW)	High ($/kW)
Dry Scrubbers	[redacted]	[redacted]
Wet Scrubbers	[redacted]	[redacted]
SCR	[redacted]	[redacted]
Activated Carbon	[redacted]	[redacted]

Source: Cambridge Energy Research Associates, "Cinergy," 1 October 2004, Naples Florida, p. 33, provided in response to CAC 4.6, 4.10 and 4.14.

Carbon Dioxide Price Forecasts: ICF
(2004 dollars per ton of CO2)

Year	Mild	Moderate	Stringent	Expected
2010	[redacted]	[redacted]	[redacted]	[redacted]
2015	[redacted]	[redacted]	[redacted]	[redacted]
2020	[redacted]	[redacted]	[redacted]	[redacted]
2025	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
Levelized	[redacted]	[redacted]	[redacted]	[redacted]

REDACTED

Source: ICF Forecast is from Page 6 of [redacted],” Green Box Meeting, July 12, 2004. The document, which discusses CO_2 policy implications for planning, appears to be created by ICF for Cinergy or created by Cinergy based on information from ICF.

The levelization calculation was done by Synapse, using a real discount rate of 7 percent.

Projection of Cinergy and PSI Carbon Dioxide Emissions

REDACTED

Year	PSI total	Cinergy total
2004	[redacted]	[redacted]
2005	[redacted]	[redacted]
2006	[redacted]	[redacted]
2007	[redacted]	[redacted]
2008	[redacted]	[redacted]
2009	[redacted]	[redacted]
2010	[redacted]	[redacted]
2011	[redacted]	[redacted]
2012	[redacted]	[redacted]
2013	[redacted]	[redacted]
2014	[redacted]	[redacted]
2015	[redacted]	[redacted]
2016	[redacted]	[redacted]
2017	[redacted]	[redacted]
2018	[redacted]	[redacted]
2019	[redacted]	[redacted]
2020	[redacted]	[redacted]
2021	[redacted]	[redacted]
2022	[redacted]	[redacted]
2023	[redacted]	[redacted]
2024	[redacted]	[redacted]

Notes on Projection of Cinergy and PSI Carbon Dioxide Emissions

The carbon projections in this exhibit were calculated by Synapse Energy Economics based upon fuel use projections in the PSI's Strategist Model run sponsored by PSI witness Diane Jenner (filename "[redacted]" run on February 3, 2005).

The following emission coefficients, based upon the US EPA's eGRID data (for the year 2000), were used in this calculation.

Fuel Type	CO2 Emissions Coefficient (short tons of CO2 per MMBTU)
Coal	0.1026
Natural Gas	0.0604
Oil	0.0798

Projection of Cinergy and PSI Coal Use

REDACTED

Year	PSI total	Cinergy total
2004	[redacted]	[redacted]
2005	[redacted]	[redacted]
2006	[redacted]	[redacted]
2007	[redacted]	[redacted]
2008	[redacted]	[redacted]
2009	[redacted]	[redacted]
2010	[redacted]	[redacted]
2011	[redacted]	[redacted]
2012	[redacted]	[redacted]
2013	[redacted]	[redacted]
2014	[redacted]	[redacted]
2015	[redacted]	[redacted]
2016	[redacted]	[redacted]
2017	[redacted]	[redacted]
2018	[redacted]	[redacted]
2019	[redacted]	[redacted]
2020	[redacted]	[redacted]
2021	[redacted]	[redacted]
2022	[redacted]	[redacted]
2023	[redacted]	[redacted]
2024	[redacted]	[redacted]

The graphs in this exhibit were created by Synapse Energy Economics based upon outputs from the PSI's Strategist Model run sponsored by PSI witness Diane Jenner (filename "OUTFGDSLIPBASPLN14F.REP", run on February 3, 2005).

2004 Global Warming Shareholder Campaign

Cinergy Corporation Shareholder Resolution

Status: A negotiated agreement has been reached between Cinergy and the filer, and this resolution did not appear on the company's proxy statement.

Whereas:

In 2001, the Intergovernmental Panel on Climate Change concluded that "there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities."

In 2002, the United States EPA concluded that climate change may harm the country and pose risks to coastal communities due to sea level rise, water shortages, and increases in heat wave frequency.

In 2003, the World Meteorological Organization declared that, "As the global temperatures continue to warm due to climate change, the number and intensity of extreme events might increase."

U.S. power plants are responsible for about two-thirds of the country's sulfur dioxide emissions, one- quarter of its nitrogen oxides emissions, one-third of its mercury emissions, nearly 40 percent of its carbon dioxide emissions, and 10 percent of global carbon dioxide emissions. Scientific studies show that each year, air pollution from U.S. power plants causes tens of thousands of premature deaths and hospitalizations, hundreds of thousands of asthma attacks, and several million lost workdays nationwide.

Scientists also estimate that about 160,000 people die every year from side-effects of global warming ranging from malaria to malnutrition and the numbers could almost double by 2020. Commitments to reduce carbon dioxide emissions and other air pollutants are emerging. More than 100 countries have ratified the Kyoto Protocol. Massachusetts and New Hampshire have enacted legislation capping power plants' greenhouse gases emissions. Governors of eleven states have pledged to reduce carbon dioxide emissions significantly. Renewable energy standards now exist in 13 states, indicating increasing support for non-polluting electricity sources.

In October 2003, 43 U.S. Senators voted in favor of legislation that would have capped greenhouse gas emissions from a range of industrial sectors.

