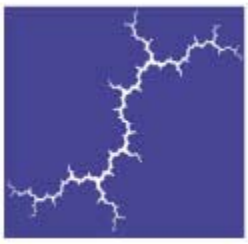

Synapse
Energy Economics, Inc.

Greenhouse Gas Reduction Strategies of Electric and Gas Companies in North America

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I. Introduction

I.A. Context

Both the United States and Canada are signatories to the United Nations Framework Convention on Climate Change. As signatories, they have agreed to a goal of "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system." Canada has ratified the Kyoto Protocol, the United States has not. Neither of the federal governments has adopted mandatory climate change policies. The Bush Administration has only recently acknowledged the link between anthropogenic greenhouse gas emissions and climate change, and continues to favor voluntary approaches to emissions reductions. Despite inaction to date at the federal level in North America, several factors are driving greenhouse gas reduction to the forefront of public policy debate, making it an increasingly important issue in the resource decisions of many owners of electric generation and natural gas facilities. State and provincial governments, the financial community, public opinion, and changes in federal government are all beginning to push consideration of greenhouse gas emission risks in energy resource decisions.

In the absence of federal action in North America, state or provincial governments are imposing requirements that affect greenhouse gas emissions. In the United States, states are adopting variety of policies that focus primarily on electric sector greenhouse gas emission reductions, though several states seek to reduce greenhouse gases from the transportation sector. In Canada, federal actions are very slow as they are in the U.S. Some provinces have adopted greenhouse gas reduction policies, but emissions in most provinces have been increasing since 1990.

The financial community (investors, banks, insurers) has become interested in greenhouse gas emissions as a risk factor in investments, loans, and insurance policies. Some of these entities now require that risks associated with greenhouse gas emissions be specifically factored into financial decisions. Similarly, public awareness and education on climate change issues in both countries means that the public is beginning to expect that corporate and policy leaders address climate change. While public awareness has been slower to develop in the U.S., recent trends indicate climate change is no longer a marginalized issue in this country.

Finally, both countries have seen major changes at the federal level recently. In the United States, elections in November 2006 changed the leadership in both legislative houses of Congress (Senate and House). There is widespread expectation that climate change, and policies to address climate change, will be given great attention in the new Congress, perhaps even over the objections of the President. Similarly, a new federal government in Canada is likely to take a stronger approach to climate change policy.

In this context, while many energy companies see financial risks to their businesses, growing number of electric and gas companies have initiated a wide range of actions, both required and voluntary, to quantify and reduce greenhouse gas emissions. Some

companies already face mandatory greenhouse gas emission reduction requirements. Some companies are required to examine the risks associated with their resource portfolios in the face of potential mandatory reduction requirements. Several electric and gas companies are participating actively in the development of state, provincial, and federal policies pertaining to greenhouse gas emissions and energy resource portfolios. Many electric companies are required to incorporate and increase renewable energy generation among their supply portfolio. Finally numerous electric utilities and several gas utilities are implementing customer-side energy efficiency programs.

I.B. Purpose of this research

This report investigates and surveys how electric and gas companies in North America are developing strategies to address risks associated with greenhouse gas emission regulation and other climate change impacts.

I.C. Research approach

Synapse will collect information through interviews and publication reviews. We will consult sources such as state and provincial regulatory commissions, federal policy makers, electric and gas utilities, industrial organizations (e.g., American Gas Association, American Petroleum Institute, Gas Research Institute, and Electric Power Research Institute), investment analysts, consulting firms, conference proceedings and presentations, and public interest organizations.

I.D. Structure of the report

First we provide an overview of regulatory structure and initiatives in North America in Section II. The purpose of this section is to describe the context within which energy companies are taking decisions. Section III describes different types of strategies that companies are pursuing in light of potential carbon constraints.

II. Regulatory structure and initiatives in North America

Before surveying the actions of energy companies, it is important to understand the regulatory context within which they operate. In general, in North America, energy companies can be subject to regulation by federal government as well as by state or provincial government. "Energy Companies" in North America encompass a broad range of corporate structures covering retail activities, wholesale activities, or both. For example, some electric companies are vertically integrated, owning electric generation, transmission and distribution. Some gas companies offer retail service to customers. Other companies only own power plants, provide wholesale gas supply. In general, emissions from power plants are controlled by federal and state regulations. As described below, Greenhouse gas emission reduction requirements could be imposed at the federal level, at the state or provincial level, or both.

II.A. Federal policies and proposals

Neither the United States nor Canada has imposed federal mandatory emission reduction requirements; both federal governments have favored voluntary approaches to

greenhouse gas emissions. Both countries have considered several legislative proposals. In the United States the primary emissions regulation tool for the federal government is the Clean Air Act (CAA) that was adopted in 1970 and amended in 1977 and 1990. Greenhouse gases are not defined as pollutants under the CAA, though several states have taken legal action to have greenhouse gases defined as pollutants under the CAA and therefore subject to regulation. The current President opposes a mandatory program fearing that such a program would harm the country's economy. There have been various legislative proposals for mandatory greenhouse gas reduction programs all of which focus on a cap and trade program. Lively debate continues over such questions as (1) whether requirements should apply to the power sector only or to all sectors (2) whether requirements apply to upstream sources (e.g. fossil fuel suppliers) or to downstream emission sources (such as power plants and automobiles), (3) whether emission reduction targets are established as a tonnage cap or an emissions intensity limit, and (4) whether emissions allowances (or permits) should be distributed by allocation or by auction.

In Canada, the federal government regulates air pollutants under the Canadian Environmental Protection Act. Emissions standards are set primarily by the federal government (though Provinces can set more stringent standards). Electricity is regulated primarily on the provincial level (thought the Federal government has jurisdiction over electricity exports, and transmission lines to serve those exports). Provinces determine how the federal emissions standard should be achieved, (e.g. via fuel switching, back-end controls, or other method), on a least cost basis. These jurisdictional lines are well defined and have historically been respected, and as a result there is somewhat of a disconnect between electricity & environmental regulation. For example, there may be little or no incentive to do significantly better than the standard. Even if utilities have high confidence that a tighter federal emissions standard is on the horizon, they may not pursue the resource option that would have the best economics under that most likely scenario for fear of having costs disallowed.

However, as in the United States, the current administration does not define greenhouse gases as air pollutants. Under the previous government, a program based on voluntary measures was implemented but fell far short of its goals. Recent proposals from Prime Minister Harper and Liberal party leader Stephane Dion are both mandatory, albeit on very different time scales. Recent emphasis has been on intensity-based targets (e.g., tons/mmBtu or MWh) in Canada, although this emphasis is shifting as opposition groups criticize the current government's proposed Clean Air Act for its inability to meet Kyoto targets.

Electric power companies in the U.S. are required to have continuous emissions monitors (CEMS) for all facilities above a threshold that approximates a 25MW plant, and the data is reported to EPA. CEMS are required by legislation or by the EPA under several emission limitations or standards (for example, the 1990 Clean Air Act Amendments required CEMS to monitor the Acid Rain Program). Canada's federal government requires all companies to report greenhouse gas emissions from all facilities that emit more than 100,000 metric tons of greenhouse gases annually.

II.B. State and Provincial policies and proposals

In addition to federal regulation, energy companies in North America are subject to state or provincial regulation. States and Provinces are implementing and developing a wide variety of programs that reduce greenhouse gas emissions from the electric sector. States in the United States are charged with implementing the CAA and with adopting regulations that protect the health and welfare of citizens. States can generally adopt emissions limits on sources in order to protect health and welfare of citizens, including for pollutants that the federal government does not regulate. Several states have determined that reducing GHG is necessary and that they will require such reductions for sources under their jurisdiction in the absence of federal policy (as described more below). State policies generally fall into the following categories: (a) policies that require specific greenhouse gas emission reductions from electric generation sources; (b) indirect policies that affect electric sector resource mix such as planning requirements or those promoting low-emission electric sources; and (c) legal proceedings that seek federal regulation of greenhouse gases. In Canada the federal government needs provinces to participate in GHG policy development, because provinces have jurisdiction over electricity. The proposed federal Clean Air Act could overlap and conflict with provincial policies.

Following is a description of the main types of state and provincial policies in North America that address greenhouse gas emissions from power companies.

Mandatory Cap and Trade: There are two main cap and trade programs under development in U.S. states. The Regional Greenhouse Gas Initiative is a program to develop a greenhouse gas cap and trade program for power plants in the northeastern United States. Discussions to develop the program began in 2003, states signed a memorandum of understanding identifying the main elements of the program in December 2005 and in August 2006 they adopted a model rule for implementing the program.[1] Currently nine states have decided to participate: CT, DE, MA, ME, NH, NJ, NY, RI and VT. Maryland passed a law in April 2006 requiring participation in RGGI.[2] Pennsylvania, the District of Columbia, the Eastern Canadian Provinces, and New Brunswick are official "observers" in the RGGI process.[3]

As currently designed, the program will:

- Stabilize CO_2 emissions from power plants at current levels for the period 2009-2015, followed by a 10 percent reduction below current levels by 2019.
- Allocate a minimum of 25 percent of allowances for consumer benefit and strategic energy purposes. Allowances allocated for consumer benefit will be auctioned and the proceeds of the auction used for consumer benefit and strategic energy purposes.
- Include certain offset provisions that increase flexibility to moderate price impacts and development of complimentary energy policies to improve energy efficiency,

[1] Information about RGGI is available at the website: www.rggi.org

[2] Maryland Senate Bill 154 *Healthy Air Act*, signed April 6, 2006.

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

decrease the use of higher polluting electricity generation and to maintain economic growth.[4]

Individual states are now engaged in regulatory proceedings to adopt regulations consistent with the agreement. Initial indications are that several states (such as New York and Massachusetts) contemplate auctioning the majority or all of the allowances requiring emitters to purchase allowances rather than receiving them for free.

In September 2006 California adopted a law requiring an estimated 25 percent cut in the state's greenhouse gas emissions by 2020. "The Global Warming Solutions Act" is the first enforceable state-wide program in the U.S. to cap all greenhouse gas emissions from major industries that includes penalties for non-compliance. The State Air Resources Board will have to write regulations to implement the law by 2011, including a program for statewide greenhouse gas emissions reporting and provisions to monitor and enforce compliance with this program. The state board can adopt market-based compliance mechanisms including cap-and-trade, and allows a one-year extension of the targets under extraordinary circumstances. Companion legislation requires the state Public Utilities Commission establish a performance standard for utilities that requires at a minimum that emissions not exceed the greenhouse gases associated with a combined cycle natural gas plant that is considered among the cleanest available. California plans to link its allowance trading program with the program developed under RGGI. Two other states are considering economy-wide caps on greenhouse gas emissions, New Jersey and Oregon, though those programs are not final.

Carbon sequestration requirement: British Columbia has announced its intent to impose low-carbon mandates for fuel and coal-fired power plants, and to require 100 percent carbon sequestration for power plants.[5]

Offset requirements: Oregon requires new power plants to mitigate their global warming impact by offsetting approximately 17 percent of their CO_2 emissions. The legislation (Oregon HB 3283) allows power plant developers to meet a CO_2 emission standard by paying into a Trust ("The Climate Trust"), which uses the funds to stimulate projects that reduce or sequester CO_2 emissions. The neighboring state of Washington requires new power plants to offset approximately 20 percent of anticipated CO_2 emissions. Massachusetts requires new power plants to make a monetary contribution intended to fund projects to offset one percent of the plant's CO_2 emissions over 20 years. Other states are also considering offset requirements. For example, the Governor of

[4] The MOU states "Each state will maintain and, where feasible, expand energy policies to decrease the use of less efficient or relatively higher polluting generation while maintaining economic growth. These may include such measures as: end-use efficiency programs, demand response programs, distributed generation policies, electricity rate designs, appliance efficiency standards and building codes. Also, each state will maintain and, where feasible, expand programs that encourage development of non-carbon emitting electric generation and related technologies." RGGI MOU, Section 7, December 20, 2005.

[5] Greenwire, February 14, 2007.

Minnesota has called on electric utilities to include offsets in any proposal for any new fossil-fueled power plants.[6]

State emission reduction goals: Several states have adopted statewide emission reduction goals, though they may not have adopted mandatory greenhouse gas emission reduction requirements for the power sector. States with greenhouse gas emission reduction goals include Arizona, California Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New Mexico, New York, Oregon, Rhode Island, and Vermont. Other states, like Illinois and Minnesota are in the process of considering what goals would be appropriate, while South Carolina and Florida are initiating a study process.

Canadian provinces have also adopted emission reduction goals. For example, British Columbia, announced intentions to cut greenhouse gas emissions 33 percent by 2020 through controls on vehicles, fuel and power plants.[7] Alberta has adopted new climate change legislation requiring large emitters to slice their greenhouse gas emissions intensity (carbon dioxide per barrel) by 12% between July 1 (when regulations take effect) and Dec. 31, 2007. If they don't succeed, the legislation includes other compliance options, including a technology fund.[8] We provide a table of state emission reduction goals in the Appendix.

Requirements for resource portfolio planning:[9] Some states require companies under their jurisdiction to account for costs and/or risks associated with regulation of greenhouse gas emissions in resource planning. These states include California, Oregon, Washington, Montana, Kentucky (through staff reports), Utah, and Washington. Other states, such as Vermont, require that companies take into account environmental costs generally. The Northwest Power and Conservation Council includes various carbon scenarios in its Fifth Power Plan.

California has one of the most specific requirements for valuation of carbon in integrated resource planning. The California Public Utilities Commission (PUC) requires companies to include a carbon adder in long-term resource procurement plans. The Commission's decision requires the state's largest electric utilities (Pacific Gas & Electric, Southern California Edison, and San Diego Gas & Electric) to factor the financial risk associated with greenhouse gas emissions into new long-term power plant investments, and long-term resource plans. In April 2005, the Commission adopted a CO_2 adder of $8 per ton of CO_2 in 2004, escalating at 5% per year, for use in resource planning and bid evaluation.[10]

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[6] Platts, December 13, 2006.

[7] Greenwire, Februrary 14, 2007.

[8] National Post, "Premier, Alberta PM tout greener oilsands," March 9, 2007.

[9] This section of the report draws on the following report Johnston et. al., *Climate Change and Power: Carbon Dioxide Emissions Costs and Electricity Resource Planning*. Synapse Energy Economics, May 2006.

[10] California Public Utilities Commission, Decision 05-04-024, April 2005.

The Montana Public Service Commission specifically directed Northwest Energy to evaluate the risks associated with greenhouse gas emissions in its 2005 Integrated Resource Plan (IRP).[11] In early 2007 the Oregon Public Utilities Commission (PUC) issued revised guidelines and direction on integrated resource planning; in 2007 the Commission will investigate the treatment of carbon dioxide risk in IRPs and a carbon dioxide emissions standard for long-term power supplies.[12]

Incorporating evaluation of financial risk associated with greenhouse gas emissions is a prudent strategy given the following factors: (1) analyses of economy-wide policy proposals in the U.S. indicate that a majority of emissions reductions would be from the electric sector;[13] (2) a company can assess whether its resource plan is robust under a variety of scenarios; (3) capital stock in the electric industry usually has a lifetime of fifty or more years and consequently is particularly vulnerable to changing external market and regulatory conditions;[14] and (4) analysis indicates that control decisions are more efficient if they factor in multiple pollutants than if they address emission control requirements for one pollutant at a time.[15]

State requirements range from the use of a specific value, such as in California, to a general requirement that companies consider the risk of future regulation in their planning process. We provide a table summarizing state requirements for consideration of greenhouse gas emissions in the planning process in the Appendix.

There are also other indirect state policies that aim to reduce GHG emissions from electricity and natural gas usage through increasing the amount of renewable energy generation such as solar, wind, and biomass and through improving customer-side energy efficiency. These policies are often formulated in pursuit of various other objectives such as reduction of various other pollutants (e.g., nitrogen oxide, sulfur dioxide, mercury, particular matters, etc), creation of local job, increase of disposal income, reduction of risks associated with fossil fuels, improvement of energy self-sufficiency and resource diversity.

Renewable Portfolio Standard (RPS): A large number of states across the United States and Canada are implementing RPS to encourage the development of renewable energy such as wind, solar, and biomass-fueled generation. An RPS requires retail sellers of

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[11] Montana Public Service Commission, "Written Comments Identifying Concerns with NWE's Compliance with A.R.M. 38.5.8209-8229," August 17, 2004.

[12] Oregon Public Utilities Commission, Order No. 07-002 in docket UM-1056, January 8, 2007.

[13] See EIA, Analysis of S. 139, the Climate Stewardship Act of 2003, June 2003, SR/OIAF/2003-02, page 13; EIA, Analysis of Senate Amendment 2028, the Climate Stewardship Act of 2003, May 2004, SR/OIAF/2004-06, page 5; EIA. "Energy Market Impacts of Alternative Greenhouse Gas Intensity Reduction Goals," March 2006, SR/OIAF/2006-01, page 18.