Recent reports by CERES, The Carbon Disclosure Project, Innovest Strategic Value Advisors, and the Investor Responsibility Research Center demonstrate both the growing financial risks of climate change for US corporations, and inadequate risk disclosure to investors.

A study by the U.S. EPA and one by Robert Repetto and James Henderson indicate that proposed legislation to regulate carbon dioxide poses significant financial risks to some electric companies, with wide sector variation.

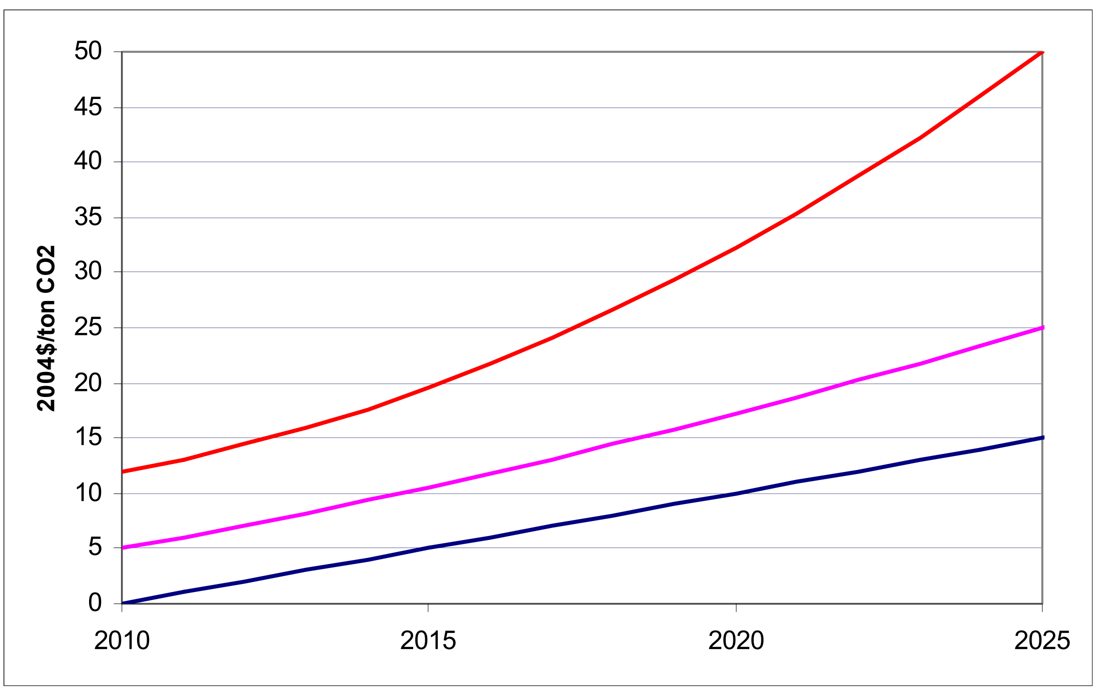
In April 2003, the Wall Street Journal reported that, Swiss Re is starting to ask companies applying for directors and officers liability coverage to explain how they are preparing for potential government regulation of greenhouse-gas emissions."

Resolved: The shareholders request that a committee of independent directors of the Board assess how the company is responding to rising regulatory, competitive, and public pressure to significantly reduce carbon dioxide and other emissions and report to shareholders (at reasonable cost and omitting proprietary information) by September 1, 2004.

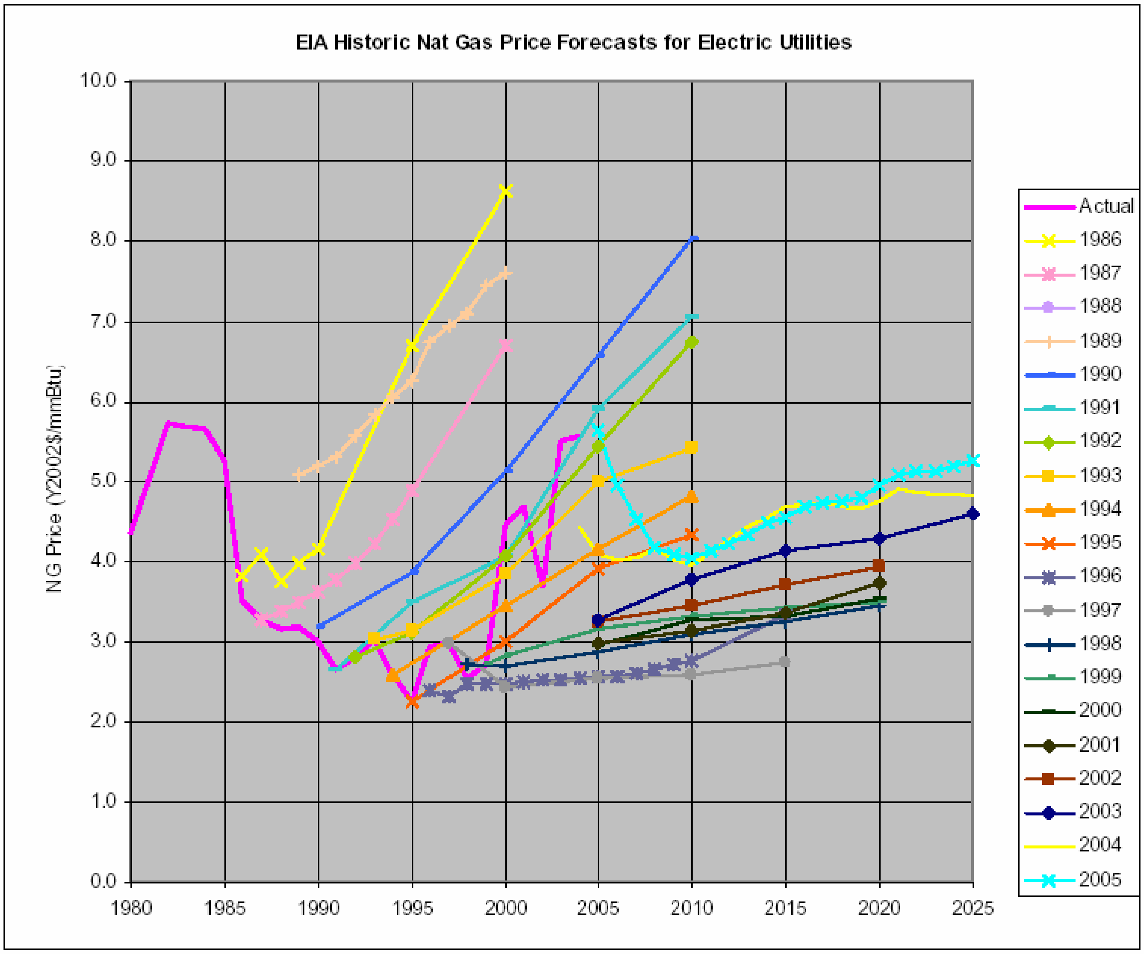
Supporting Statement:
We believe management and the Board have a fiduciary duty to carefully assess and disclose to shareholders all pertinent information on its climate change responses. We believe taking early action to reduce emissions and prepare for standards will provide competitive advantages, and inaction and opposition to emissions control efforts could expose companies to regulatory risk and reputation damage.