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

[15] US EPA, *Analysis of Emissions Reduction Options for the Electric Power Industry*, March 1999; EIA, *Analysis of Strategies for Reducing Multiple Emissions from Power Plants: Sulfur Dioxide, Nitrogen Oxides, and Carbon Dioxide*, December 2000.

electricity (or load-serving entities or LSEs) to include a certain amount of (generally increasing percentage of) renewable resources in their total portfolio of electricity supply mix. A RPS often combines a flexible market mechanism that allows companies to satisfy their goals just by purchasing renewable energy certificates from other entities. One REC is often created for MWh of renewable generation. To date, approximately 21 states plus Washington D.C. in the U.S. have implemented a RPS or a similar type of policy.[16] In Canada, 10 provinces have adopted a RPS or a similar type of policy.[17] Most RPS policies are applied to investor-owned utilities or retail energy suppliers, though some other types of utilities-- such as municipal and cooperative utilities—have also adopted RPSs. We provide a table summarizing the magnitude of the RPS targets in the U.S.

Feed-in Tariff (FIT): While an RPS establishes targets for the quantity of renewable generation and the market (including spot and bilateral) determines the prices for certificates and/or power, a FIT establish a long-term, fixed prices to renewable energy sources. Renewable generators under an RPS in deregulated states and provinces often suffer from difficulties in having long-term contract; a FIT in its inherent design guarantees the long term payment to generators. FIT policies are widespread in European countries but are not popular in North America. However, some states and provinces recently proposed or adopted FIT in the U.S. and Canada.

Net Metering: Net metering allows consumers with renewable generators under a certain capacity (e.g., less than 1 MW) to turn back their electric meter when electricity generation exceeds customer demand. At the end of month or a certain set period, only net consumption is charged to customers or if there is any net generation, customers often can "bank" the excess and use it in the following months. Net metering is a low-cost, easily administered way of promoting renewable energy by consumers because it allows customers to effectively receive retail price for the excess electricity they generate. Currently more than 35 states have adopted net metering policies.[18]

System Benefit Charges (SBC): SBC have been adopted by many states to fund programs associated with energy conservation, low-income energy assistance, and renewable energy. It is a non-bypassable and competitively neutral charge because it applies to all sales, and the collection of funds does not create any disadvantages for any competitive energy providers. SBC is normally collected by distribution companies through a small amount of money per KWh. Currently around 23 states have adopted a SBC type policy to fund public purpose programs.

Demand-side management (DSM): Utility DSM programs are programs to improve customer-side energy efficiency and reduce peak energy demand. It is often referred to

[16] Database of State Incentives for Renewables & Efficiency (DSIRE) at http://www.dsireusa.org/library/includes/type.cfm?EE=0&RE=1

[17] Pollution Probe, "Green Power Provincial Targets and Policies," August 2006, http://www.pollutionprobe.org/whatwedo/greenpower/GP%20Provincial%20Targets%20and%20Policies%20-%20Aug%20'06.pdf

[18] See http://www.eere.energy.gov/greenpower/markets/netmetering.shtml

as energy efficiency or conservation programs when there is no load management programs. DSM started in 70s when energy prices skyrocketed due to oil crises. To date, a large number of states and provinces require electric and gas utilities to implement DSM or energy efficiency programs to pursue various objectives including GHG emissions and other pollutants reduction, energy bill reduction, local job creation, and local economic development. The costs of the programs are either recovered in rates or SBC discussed above.

Energy Efficiency Resource Standard (EERS): An EERS is a mandate to achieve a certain level of energy savings from energy efficiency measures at end-use. It is similar to a RPS in that efficiency providers can bank and trade energy efficiency savings in the form of "credits" or "certificates." Currently nine states (California, Colorado, Hawaii, New Jersey, Nevada, Pennsylvania, Texas, and Vermont) have adopted an EERS or a similar policy. Some of these states have incorporated efficiency standards as part of an RPS.

III. Company activities

Within the regulatory context described in Section II, companies are identifying risks and opportunities that could arise in a carbon constrained future. Perceived risks include the following:

- Impact of future constraints on existing assets
- Changes in demand for energy due to lower and higher temperatures, and due to higher energy cost
- Changes in market position relative to competitors
- Impacts on brand value and reputation due to stakeholder perception of risk
- Uncertain environment for investments in long-lived resources.

Forced premature retirement of existing capital stock is one of the primary concerns of companies who have coal-fired power plants. American Electric Power has determined that "the central challenge that the company faces is that of making decision about large investments in long-lived assets in a setting of uncertain public policy and rapidly evolving technology."[19] Similarly, E.ON, a German company that owns assets in the U.S., says the "main commercial risk arising from climate change is the political uncertainty about the future of carbon emissions reduction policy. E.ON makes large capital investments in projects with long lifetimes whose commercial viability is very sensitive to CO2 price assumptions. It is therefore essential to have a long term stable international framework for reducing CO2 emissions to give sufficient certainty to investors to make the right long term investment decisions."[20]

Different companies have different risk profiles in a carbon- constrained environment due to different corporate structures (e.g. regulated cost recovery or independent), and

[19] American Electric Power response to the Carbon Disclosure Project 4, question 2.

[20] E.ON. response to CDP 4, Question 1

different resource portfolios (low carbon vs. high carbon). Opportunities and risks are perceived differently by different groups.[21] Institutional investors have initiated a worldwide effort to gather information about companies' greenhouse gas emissions and corporate strategies on climate change.

The Carbon Disclosure Project (CDP), an effort to gather information on how companies around the world are addressing carbon emissions and climate change, was launched in 2000. Each year more companies from around the world and diverse sectors participate, and these companies' responses are a valuable source of information on carbon risks, opportunities and corporate attitudes and strategies.[22] The CDP estimates that "some U.S. Electric Utilities could face costs equivalent to 7% of revenue if they had to reduce emissions by 25%, as proposed by new regulations instituted in California recently, on the basis of their emissions today."[23] Some investor research services anticipate greenhouse gas regulation within five years, and anticipate that such regulations will have very different implications for companies depending on their fuel mix.[24] For example, Citigroup anticipates that nuclear generators will do well under any scenario, gas generators are likely to see margins improve in most scenarios, and coal generators could benefit from higher energy prices when coal is on the margin, but will suffer when gas is on the margin under a scenario where generators must purchase emission allowances.

The degree to which a generating unit benefits from higher energy prices in the market is affected by the unit's cost (including costs associated with the greenhouse gas emissions). Thus the impact of market prices on an energy source will be affected by the relative magnitude of increased costs associated with carbon emissions and increased revenue associated with higher prices for electricity sold in the market. Nuclear, which has no increased costs associated with compliance, will always benefit from higher prices and sees the greatest revenue increase. With respect to fossil fuel generating resources, the degree of benefit varies as a function of different control and allocation scenarios. Since coal has higher greenhouse gas emissions on a per kWh basis than gas, a greater share of its revenues will go to allowance costs if allowances are auctioned. In regions where coal is on the margin (i.e. setting the market price), the market price will essentially include costs associated with greenhouse gas emissions from coal (either actual costs, or opportunity costs). In regions where gas is on the margin (i.e. setting the market price), the market price will essentially include costs associated with GHG emissions from gas - these costs are much lower than costs of GHG from coal due to the higher emissions from coal.

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[21] CERES, *2006 Corporate Governance and Climate Change: Making the Connection*, 2006, http://www.ceres.org/pub/publication.php?pid=84

[22] Information on the Carbon Disclosure Project is available at the website: www.cdproject.net

[23] Thomas, S. , *Carbon Disclosure Project Report 2006 Electric Utilities 265*, Carbon Disclosure Project, January 2007, www.calpers.ca.gov/eip-docs/about/press/news/elec-util-265.pdf; The CDP website is a public source of annual emissions reports from over 1,000 companies from 2002 on and is regarded as the world's largest repository of corporate GHG emissions today.

[24] Gordon and Chin, *Carbon Limits are Coming*, Citigroup, September 11, 2006; H Wynn, *U.S. Utilities: The Prospects for CO2 Emissions Limits in the United States and their Implications for the Power Industry*, Bernstein Research, April 2006.

Companies also see several opportunities arising from carbon constraints. Perceived opportunities include:

- Enhanced value of existing low carbon resources. For example, companies that have high percentages of nuclear, natural gas, and renewables in their resource mix anticipate that carbon constraints will enhance the value of their low carbon resources.
- Opening new lines of business. Many companies are developing new low carbon resources such as renewables, or are developing new technologies, such as carbon capture and sequestration, to ensure that the U.S. coal resource can be used. In pursuing this strategy companies anticipate profiting from technology development and diffusion.
- Possibilities for gaining a competitive edge over rivals through lower carbon resources and public perception of company.