Carbon Dioxide Price Forecasts: Synapse Energy Economics (2004 dollars per ton of CO2)

Year	Low	Mid	High
2010	0.0	5.0	12.0
2011	1.0	6.0	13.1
2012	2.0	7.1	14.4
2013	3.0	8.2	15.9
2014	4.0	9.4	17.6
2015	5.0	10.6	19.6
2016	6.0	11.8	21.7
2017	7.0	13.1	24.0
2018	8.0	14.4	26.5
2019	9.0	15.8	29.3
2020	10.0	17.2	32.2
2021	11.0	18.7	35.4
2022	12.0	20.2	38.7
2023	13.0	21.8	42.3
2024	14.0	23.4	46.0
2025	15.0	25.0	50.0
Levelized	6.1	12.4	23.9

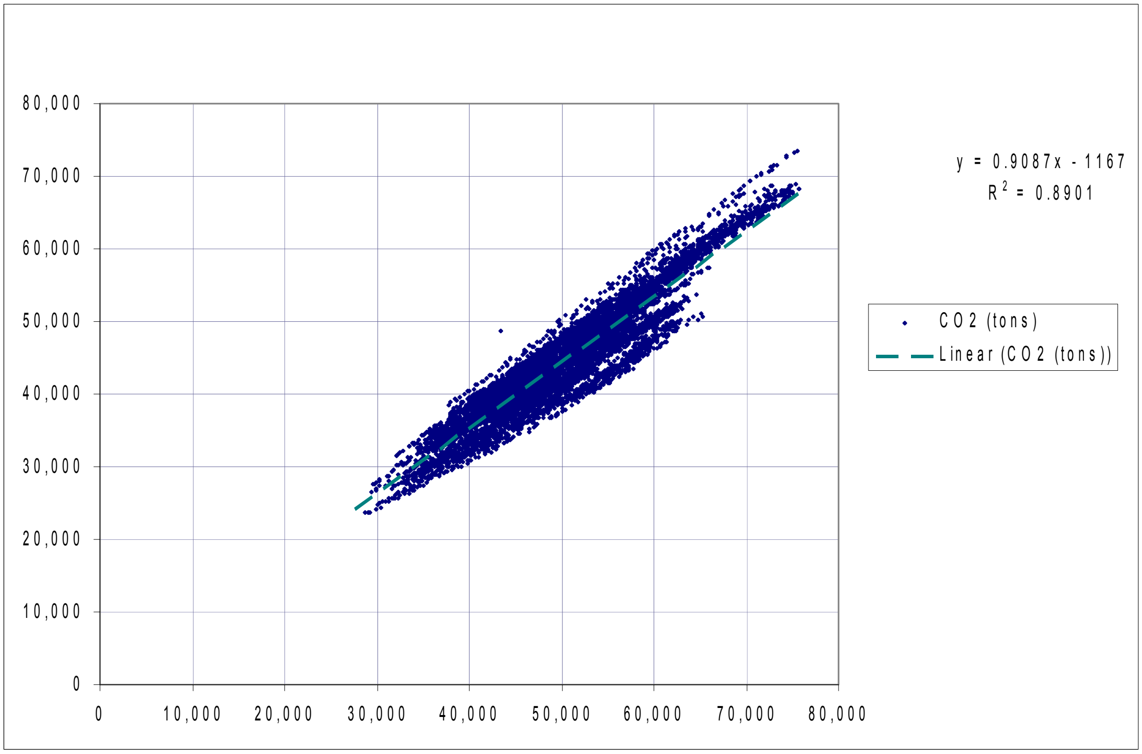


EIA Gas Price Forecasts 1986 to 2005

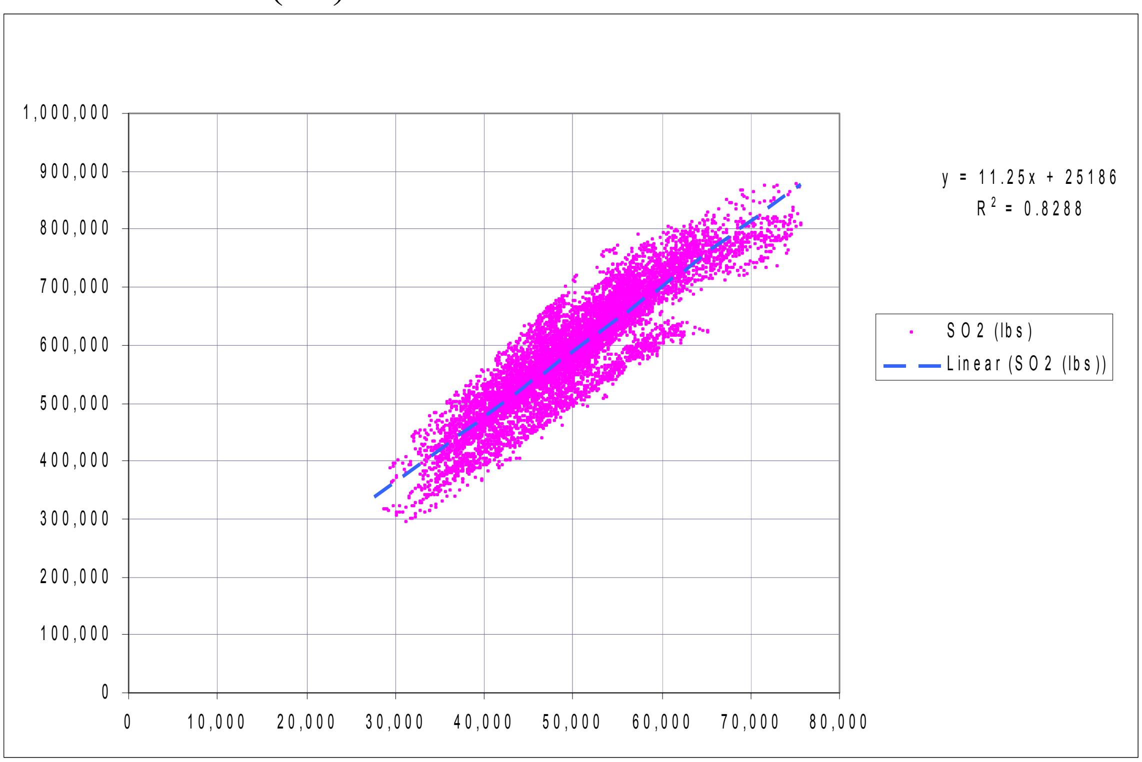


Hourly Emissions and Fossil Fuel Electricity Generation (ECAR Ohio Valley 2002)

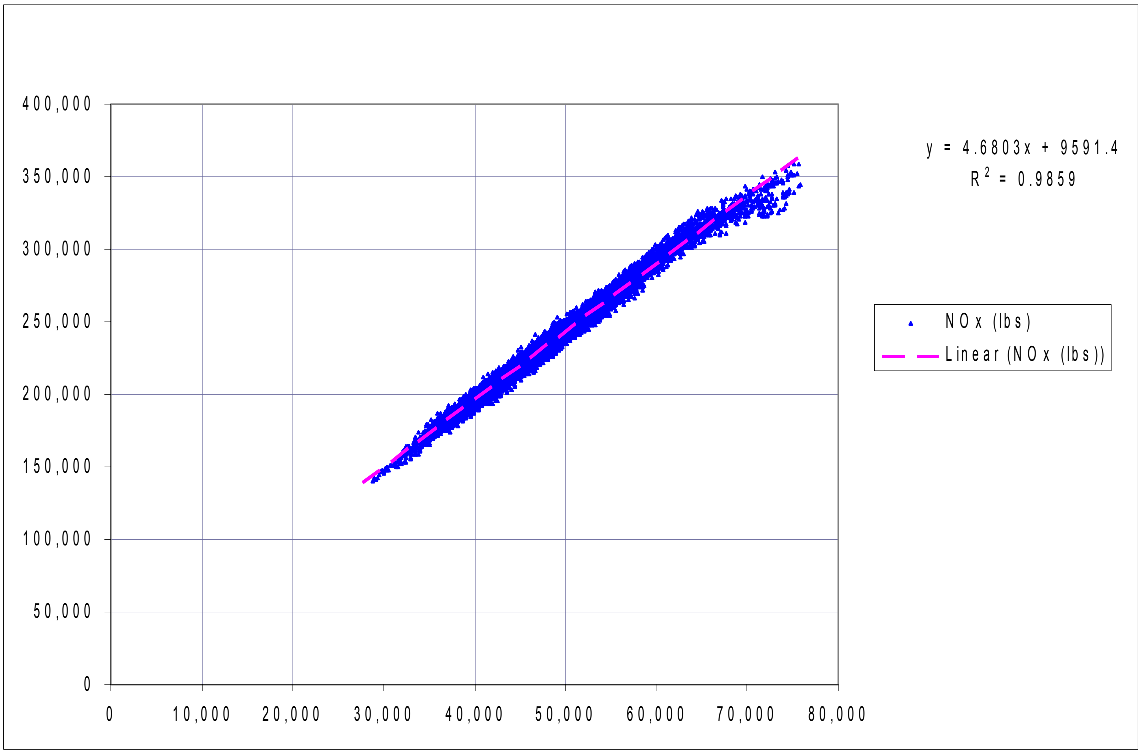
Carbon Dioxide Emissions (tons) vs. MW



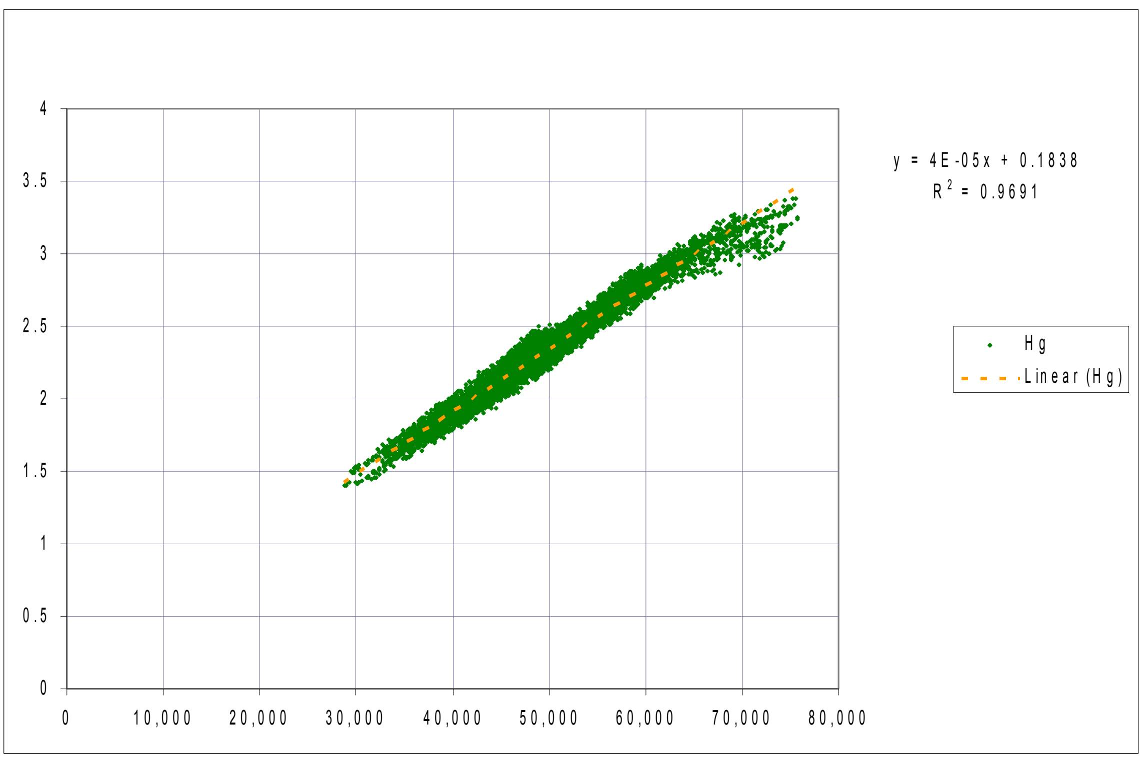
SO2 Emissions (lbs) vs. MW



NOX Emissions (lbs) vs. MW



Mercury Emissions (lbs) vs. MW



Emissions Profiles for the Cinergy System, 2010

REDACTED

REDACTED

REDACTED

REDACTED

Notes on Cinergy Air Emission Profiles

The graphs in this exhibit were created by Synapse Energy Economics based upon inputs to and outputs from the PSI's Strategist Model run sponsored by PSI witness Diane Jenner (filenames "INPFGDSLIPBASPLN14F.REP" and "OUTFGDSLIPBASPLN14F.REP", run on February 3, 2005).

From the Strategist outputs for the year 2010 we obtained the following for each of Cinergy's generating units: capacity, operating cost ("AV Var Cost"), and fuel use.

From the Strategist inputs we obtained the emissions rates by unit for SO_2, NO_x, and Hg (per MMBTU of fuel). In some cases the Strategist inputs specified different emission rates for NO_x at the low and maximum operating capacities. Where this was the case we averaged the two for purposes of this analysis. In the occasional case when the low and maximum rates were not the same, the difference between the two was less than 33% (with a few exceptions).

For CO_2, we use the following emission coefficients, based upon the US EPA's eGRID data (for the year 2000).