Many companies in the power sector, but certainly not all, have undertaken a number of different types of activities related to greenhouse gas emissions. As an initial matter, many companies have assigned responsibility for climate change activities to specific people, or groups of people within the company. Beyond that, the activities include measuring and reducing emissions from existing assets, avoiding emissions, managing emissions, offsetting emissions, and participating in the formation of public policies. For example, Sempra Energy recently dropped plans to build two coal–fired power plants in Nevada and Idaho because of impending state regulations to curb global warming pollutants. PG&E has avoided coal altogether, opting instead to spend billions of dollars on energy efficiency so that it will delay needing new power sources. And even though American Electric Power is relying on coal, it is pushing to build "clean coal" power plants in the Midwest that will be able to capture carbon dioxide, the main pollutant causing global warming.[25]

In general companies undertake these activities for a variety of reasons including reducing their exposure to risks associated with anticipated carbon constraints, gaining experience with new technologies and processes, developing a competitive edge over other companies, and shaping public policy. A recent report on Corporate Strategies that address climate change indicates that the following are considered very important: (1) strategic timing to ensure that company action is not too early or too late, (2) establishing an appropriate level of commitment, (3) influencing policy development, and (4) creating business opportunities.[26]

Carbon dioxide emissions from the electric industry grew 27% between 1990 and 2004 (compared with a 36% reduction in SO_2 emissions, and a 44% reduction in NO_x emissions). The US Energy Information Administration projects that CO2 emissions from the electric industry will increase 44% between 2004 and 2030, almost entirely due

[25] CERES, "Investors Concerned about TXU's Aggressive Coal Strategy" press release May 17, 2006

[26] Hoffman, Andrew J., *Getting Ahead of the Curve: Corporate Strategies that Address Climate Change*, Pew Center on Global Climate Change, October 2006, http://www.pewclimate.org/global-warming-in-depth/all_reports/corporate_strategies/index.cfm

to an increase in coal-fired generation.[27] It is interesting to note that the electric utility sector in North America is more carbon intensive than in Europe.[28]

Results from electric utilities' participation in the CDP indicate that while 80 percent of the 228 companies that responded to the survey (182 companies) addressed the need to reduce greenhouse gas emissions, only a quarter (59 companies) disclosed measurable emissions reductions targets and specific time frames for reductions. Nearly 75 percent of the responding companies (171 companies) acknowledged bottom-line risks associated with extreme weather events such as hurricanes, fires and floods. However, very few of the co mpanies surveyed link more-extreme weather to climate change and fewer still—only four percent – disclosed strategies for mitigating and adapting to the growing physical impacts from climate change. [29]

III.A. Compliance with existing requirements

Companies in California and the Northeast and Mid-Atlantic states are anticipating compliance with the greenhouse gas emission reduction requirements that will be in place. In the RGGI states, companies are participating in individual state regulatory proceedings to establish the states' rules for the regional cap and trade program (see Section III.J Shaping public policy for this topic in detail). They are providing written comments to state agencies, and are participating in stakeholder meetings.

In California, companies are participating in the California Air Resources Board's proceeding to develop implementing regulations for California Law AB 32. Businesses in California have begun registering their greenhouse gas emissions in order to be eligible to receive pollution credits once the state's new global warming law takes effect. The California Climate Action Registry logged 116 companies in December 2006, bringing the total registered to 221. Enrollees include Dow Chemical, Hewlett Packard, Kaiser Permanente, Kodak, Southern California Edison, Stanford University and Xerox. The 221 companies have registered about 300 million tons of greenhouse gases[30] (see Section III.C Greenhouse gas emission inventories and registries for this topic in detail).[31]

III.B. Risk disclosure to shareholders

More and more investors are demanding that companies take seriously the financial risks associated with carbon emissions. Some companies include a discussion of climate change risks in their annual reports to shareholders; however such disclosure is not mandatory, and often does not include forward-looking guidance or discussion of

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[27] CERES, *Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States – 2004*, CERES, NRDC, PSEG, April 2006, pages 13-16, http://www.nrdc.org/air/pollution/benchmarking/default.asp

[28] Carbon Disclosure Project, Analysis of CDP 4 Utilities Responses, January 2007.

[29] Calvert Press Release January 31, 2007

[30] Greenwire January 26, 2007.

[31] Greenwire January 26, 2007.

business impact.[32] Shareholders have filed numerous global warming resolutions for oil and gas companies, and electric power companies.[33] 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. First-Energy, Progress Energy and DTE Energy agreed in 2005 to file reports. Resolutions were withdrawn at ChevronTexaco, Anadarko, Apache, Tesoro and Unocal when those companies took actions to disclose their potential financial exposure from climate change and develop strategies to improve their strategic positioning as international pressure grows to reduce greenhouse gas emissions and promote renewable energy sources. Marathon Oil has also made numerous climate risk-related commitments resulting in no resolution being filed in 2005. Resolutions are still pending with ExxonMobil, and Vintage Petroleum.

Shareholders are also pressuring the Securities and Exchange Commission (SEC) to require that companies disclose risks associated with greenhouse gas emissions on a routine basis rather than leaving such reporting on a voluntary basis. Institutional investors find that sufficient evidence exists for including climate risk as part of the SEC's 'materiality' standard for corporate reporting. Twenty eight institutional investors have urged the SEC to require disclosure of material financial risks associated with climate change as a matter of routine corporate financial reporting to SEC. [34] There are several initiatives to establish reporting guidelines. For example, a coalition of investors has developed a set of reporting guidelines—the Global Framework for Climate Risk Disclosure—that corporations can use.[35] While some U.S. companies have voluntarily reported their climate risk to shareholders, the vast majority of businesses - including many of the country's largest emitters of global warming pollutants - have refused to do so, citing ambiguous SEC rules governing the acknowledgment of such material dangers to shareholder wealth.

The United Nations Environment Program Finance Initiative (UNEP FI) working groups, especially the Climate Change Working Group and the Asset Management Working Group, are making urging improved corporate disclosure and management of climate change impacts. In addition, both UNEP FI working groups are working to assess the financial and investment implications of climate change.

III.C. Greenhouse gas emission inventories and registries

Inventories and registries are both mechanisms for identifying and quantifying greenhouse gas emissions from individual emission sources or groups of emission

[32] See, e.g. Stratos Inc, *Corporate Disclosure and Capital Markets: Demand and Supply of Financially Relevant Corporate Responsibility Information*, 2004, http://www.nrtee-trnee.ca/eng/programs/current_programs/Capital-Markets/Documents/Corporate-Disclosure/Corporate-Disclosure_Index_E.htm

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

[34] CERES press release.

[35] Calvert Press Release January 31, 2007

sources. Both inventories and registries have been under development in the US and Canada and include both voluntary and mandatory efforts.

Greenhouse Gas Inventories

A number of companies, acting independently or as part of a larger initiative, are creating inventories of their greenhouse gas emissions. A greenhouse gas (GHG) inventory is the identification and quantification of greenhouse gas emissions from all aspects of a company's operations. To date, the creation of company-level inventories in the US has been voluntary and is done to satisfy a shareholder request for disclosure, to take advantage of first-mover benefits once regulations are set, as a means of understanding exposure to risk, and/or as a precursor to implementation of emissions goals and reduction strategies. Creation of such inventories is facilitated by the fact that U.S. companies are required to have continuous emissions monitors (CEMS) for all facilities above a threshold that approximates a 25 MW plant and the data is reported to EPA. Companies have an incentive to keep CEMS monitoring correctly because otherwise emissions are estimated by substitute data routines that are punitive to the generation owner. In Canada, company-level inventories were completely voluntary in the past. However, with Canada's participation in the Kyoto Protocol, inventories have become mandatory for certain companies. Companies that are not required to produce inventories can still do so voluntarily.

In general, GHG inventories are an important first step to implementing reduction or trading strategies because they establish baseline GHG emissions data necessary to determine the performance of reduction strategies farther down the road. Also, GHG inventories permit identification of reduction opportunities. The U.S. and Canadian companies are beginning to use the consistent metrics and calculations to produce these inventories that are recommended by the Greenhouse Gas Protocol and assembled by the World Business Council for Sustainable Development and the World Resources Institute. However, there remain significant variations in what these companies are accounting for in their inventories. Ambiguous areas where there are likely to be company differences in accounting include (1) how emissions from joint ventures, partially- or wholly-owned subsidiaries, divested operations, and third party vendors are addressed, (2) how product usage is factored into the inventory, (3) how transport including material transport, business travel, and/or commuting are factored into the inventory and (4) how emission credits from biological carbon sequestration could be addressed.[36]

In the U.S. a number of investor-owned utilities including AEP, Duke Energy, Enbridge, Inc., Entergy, Excelon, Pacific Gas & Electric, PNM, and Wisconsin Energy participated in the Carbon Disclosure Project (CDP) in 2004 by responding to a questionnaire and reporting their annual emissions inventories to the public. The CDP website provides

[36] Hoffman, Andrew J., *Getting Ahead of the Curve: Corporate Strategies that Address Climate Change*. University of Michigan. Prepared for the PEW Center on Global Climate Change. October 2006, http://www.pewclimate.org/global-warming-in-depth/all_reports/corporate_strategies/index.cfm

public access to the inventories from over 1,000 companies from 2002 on and is regarded as the world's largest repository of corporate GHG emissions today.[37]

Greenhouse Gas Registries

Registries are cross-company databases that are built to enable broader-scale GHG reporting, emissions reduction, and trading initiatives. In the US, registries have been assembled through voluntary participation by companies or by project groups within companies. A number of state and regional initiatives have developed over the years in the US, in the absence of a national mandatory greenhouse gas reduction strategy. In Canada, federal requirements to report greenhouse gases, starting with the first reporting year of 2004, have added another layer of reporting to a number of provincial reporting requirements and voluntary greenhouse gas reporting mechanisms that were already in place.