Fuel Type	CO2 Emissions Coefficient (short tons of CO2 per MMBTU)
Coal	0.1026
Natural Gas	0.0604
Oil	0.0798

Estimate of the Emissions Reduction Value of Energy Efficiency on the PSI System for 2010

Using ICF Emission Price Forecasts

Emission type	Estimated Displaced Emission Rate	Allowance Price (2000 $ per unit weight)	Emission Reduction Value ($/MWh)
SO2	[redacted] tons/GWh	$[redacted] per ton	$[redacted] / MWh
NOx	[redacted] tons/GWh	$[redacted] per ton	$[redacted] / MWh
Hg	[redacted] lbs/GWh	$[redacted] per lb.	$[redacted] / MWh
CO2	[redacted] tons/GWh	$[redacted] per ton	$[redacted] /MWh
Total			$[redacted] /MWh

Using Synapse Carbon Price Forecast

Emission type	Estimated Displaced Emission Rate	Allowance Price (2000 $ per unit weight)	Emission Reduction Value ($/MWh)
SO2	[redacted] tons/GWh	$[redacted] per ton	$[redacted] / MWh
NOx	[redacted] tons/GWh	$[redacted] per ton	$[redacted] / MWh
Hg	[redacted] lbs/GWh	$[redacted] per lb.	$[redacted] / MWh
CO2	900 tons/GWh	$12.4 per ton	$11.2 /MWh
Total			$[redacted] /MWh

Sources:
Estimated displaced emission rates for 2010 are calculated based on the emission profiles developed from the Company's STRATEGIST runs and presented in Exhibit BEB-20. We calculated capacity-weighted averages of the emission rates for the capacity above 5000 MW.