Three state-level registries were formed in the US around 2000 (California, New Hampshire, and Wisconsin).[38] As of 6 Feb 2007, there were 6 investor-owned utilities participating in the California Climate Action Registry; Pacific Gas & Electric Corporation, PacifiCorp, San Diego Gas & Electric, Southern California Edison, Southern California Gas Company, Southwest Gas Corporation. [39] This registry, widely regarded as a leading registry model[40], is a statewide non-profit voluntary registry with some 228 members across a variety of sectors at the time of this writing. The New Hampshire Greenhouse Gas Registry and the Wisconsin Voluntary Emission Reduction Registry are both significantly smaller, with three or fewer utilities participating.[41] The reporting schemes for each of these registries were uniquely designed, signaling need for a higher level reporting mechanism that was consistent across states and could enable emissions trading across state boundaries in the future.

A few years after the state-level registries began to form, several cross-state and regional-level initiatives were begun to link these state initiatives together, inspire consistency across states, support upcoming state voluntary and mandatory reporting programs, provide a technical platform for state and regional climate change initiatives, and encourage broader state participation in emissions reporting and reductions. Cross-state registries were designed first to reward a larger circle of first-movers and included EPA Climate Leaders[42] and the U.S. Department of Energy Voluntary Reporting of

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[37] Enbridge, Inc. "Environmental Performance: Climate Change" in *2006 Corporate Responsibility Report*, 2006, http://www.enbridge.com/csr2006/environmental-performance/climate-change/

[38] State GHG Actions. Compiled by Amy Royden-Bloom, Senior Staff Associate, STAPPA & ALAPCO. 18 Sep 2006, http://www.ncel.net/news_uploads/158/StateGHGActions-chart.STAPPA.9-18-06.pdf

[39] California Climate Action Registry, http://www.climateregistry.org/

[40] Eastern Climate Registry. "Other Accounting and Reporting Programs," http://www.easternclimateregistry.org/registriesother.html

[41] More information on these registries is available at: New Hampshire Department of Environmental Services. New Hampshire Greenhouse Gas Registry, http://www.des.state.nh.us/ard/climatechange/ghgr.htm, and Wisconsin Department of Natural Resources. The Wisconsin Voluntary Emission Reduction Registry. http://dnr.wi.gov/org/aw/air/registry/

[42] U.S. EPA, "Climate Leaders." http://www.epa.gov/stateply/

Greenhouse Gases Program.[43] Shortly thereafter, regional initiatives started to come into effect.

In 2003, the Eastern Climate Registry (formerly referred to as the regional greenhouse gas registry or RGGR) was formed in preparation for a regional cap and trade program (RGGI – described above).[44] This registry is the first multi-state registry, and comprises 10 Northeast and Mid-Atlantic states (including Connecticut, Delaware, Maine, Massachusetts, New York, New Hampshire, New Jersey, Pennsylvania, Rhode Island and Vermont). The goal of the Eastern Climate Registry is to provide a GHG emissions inventory to support state voluntary and mandatory GHG reporting programs and to provide the technical platform for state and regional climate change initiatives, such as emissions trading. The Registry will ensure that GHG policies and programs at both the state and regional level are using consistent data reporting and accounting methodologies. A second regional registry called The Midwest Greenhouse Gas Registry, including Illinois, Indiana, Iowa, Michigan, Ohio, Minnesota, Missouri and Wisconsin, is currently in formation.[45]

In the U.S., there are several benefits for companies who voluntarily register their greenhouse gas emissions. First, companies can improve their reputation both nationally and globally while marketing themselves to new customer sectors. Second, companies who have established a baseline (or starting point) to be used in the future to establish emissions reductions, allowances, and credits could be protected from having to recalculate this baseline in the future. Public recognition for early emissions reduction actions and baseline protection were the primary objectives of the California Climate Action Registry, though now the Registry will serve a regulatory function as the state implements its cap on greenhouse gas emissions.[46] Third, companies may receive recognition for early participation in the form of additional credits or allowances when regulations do come into force. Fourth, companies can gain a competitive advantage for already having begun to adjust to anticipated regulatory schemes that are perceived to be forthcoming. Fifth, companies can gain a position of influence over both the development of the reporting, reduction, and trading schemes as well as national policy through relationships with other stakeholders and experience.[47]

In Canada, federal requirements to report greenhouse gases, are building upon a number of provincial reporting requirements and voluntary greenhouse gas reporting mechanisms that were already in place. Some Provinces, such as Alberta and Ontario, have their own mandatory greenhouse gas reporting requirements. Also, previously established

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[43] Eastern Climate Registry, "Other Accounting and Reporting Programs." http://www.easternclimateregistry.org/registriesother.html

[44] Eastern Climate Registry, "About the Project," http://www.easternclimateregistry.org/

[45] Koerber, Michael, *Planning for a Voluntary Midwest Regional Greenhouse Gas Registry*. Lake Michigan Air Directors Consortium. 18 Jul 2006. http://www.wrapair.org/WRAP/meetings/060717reg/LADCO-%20RGGR-July17.pdf

[46] Eastern Climate Registry, "Other Accounting and Reporting Programs."

[47] Eastern Climate Registry, "Background on Greenhouse Gas Registries."

voluntary greenhouse gas reporting mechanisms such as Canada's Climate Change Voluntary Challenge & Registry Inc. and the Canadian GHG Challenge Registry© still exist, but appear to be consolidating under the Canadian Standards Association[48]. However, it seems that some members are suspending participation in these voluntary programs now that they are required to report to the national registry. Lastly, there are separate emissions reporting systems like the National Pollutant Release Inventory (NPRI)[49], which is a database of annual key pollutant releases to air, water, and land from all sectors, and the National Air Pollutant Emissions Inventory (NEI), which is a log of information from stationary and mobile sources that emit criteria air pollutants and their precursors, as well as hazardous air pollutants.[50] Many utilities may be submitting greenhouse gas emissions reports to their provincial government as well as the federal government, and submitting criteria pollutant reports to a third reporting source.

Examples from two companies illustrate this overlap. Enbridge Inc., a Canadian gas distributor, submits emissions data to the Canadian federal government's (Environment Canada's) mandatory GHG reporting program,[51] as well as to the National Pollutant Release Inventory.[52] Prior to the formation of the mandatory national greenhouse gas registry, Enbridge reported annually to the Canadian Standards Associations' Canadian GHG Challenge Registry.[53] TransAlta provided detailed GHG emissions reporting through its annual Sustainable Development Report and participation in Canada's Voluntary Challenge and Reporting (VCR) Program. Now it appears that TransAlta is participating in mandatory reporting while continuing to participate in voluntary reporting via the Canadian GHG Challenge Registry© on the Canadian Standards Association website.[54]

The goal of the federal registry is to have a "well-harmonized single-window reporting system" for GHG emissions, and will require minimizing the reporting burden for industry and government and consolidating existing registries.[55] Streamlining greenhouse gas registries should continue to occur as the fully developed mandatory system is put into place by 2007, in time for the first commitment period in 2008-2012. However, only those facilities that emit the equivalent of 100,000 tonnes or more of carbon dioxide per year are required to report in Phase One of the mandatory greenhouse

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[48] Canadian Standards Association website, "Products & Services," http://www.csa.ca/climatechange/production/Default.asp?language=english

[49] Environment Canada's National Pollutant Release Inventory website, http://www.ec.gc.ca/pdb/npri/npri_home_e.cfm

[50] U.S. Environmental Protection Agency (EPA) . "National Emissions Inventory – Background," http://www.epa.gov/ttn/chief/net/neiwhatis.html

[51] Government of Canada's Greenhouse Gas Reporting Website, http://www.ghgreporting.gc.ca/GHGInfo

[52] Environment Canada's National Pollutant Release Inventory, http://www.ec.gc.ca/pdb/npri

[53] Canadian GHG Challenge Registry, http://www.ghgregistries.ca/challenge

[54] Canadian GHG Challenge Registry, "Canadian GHG Challenge Registry© Participants [by Company]," http://www.ghgregistries.ca/challenge/cha_alpha_e.cfm#T

[55] Canadian GHG Challenge Registry, "Greenhouse Gas Reporting Site: Frequently Asked General Questions," http://www.ghgreporting.gc.ca/GHGInfo/Pages/page21_1.aspx

gas reporting.[56] This threshold is expected to apply to about 400 facilities across all sectors. As a result, voluntary mechanisms may provide the only platform for smaller companies to participate in reductions and one or more may be preserved for this purpose. The consolidation of criteria pollutant reporting and greenhouse gas emissions reporting appears to be further off because it is unclear whether companies have a strong desire to consolidate these types of reporting under one reporting mechanism.