Allowance prices for SO2, NOx, and Hg are from ICF's analysis presented in the exhibits of Judah Rose in this case. We selected the lowest of the prices from the various cases presented. For SO2 and Mercury this was the "CAIR plus Tradable Hg" case. For NOX this was "CAIR plus MACT." See Rose's confidential exhibits D-10, D-19, and D-25.

Allowance price for CO2 is from ICF's modeling, levelized by Synapse. Specifically, the ICF forecast is the "Expected" case from page 6 of "CO2 Policy Considerations for Long Term Planning Scenarios," Green Box Meeting, July 12, 2004. See also Exhibit BEB-13.

Illustrative Costs of New Capacity Additions: Based on ICF[1]

	Combined Cycle Natural Gas	Integrated Gasification Combined Cycle Coal	Wind
Capital Cost	$[redacted]/kW	$[redacted]/kW	$[redacted]/kW
Levelized Real Fixed Charge Rate	[redacted]%	[redacted]%	[redacted]%
Capital Cost Annualized	$[redacted]/kW-year	$[redacted]/kW-year	$[redacted]/kW-year
Fixed O&M	$[redacted]/kW-year	$[redacted]/kW-year	$[redacted]/kW-year
Fixed Costs per kW-year	$[redacted]/kW-year	$[redacted]/kW-year	$[redacted]/kW-year
Capacity Factor	[redacted]%	[redacted]%	[redacted]%
Fixed Costs per MWh	$[redacted]/MWh	$[redacted]/MWh	$[redacted]/MWh
Fuel Price per MMBtu	$[redacted]/MMBtu	$[redacted]/MMBtu[2]	0
Heat Rate	[redacted] Btu/kWh	[redacted] Btu/kWh	NA
Fuel Price per MWh	$[redacted]/MWh	$[redacted]/MWh	0
Variable O&M Cost	$[redacted]/MWh	$[redacted]/MWh	0
All-in Cost (excluding emissions)	$[redacted]/MWh	$[redacted]/MWh	$[redacted]/MWh
Air emissions cost ($/MWh)[3]	$[redacted]/MWh	$[redacted]/MWh	0
All-in Cost (including emissions)	$39.3/MWh	$49.7/MWh	$41.9/MWh

[1] All costs listed are in constant year 2000 dollars. Assumptions for gas, coal, and wind plant costs are from ICF, Judah Rose Exhibits D-7A, D-7B, and D-7C and CAC 2.3 Confidential Attachment – A, part 1.

[2] [redacted]

[3] Air emissions costs are calculated in Exhibit BEB - 23.

Illustrative Air Emissions Costs of New Capacity Additions (2000 dollars)

	Combined Cycle Natural Gas	Integrated Gasification Combined Cycle Coal	Wind or Demand-Side Management
Emission rates per unit of fuel:			
SO2 (lbs/MMBTU)	0	0.03	0
NOX (lbs/MMBTU)	0.01	0.07	0
Hg (lbs/TBTU)	0	0.56	0
CO2 (lbs/MMBTU)	123	213	0
Heat Rate (Btu/kWh)	7120	8630	NA
Emission rates per unit of generation:			
SO2 (tons/GWH)	0	0.13	0
NOX (tons/GWH)	0.04	0.30	0
Hg (lbs/GWH)	0	0.005	0
CO2 (tons/GWH)	438	919	0
Emission prices			
SO2	$[redacted] per ton		
NOX	$[redacted] per ton		
Hg	$[redacted] per lb.		
CO2	$[redacted] per ton		
Air emissions cost ($/MWh)			
SO2	[redacted]	[redacted]	0
NOX	[redacted]	[redacted]	0
Hg	[redacted]	[redacted]	0
CO2	[redacted]	[redacted]	0
Total Air emissions cost ($/MWh)	[redacted]	[redacted]	0

Sources:
Emission rates and heat rates are from *Economics of Integrated Gasification Combined Cycle Coal Plant (IGCC) Investments*, NorthBridge, June 1, 2004.

Emission prices are from ICF forecasts. See the notes to Exhibit BEB - 13.

Impact of Forecasted Carbon Dioxide Prices on the Costs of New Resources

	Levelized Carbon Price (2004$ for 2010-2025)	Combined Cycle Natural Gas (2004$/MWh)	Integrated Gasification Combined Cycle Coal (2004$/MWh)
Carbon Dioxide Price			
ICF Mild	[redacted]	[redacted]	[redacted]
ICF Moderate	[redacted]	[redacted]	[redacted]
ICF Stringent	[redacted]	[redacted]	[redacted]
ICF Expected	[redacted]	[redacted]	[redacted]
Synapse Low	6.1	2.7	5.9
Synapse Mid	12.4	5.4	11.4
Synapse High	23.9	10.5	22.0

Notes:
Emission rates of 438 tons/GWH and 919 tons/GWH are used for combined cycle natural gas and integrated gasification combined cycle coal, respectively. These are from Exhibit BEB - 23.

Table 1. Efficiency Program Funding

State	Mills/kWh	% of Revenues
Connecticut	3.00	3.00
Vermont	2.90	3.40
Massachusetts	2.50	2.50
Rhode Island	2.00	2.00
New Hampshire	1.80	1.52
Maine	1.50	1.30
California	1.30	1.30
New Jersey	1.30	1.35
Oregon	1.26	2.00
Wisconsin	1.15	2.30
PSI Energy	[redacted]	[redacted]

Source: www.aceee.org/briefs/mktabl.htm, May 2004 and Testimony of Dr. William Steinhurst in Cause No. 42612.

Table 2. Efficiency Program Savings

State	Savings (MWh)	Savings (%of Sales)	Savings Year
Connecticut	24,600	0.80	2002
Vermont	38,400	0.80	2002
California	933,365	0.80	2003
Rhode Island	50,568	0.80	2002
Massachusetts	241,000	0.70	2002
Oregon	112,100	0.40	2002
Wisconsin	214,800	0.40	FY2003
Maine	25,500	0.30	2003
PSI Energy	[redacted]	[redacted]	Projected 2005
New Jersey	171,692	0.20	2002
New Hampshire	12,039	0.10	2002-2003

Source: ACEEE, *Five Years In,* April 2004 and Testimony of Dr. William Steinhurst in Cause No. 42612.

Strategist Modeled Coal Unit Information, Year 2004

Company	Plant	Unit	Capacity	Capacity Factor	Heat Rate (MMBtu/GWh)	Online Year
PSI	Cayuga	1	505	[redacted]%	[redacted]	1970
		2	500	[redacted]%	[redacted]	1972
	Edwardsport	7	45	[redacted]%	[redacted]	1949
		8	75	[redacted]%	[redacted]	1951
	Gallagher	1	140	[redacted]%	[redacted]	1959
		2	140	[redacted]%	[redacted]	1958
		3	140	[redacted]%	[redacted]	1960
		4	140	[redacted]%	[redacted]	1961
	Gibson	1	635	[redacted]%	[redacted]	1976
		2	635	[redacted]%	[redacted]	1975
		3	635	[redacted]%	[redacted]	1978
		4	627	[redacted]%	[redacted]	1979
		5	625	[redacted]%	[redacted]	1982
	Wabash River	1	290	[redacted]%	[redacted]	1953
		2	85	[redacted]%	[redacted]	1953
		3	85	[redacted]%	[redacted]	1954
		4	85	[redacted]%	[redacted]	1955
		5	95	[redacted]%	[redacted]	1956
		6	318	[redacted]%	[redacted]	1968
PSI Total			5510			
CGE	Beckjord	1	94	[redacted]%	[redacted]	1952
		2	94	[redacted]%	[redacted]	1953
		3	128	[redacted]%	[redacted]	1954
		4	150	[redacted]%	[redacted]	1958
		5	238	[redacted]%	[redacted]	1962
		6	157	[redacted]%	[redacted]	1969
	Conesville	4	312	[redacted]%	[redacted]	1973
	East Bend	2	414	[redacted]%	[redacted]	1981
	Killen	2	198	[redacted]%	[redacted]	1982
	Miami Fort	5	80	[redacted]%	[redacted]	1949
		6	163	[redacted]%	[redacted]	1960
		7	320	[redacted]%	[redacted]	1975
		8	320	[redacted]%	[redacted]	1978
	Stuart	1	228	[redacted]%	[redacted]	1971
		2	228	[redacted]%	[redacted]	1970
		3	228	[redacted]%	[redacted]	1972
		4	229	[redacted]%	[redacted]	1974
	Zimmer	1	605	[redacted]%	[redacted]	1991
CGE Total			4186			
Cinergy Total			9696			

Notes on the Strategist model data

The dispatch information presented in this exhibit was extracted from PSI's Strategist model run sponsored by PSI witness Diane Jenner (filename "[redacted]" run on February 3, 2005).

Strategist Modeled Coal Unit Emissions, Year 2004

Company	Plant	Unit	Generation (GWh)	CO2 emissions (tons)	SO2 emissions (tons)	NOx emissions (tons)	Mercury emissions (lbs)
PSI	Cayuga	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Edwardsport	7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Gallagher	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Gibson	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Wabash River	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
PSI Total			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CGE	Beckjord	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Conesville	4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	East Bend	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Killen	2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Miami Fort	5	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		7	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		8	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Stuart	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	Zimmer	1	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CGE Total			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Cinergy Total			[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Company	Plant	Unit	CO2 tons/ GWh	SO2 tons/ GWh	NOx tons/ GWh	Hg lbs/ GWh
PSI	Cayuga	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
	Edwardsport	7	[redacted]	[redacted]	[redacted]	[redacted]
		8	[redacted]	[redacted]	[redacted]	[redacted]
	Gallagher	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]
	Gibson	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]
	Wabash River	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]
PSI Total			[redacted]	[redacted]	[redacted]	[redacted]
CGE	Beckjord	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]
		5	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]
	Conesville	4	[redacted]	[redacted]	[redacted]	[redacted]
	East Bend	2	[redacted]	[redacted]	[redacted]	[redacted]
	Killen	2	[redacted]	[redacted]	[redacted]	[redacted]
	Miami Fort	5	[redacted]	[redacted]	[redacted]	[redacted]
		6	[redacted]	[redacted]	[redacted]	[redacted]
		7	[redacted]	[redacted]	[redacted]	[redacted]
		8	[redacted]	[redacted]	[redacted]	[redacted]
	Stuart	1	[redacted]	[redacted]	[redacted]	[redacted]
		2	[redacted]	[redacted]	[redacted]	[redacted]
		3	[redacted]	[redacted]	[redacted]	[redacted]
		4	[redacted]	[redacted]	[redacted]	[redacted]
	Zimmer	1	[redacted]	[redacted]	[redacted]	[redacted]
CGE Total			[redacted]	[redacted]	[redacted]	[redacted]
Cinergy Total			[redacted]	[redacted]	[redacted]	[redacted]