III.D. Corporate emission targets

Several companies have established corporate emission targets for greenhouse gases. There are multiple programs through which companies make commitments. For example, two federal agencies in the U.S. – the Environmental Protection Agency, and the Department of Energy – have established programs to encourage voluntary corporate actions. The U.S. EPA established a Climate Leaders program, and U.S. DOE has established Power Partners to encourage and recognize voluntary corporate actions.[57] The participants in DOE's Power Partners program have signed a Memorandum of Understanding supporting a 3-5% reduction in the greenhouse gas intensity of the electric industry by the period 2010-2012. Several companies have made commitments through other avenues including the Pew Center on Global Climate Change's Business Environmental Leadership Council.

Many companies discuss their corporate emissions targets in their response to the Carbon Disclosure Project and demonstrate a large range in commitments.[58] In general a company chooses a baseline year from which to measure reductions, and then sets an emission reduction goal. Table 1 shows a sample of emission reduction goals that companies have adopted – the table is by no means exhaustive.

Table 1. Company Emission Reduction Goals

Company	Baseline year	GHG reduction goal	Intensity reduction goal
Exelon	2001	8% by end 2006	
Entergy	2000	Stabilize at 2000 levels by 2005 Then 20% reduction between 2006 and 2010	
AEP	1998-2000	1% in 2003 2% in 2004 3% in 2005 4% in 2006	
FPL	2001		Reduce 18%

[56] Greenhouse Gas Reporting Site Frequently Asked General Questions. http://www.ghgreporting.gc.ca/GHGInfo/Pages/page21_1.aspx

[57] http://www.epa.gov/climateleaders/

[58] Carbon Disclosure Project, CDP4 Electric Utilities Report (January 2007), CDP4 Canada Report, S&P500 Report (January 2007)

Southern			Power Partners intensity reduction goal: reduce GHG intensity of the electric industry by 3-5% by 2010-2012.
Ontario Power Generation	1990	Stabilize emissions at 1990 levels	
DTE Energy	1999	Reduce emissions 5% from 1999 levels by 2005	
Transalta	1990	Return to 1990 levels by 2000. Achieve zero net GHG emissions from Canadian operations by 2024.	

Some companies are also participating in other programs such as the Pew Center Business Environmental Leadership Council through which companies set goals and are rated annually for their sustainability practices. (including annual sustainability reports)

Several companies have begun to participate in voluntary emissions trading programs. One of the largest forums for voluntary emissions trading is the Chicago Climate Exchange (CCX). CCX is a greenhouse gas registry, reduction and trading system for all six greenhouse gases. It is operated under rules designed by its members, and covers emission sources and offset projects in the U.S., Canada, Mexico, Brazil and other areas of the world. The Phase I emission reduction target for each Member (program years 2003-2006) was 4% below baseline by 2006. The Phase II emission reduction target (program years 2007-2010) will require all Members to reduce 6% below baseline by 2010. Members can reduce emissions from their facilities to the targeted levels, purchase allowances and/or project-based offsets to mitigate their emissions.[59]

Electric power generation companies participated in the development of this Exchange, and some are involved in trades. American Electric Power, TECO Power and Manitoba Hydro all participate in the CCX. Exelon participated in the development of the CCX, but does not participate in trading. Florida Power and Light is monitoring the development of CCX, but also does not participate in the trading.

[59] Information about CCX is available at the website www.chicagoclimateex.com

III.E. Factoring greenhouse gas emission risk into resource selection [60]

Several companies, in compliance with state requirements or on their own initiative include some evaluation of financial risk associated with carbon emissions in their periodic resource plans. For example, Pacificorp, Pacific Gas and Electric (PG&E), Avista, Portland General Electric, Excel, Idaho Power, and Northwest Energy all include some evaluation of future costs associated with greenhouse gas emissions in their resource planning process.

Uncertainty about the form of future greenhouse gas reduction policies poses a planning challenge for generation-owning entities in the electric sector, including utilities and non-utility generators. As noted above, several companies have indicated that the single largest challenge they face is regulatory uncertainty. To mitigate their risk exposure, several electric companies, either pursuant to state regulatory requirements or on their own initiative, evaluate costs or risks associated with greenhouse gas emissions in long-range planning or resource procurement.[61] These companies cite a variety of reasons for incorporating risk of future carbon regulation as a risk factor in their resource planning and evaluation, including scientific evidence of human-induced climate change, the US electric sector emissions contribution to emissions, and the magnitude of the financial risk of future greenhouse gas regulation.

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 US carbon regulation policy. Some of the companies believe that there is a high likelihood of federal regulation of greenhouse gas emissions within their planning period. For example, Pacificorp states a 50% probability of a CO_2 limit starting in 2010 and a 75% probability starting in 2011. The Northwest Power and Conservation Council models a 67% probability of federal regulation in the twenty-year planning period ending 2025 in its resource plan. Northwest Energy states that CO_2 taxes "are no longer a remote possibility."[62] Table 2. illustrates the range of carbon cost values, in \$/ton CO_2, that are currently being used in the industry for both resource planning and modeling of carbon regulation policies.

[60] This section of the report draws on the following report Johnston et. al., *Climate Change and Power: Carbon Dioxide Emissions Costs and Electricity Resource Planning*. Synapse Energy Economics, May 2006, http://www.synapse-energy.com/Downloads/SynapsePaper.2006-06.Climate-Change-and-Power.pdf

[61] For a discussion of the use of carbon values in integrated resource planning see, Wiser, Ryan, and Bolinger, Mark, *Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans*. Lawrence Berkeley National Laboratories, August 2005. LBNL-58450, http://eetd.lbl.gov/EA/EMP/reports/58450.pdf

[62] Northwest Energy, *Electric Default Supply Resource Procurement Plan*, December 20, 2005; Volume 1, p. 4, http://www.montanaenergyforum.com/plan.html

Table 2. CO_2 Costs in Long Term Resource Plans

Company	CO2 emissions trading assumptions for various years ($2005)
PG&E*	$0-9/ton (start year 2006)
Avista 2003*	$3/ton (start year 2004)
Avista 2005	$7 and $25/ton (2010) $15 and $62/ton (2026 and 2023)
Portland General Electric*	$0-55/ton (start year 2003)
Xcel-PSCCo	$9/ton (start year 2010) escalating at 2.5%/year
Idaho Power*	$0-61/ton (start year 2008)
Pacificorp 2004	$0-55/ton
Northwest Energy 2005	$15 and $41/ton
Northwest Power and Conservation Council	$0-15/ton between 2008 and 2016 $0-31/ton after 2016

**Values for these utilities from Wiser, Ryan, and Bolinger, Mark. "Balancing Cost and Risk: The Treatment of Renewable Energy in Western Utility Resource Plans." Lawrence Berkeley National Laboratories. August 2005. LBNL-58450. Table 7.*
Other values: PacifiCorp, Integrated Resource Plan 2003, pages 45-46; and Idaho Power Company, 2004 Integrated Resource Plan Draft, July 2004, page 59; Avista Integrated Resource Plan 2005, Section 6.3; Northwestern Energy Integrated Resource Plan 2005, Volume 1 p. 62; Northwest Power and Conservation Council, Fifth Power Plan pp. 6-7. Xcel-PSCCo, Comprehensive Settlement submitted to the CO PUC in dockets 04A-214E, 215E and 216E, December 3, 2004. Converted to $2005 using GDP implicit price deflator.

In Canada, TransAlta (a power generation and wholesale marketing company) incorporates some consideration of greenhouse gas regulation in its planning. TransAlta anticipates a requirement for 12 to 13 per cent emission reduction from 2000 baseline emissions during the Kyoto period in Canada. This would amount to approximately 4 Mt's of reductions per year and the company plans to rely primarily on offsets in the early stages. The Company anticipates some form of GHG regulation in the United States in the 2010 timeframe, whether state-by-state or on a federal basis. They have estimated financial impacts associated with approximately half the Canadian Kyoto level in facilities planning work.[63]

These early efforts by utilities have brought consideration of the risks associated with future carbon regulations into the mainstream in resource planning the electric sector.