Notes on Projection of Cinergy and PSI Carbon Dioxide Emissions

The carbon projections in this exhibit were calculated by Synapse Energy Economics based upon fuel use projections in the PSI's Strategist Model run sponsored by PSI witness Diane Jenner (filename "[redacted]" run on February 3, 2005).

The following emission coefficients, based upon the US EPA's eGRID data (for the year 2000), were used in this calculation.

Fuel Type	CO2 Emissions Coefficient (short tons of CO2 per MMBTU)
Coal	0.1026
Natural Gas	0.0604
Oil	0.0798

eGRID Emissions Data on Cinergy Coal Units, Year 2000

Company	Plant	Unit	Generation (GWh)	CO2 emissions (tons)	SO2 emissions (tons)	NOx emissions (tons)
PSI	Cayuga	1	3,535	3,668,940	34,978	5,728
		2	3,042	3,058,255	30,755	4,568
	Edwardsport	6-8	528	840,477	10,793	2,857
	Gallagher	1	854	920,427	15,422	1,972
		2	817	873,980	14,643	1,872
		3	864	912,720	14,890	1,888
		4	831	861,441	14,053	1,782
	Gibson	1	4,407	4,744,240	50,572	10,427
		2	3,857	4,134,667	44,074	9,087
		3	3,941	4,064,852	46,391	8,958
		4	4,257	4,506,391	9,760	9,931
		5	4,888	4,553,205	20,708	9,414
	Wabash River	1	1,025	1,012,559	657	387
		2	473	509,809	6,523	1,335
		3	568	592,172	7,577	1,950
		4	422	479,073	6,130	1,571
		5	669	694,215	8,882	2,232
		6	2,050	2,243,311	28,703	3,939
PSI Total			37,028	38,670,733	365,510	79,899
CGE	Beckjord	1	550	624,804	4,437	2,033
		2	604	732,574	4,941	2,331
		3	925	1,109,633	7,753	5,458
		4	1,043	1,137,265	7,722	3,530
		5	1,396	1,468,987	16,139	3,080
		6	2,592	3,005,824	30,442	4,978
	Conesville	4	4,149	4,043,186	76,277	9,588
	East Bend	2	4,363	4,669,205	14,850	8,671
	Killen	2	4,593	4,769,250	24,636	10,548
	Miami Fort	5	437	528,321	6,290	2,688
		6	1,216	1,407,599	16,759	3,260
		7	3,505	3,780,256	39,663	9,717
		8	3,390	3,592,091	18,801	9,853
	Stuart	1	3,910	4,114,221	29,043	12,127
		2	3,910	4,021,769	28,501	11,657
		3	3,253	3,187,690	22,686	9,577
		4	3,629	3,704,587	25,425	9,938
	Zimmer	1	7,685	8,119,286	19,411	18,682
CGE Total			51,150	54,016,544	393,774	137,714
Cinergy Total			88,178	92,687,276	759,284	217,613

Company	Plant	Unit	CO2 tons/ GWh	SO2 tons/ GWh	NOx tons/ GWh
PSI	Cayuga	1	1,038	9.9	1.6
		2	1,005	10.1	1.5
	Edwardsport	6-8	1,592	20.4	5.4
	Gallagher	1	1,077	18.1	2.3
		2	1,070	17.9	2.3
		3	1,057	17.2	2.2
		4	1,037	16.9	2.1
	Gibson	1	1,077	11.5	2.4
		2	1,072	11.4	2.4
		3	1,031	11.8	2.3
		4	1,059	2.3	2.3
		5	932	4.2	1.9
	Wabash River	1	988	0.6	0.4
		2	1,078	13.8	2.8
		3	1,042	13.3	3.4
		4	1,137	14.5	3.7
		5	1,037	13.3	3.3
		6	1,094	14.0	1.9
PSI Total			1,044	9.9	2.2
CGE	Beckjord	1	1,135	8.1	3.7
		2	1,213	8.2	3.9
		3	1,200	8.4	5.9
		4	1,090	7.4	3.4
		5	1,053	11.6	2.2
		6	1,159	11.7	1.9
	Conesville	4	975	18.4	2.3
	East Bend	2	1,070	3.4	2.0
	Killen	2	1,038	5.4	2.3
	Miami Fort	5	1,208	14.4	6.1
		6	1,157	13.8	2.7
		7	1,078	11.3	2.8
		8	1,060	5.5	2.9
	Stuart	1	1,052	7.4	3.1
		2	1,029	7.3	3.0
		3	980	7.0	2.9
		4	1,021	7.0	2.7
	Zimmer	1	1,056	2.5	2.4
CGE Total			1,056	7.7	2.7
Cinergy Total			1,051	8.6	2.5

Sources:
EPA's eGRID emissions database (http://www.epa.gov/cleanenergy/egrid/index.htm)