III.F. Improving energy efficiency

In North America, it is widely understood by various stakeholders that energy efficiency is regarded as one of the most cost-effective ways to seek various public benefits including bill reduction, energy price stabilization, pollution reduction including

[63] TransAlta response to CDP 4 questionnaire.

reduction of GHG emissions, reliability improvements of energy supply systems, local economic development, and job creation. To pursue these benefits, a large number of electric and gas utilities, often at the direction of along with state regulators, and in consultation with other stakeholders have been engaged in improving customer side energy efficiency for decades through Demand Side Management (DSM) programs. In 1993 and 1994, DSM spending by electric utilities in the U.S. exceeded $2 billion a year (in 2005$).[64] While utilities reduced their DSM spending significantly following those years due to market uncertainty associated with efforts to restructure the industry restructuring, they began to revitalize their efforts starting around 1999. Many states included mechanisms for funding energy efficiency in legislation associated with restructuring the electric industry. We provide a table of energy efficiency spending and savings in the Appendix.

Now energy efficiency has gained renewed attention due to many challenges we face today. More electric and gas companies have recently started or enhanced such activities in response to critical challenges such as growing energy demands, investment needs for energy infrastructure, high fuel prices, growing energy security risk, climate change and uncertain future environmental regulation. One notable example of this renewed focus is the National Action Plan for Energy Efficiency launched in July 2006.[65]

The Action Plan was facilitated by the U.S. Department of Energy and Environmental Protection Agency and developed by more than 50 leading organizations including utilities, public utility commissions, energy consumers, and non-governmental groups. Among them, there are more than 20 electric and gas utilities.[66] The American Gas Association, American Public Power Association, and Edison Electric Institute were also involved in this plan as observers. The action plan reexamined the importance of energy efficiency, identified major policy and market barriers against it and developed recommendations for removing such barriers. It also reviewed several state and regional energy efficiency potential studies and identified that "adoption of economically attractive, but as yet untapped, energy efficiency could yield more than 20 percent savings in total electricity demand nationwide by 2025…[and that] …energy efficiency targeted at direct natural gas use could lower natural gas demand growth by 50 percent."[67]

Regulatory Mechanism:

[64] York, Dan and Kushler Martin, *ACEEE's 3rd National Scorecard on Utility and Public Benefits Energy Efficiency Programs: A National Review and Update of State Level Activity*, October 2005, www.aceee.org/pubs/u054.pdf ; *The National Action Plan for Energy Efficiency*, July 2006, http://www.epa.gov/cleanenergy/actionplan/eeactionplan.htm

[65] *The National Action Plan for Energy Efficiency*, 2006.

[66] Duke Energy, American Electric Power, PNM Resources, Waverly Light and Power, Seattle City Light, Baltimore Gas and Electric, Great River Energy, New Jersey Natural Gas, Austin Energy, Southern Company, Exelon, Entergy Corporation, MidAmerican Energy Corporation, Vectren Corporation, Pacific Gas and Electric, Southern California Edison, Sacramento Municipal Utility District, Xcel Energy, Bonneville Power Administration, and Tennessee Valley Authority.

[67] *The National Action Plan for Energy Efficiency*, 2006, page 1-6.

In states with utility energy efficiency activities, energy efficiency is typically required either by state statute, utility regulation, or regulatory settlement among stakeholders. A small number of utilities, however, have implemented efficiency programs without any state or statutory requirements. For example, NSTAR in Massachusetts does not have any state mandate to implement "natural gas" efficiency programs in the natural gas portion of its retail service, but has entered into agreements with state regulators to implement efficiency programs. The company spent $3.9 million (equivalent to 0.8% of their revenue) on its gas efficiency programs in 2004 and is saving 71,500 Mcf per year (equivalent to 0.2% of their sales).[68] Instead of requirements, NSTAR receives incentives and lost revenue adjustment for their efficiency investment (see below for the discussion of these incentive mechanisms). Additionally, gas utilities in British Columbia and Washington are not required to offer gas efficiency programs, but Terasen Gas in British Columbia and Avista and Puget Sound Energy in Washington have implemented gas efficiency programs.[69] Avista mentions that it implements conservation programs because the programs do not only contribute to environmental sustainability but also (1) alleviate increased natural gas cost impact on customers[70] ;(2) avoid purchases of commodity and upstream capacity, and avoid/delay expansion of the distribution system; (3) increase facility utilization rate by reducing local distribution main's peak usage; and (4) reduce maintenance expenses related to down stream distribution system.[71]

In many cases, utilities prepare and propose a detailed set of efficiency programs and budgets which will be reviewed by stakeholders and must be approved by the regulator. The efficiency program budgets are either recovered in rates or a surcharge. When a surcharge is mandated by a state, utilities usually set budgets for individual programs within the total budget limit that is predetermined by the total amount of money collected through the surcharge.

A dominant funding mechanism for electric investor owned utilities in the U.S. is now a surcharge called system benefits charge (SBC) or public benefits charge (PBC) (mentioned in the state policy section). Many states that fully or partially deregulated its electricity markets adopted this approach in order to secure funding for efficiency programs facing regulatory uncertainty under the industry deregulation and expecting that

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[68] Southwest Energy Efficiency Project, *Natural Gas Demand-Side Management Programs: A National Survey*. January 2006, page 12, www.swenergy.org/pubs/Natural_Gas_DSM_Programs_A_National_Survey.pdf

[69] IndEco and Navigant Consulting, *DSM in North American gas utilities*, 2004, http://indeco.com/www.nsf/papers/regframeworkdsm

[70] This will also make it easier for their customers to pay their bills when energy prices are high, thus reducing the staff dedicated for monthly bill collection, according to Avista staff. (personal communication with the staff on March 23, 2007)

[71] Avista Corporation 2001. the company's recommendations for the DSM filing in filing in Docket No. UG-010029. January 31, 2001, http://www.wutc.wa.gov/webdocs.nsf/d94adfab95672fd98825650200787e67/3b2393e92eb14cfd882569e300816f75!OpenDocument

cost recovery of efficiency programs would be difficult.[72] SBC funding levels range widely from 0.1 mills/kWh (in New Mexico) to 3.21 mills per kWh (in California) (see table 3).

Table 3. Efficiency Program Funding by SBC[73]

	SBC Efficiency Program Funding		
State	(million $)	(mills/kWh)	(% of revenue)
Arizona	19.5	0.57	0.72
California	567.0	3.21	2.35
Connecticut	89.0	3.00	3.00
District of Columbia	4.2	0.38	0.51
Illinois	3.0	0.03	0.03
Maine	16.0	1.50	1.46
Maryland	TBD	TBD	TBD
Massachusetts	130.0	2.50	2.81
Michigan	8.0	0.07	0.11
Minnesota	52.0	1.27	1.96
Montana	8.9	0.84	1.37
Nevada	23.3	0.82	0.96
New Hampshire	17.4	1.80	1.75
New Jersey	89.5	1.22	1.31
New Mexico	2.0	0.10	0.15
New York	87.0	0.83	0.69
Ohio	15.0	0.11	0.16
Oregon	27.8	1.48	2.01
Rhode Island	16.1	2.00	1.86
Texas	80.0	0.28	0.43
Vermont	14.9	2.64	2.40
Wisconsin	59.3	1.21	1.94

In addition to DSM cost recovery, utilities have proposed and implemented some incentive mechanisms with the Commission's approval. Efficiency programs enable utilities to avoid/delay significant utility capital investment, capacity and fuel payment, and operation and maintenance expenses, which could improve their financial integrity and keep utility bond rating high. However, when energy consumption is reduced by kWh for electricity or cubic feet for natural gas, utilities will reduce their expected revenues. Therefore, utilities in general have an inherent disincentive against promoting customer side energy efficiency programs. This is one of the major barriers addressed in

[72] York, Dan and Martin Kushler. *A Nationwide Assessment of Utility Sector Energy Efficiency Spending, Savings, and Integration with Utility System Resource Acquisition.* American Council for an Energy Efficient Economy (ACEEE), a paper presented at August 2006 ACEEE conference.

[73] ACEEE, *Summary Table of Public Benefit Programs and Electric Utility Restructuring, as of December 2005*; Minnesota Office of Legislative Auditor, *Energy Conservation Improvement Program*, January 2005; and Narragensett Electric 2005. Narragansett Electric Company, Settlement of the Parties under Docket No. 3701, October 14, 2005.

the National Action Plan for Energy Efficiency. The followings are three major incentive mechanism that have been adopted or proposed by electric and gas utilities:

- **Utility shareholder incentives**: one type of shareholder incentives is to allow utilities to put their efficiency expenditures in rate base and earn a return equal to the return from supply-side investments. One of the major problems of this approach is that it rewards utilities for spending the money but not necessarily for saving energy. Another option is the shared savings approach, where the utility is allowed to recover a portion of the net benefits of the efficiency programs (i.e., program benefits less program costs). Electric utilities in nine states in the U.S. currently have shared savings mechanism.[74]
- **Lost Revenue Adjustment**: This mechanism allows a utility to directly recover the "lost revenue" associated with not selling additional units of energy because of the success of energy efficiency programs. Experience demonstrates that estimating lost revenue is controversial and this mechanism can result in overpayment to utilities because lost revenues are based on projected savings. Further, utilities even with this mechanism still have disincentive to implement efficiency programs.[75]
- **Decoupling mechanism**: decoupling is an alternative means of removing links between sales and revenues and thus eliminating lost revenue issues associated with efficiency programs. Decoupling is one form of traditional performance based ratemaking (PBR) and sometimes is called a revenue cap PBR. This approach places a cap (or limit) on utility revenue for a specific term. Because the utility's revenue is fixed, any sales reduction due to energy efficiency, weather, or economic swings will not affect utility profits during the term. Any excess or losts of profits arises automatically returned to customers, or recovered from customers, after the term. Several states have adopted decoupling mechanism for gas and electric utilities in the past. Currently both gas and electric IOUs in California, Baltimore Gas and Electric, Washington Gas and Northwest Natural Gas are operating with decoupling mechanisms.[76]

Program Activities by Electric Utilities

A comprehensive set of electric energy efficiency programs is targeted at all customer sectors and normally includes a program specifically for low-income customers. The low-income program normally includes a weatherization component that provides for such activities as putting in insulation, patching holes, fixing roofs, etc. For residential customers this will include lighting, heating, cooling, and refrigeration end-uses as well as and building envelopes (e.g., walls and windows) and new construction. Such programs will typically provide rebates to customers for purchasing and/or installing

[74] Kushler, Martin, Dan York, and Patti Witte, *Aligning Utility Interests with Energy Efficiency Objectives: A Review of Recent Efforts at Decoupling and Performance Incentives*, October 2006, http://www.aceee.org/pubs/u061.htm

[75] See more discussions of this mechanism at U.S. EPA, *EPA Clean Energy-Environment Guide to Action* (section 6.2.), 2006. http://www.epa.gov/cleanrgy/stateandlocal/guidetoaction.htm and *the National Action Plan for Energy Efficiency*

[76] See *the National Action Plan for Energy Efficiency* (Chapter 2)

efficient appliances, heating and cooling systems, and wall and attic insulation. U.S. EPA administers a labeling program for energy efficient appliances, heating, ventilation and air conditioning systems (HVAC), electronics and other electric end-uses. If a product meets EPA's efficiency standards it is labeled an "ENERGY STAR" product. The ENERGY STAR name is widely recognized among consumer, as such utility rebates are normally structured around the ENERGY STAR label.[77] Utilities also spend money on retrofitting old equipment such as duct sealing for heating and cooling systems. For commercial and industrial customers, utilities generally provides rebates for upgrades to more efficient lighting and heating, ventilation and air conditioning system, motors, and compressed air system. For all types of customers, education and marketing are an important component of energy efficiency programs.

A large number of electric utilities have been engaged in energy efficiency programs and have saved significant amounts of energy for many years. Utilities in California and other western states and many Northeastern states are well known for their spending on, and energy savings by, energy efficiency programs. Table 4 (below) shows the level of utility spending on energy efficiency programs in the top ten states. Utilities in the top ten states are on average spending 1.2% to 2.2% of their revenues on efficiency programs. Table 5 shows the level of energy savings in comparison to utility sales in the top ten states. Utilities in the top ten states are on average saving 4.3% to 8.3% of their projected energy sales per year through efficiency programs (see Appendix A for utility spending and performance in other states) The cost of saved energy from efficiency programs typically ranges from 2 to 4 cents per kWh.[78] In comparison, average retail energy prices range from 6 cents to 20 cents per kWh, depending on states and sectors.

Table 4. 2004 Electric Energy Efficiency Spending as a Percentage of Utility Revenues: Top Ten[79]

Rank	State	Spending as a Percentage of Annual Total Revenues
1	Vermont	2.2%
2	Oregon	2.2%
3	Massachusetts	2.2%
4	Washington	1.9%
5	Connecticut	1.8%
6	Rhode Island	1.6%
7	Minnesota	1.4%
8	California	1.3%
9	New Hampshire	1.2%
10	Utah	1.2%
	U.S. Average	0.5%

[77] Energy Star products available at http://www.energystar.gov/

[78] *The National Action Plan for Energy Efficiency*, page 1-6.

[79] York, Dan and Martin Kushler, "A Nationwide Assessment of Utility Sector Energy Efficiency Spending, Savings, and Integration with Utility System Resource Acquisition," presented at August 2006 ACEEE conference, http://www.arkansas.gov/psc/EEInfo/ACEEE.pdf

Table 5. 2004 Cumulative Annual Energy Savings as a Percentage of Annual Utility Energy Sales: Top Ten[80]

Rank	State	Cumulative Annual Savings As a Percentage of Annual Energy Sales
1	Connecticut	8.3%
2	California	7.8%
3	Minnesota	7.6%
4	Washington	7.5%
5	Vermont	7.1%
6	Oregon	6.4%
7	Massachusetts	6.3%
8	Rhode Island	6.2%
9	Wisconsin	4.8%
10	Montana	4.3%
	U.S. Average	2.1%

California has recently approved the most ambitious utility energy efficiency initiative in the U.S. history. In this initiative, the investor-owned utilities, both gas and electric, are spending nearly $2 billion for the 2006-2008 energy efficiency programs. The estimated energy and demand savings over the period between 2006 and 2008 are about 7,370 GWh of electricity, 1,500 MW of peak demand, and 122,000 MegaTherms of natural gas.[81] The utilities expect to reduce around 3.4 million tons of carbon dioxide by the end of 2008 over the base case without the programs. The cost-benefit analysis estimated that the total program "life-time" benefit is $5.4 billion, twice as large as the costs of the program.[82]

Program Activities by Natural Gas Utilities

Efficiency programs by natural gas companies are not as aggressive and widespread as those by electric companies. However, a growing number of gas companies are adopting or expanding natural gas efficiency programs. For example, the Utah Public Service Commission approved Quester Gas Company's natural gas efficiency program proposal for residential and commercial customers in 2005.[83] The company plans to spend $7 million in 2005 and estimated the net benefits to consumers to be $8.8 million. In addition, the Arizona Corporation Commission approved new natural gas efficiency

[80] Ibid.

[81] Note that electricity and gas savings will be more over the life of efficiency measures that are installed during this three year period. The efficiency program includes natural gas investor owned utilities. Gas utilities plan to save 122,000 MegaTherms of natural gas over the same period of time.

[82] California Public Utilities Commission (CPUC) 2005. Interim Opinion: Energy Efficiency Portfolio Plans and Program Funding Levels for 2006-2008 - Phase 1 Issues. Decision 05-09-043. September 22, 2005, http://www.cpuc.ca.gov/PUBLISHED/FINAL_DECISION/49859.htm

[83] http://www.psc.utah.gov/gas/07orders/Jan/05057T01o.pdf

programs by the Southwest Gas Corporation last year in February. The approved annual budget was $4.4 million and the programs include promotion of ENERGY STAR® gas appliances, low-income home retrofit, multi-family new construction, food service equipment, commercial new construction, and distributed generation programs. Other utilities that have had gas efficiency programs for a long time are Keyspan Energy, Northwest Natural Gas, PG&E, Puget Sound Energy, Southern California Gas, Vermont Gas, and Xcel Energy. In Canada, Terasen and Enbridge natural gas distribution companies have efficiency programs.[84] The expenditures and performance of efficiency programs by some of these utilities are presented in the following table.

Table 6. Natural Gas Efficiency Programs in the U.S. in 2004

	Program spending (million $)	Revenue (million $)	% of retail revenues	Gas savings (MCF/yr)	% of gas sales saved	MCF/yr saved per million dollars	Benefit-Cost Ratio
Aquila (MN)	2.1	150	1.4	146,000	0.5	69,000	--
Centerpoint	5.6	1120	0.5	720,000	0.5	129,000	2.6
Keyspan	12	1200	1	490,000	0.4	41,000	3
Northwest Natural Gas	4.7	671.4286	0.7	85,000	0.1	18,000	--
NSTAR	3.9	487.5	0.8	71,500	0.2	18,000	2.29
PG&E	21.7	3100	0.7	2,040,000	0.7	94,000	2.1
PSE	3.8	950	0.4	311,000	0.5	82,000	1.93
So Cal Gas	21	3500	0.6	1,100,000	0.3	53,000	2.67
Vermont Gas	1.1	68.75	1.6	57,000	1	57,000	5.6
Xcel (MN)	4	571.4286	0.7	663,000	0.9	166,000	1.56
Average	7.9	987.5	0.8	564,000	0.5	72,700	2.7
Median	4.3	614.2857	0.7	400,500	0.5	63,000	2.4

Source: Southwest Energy Efficiency Project 2006. *Natural Gas Demand-Side Management Programs: A National Survey*, January 2006.

III.G. Alternative fuels and technologies

While there are still many companies that do not supply electricity from renewable generation, an increasing number of electric utilities in North America are supporting the development of renewable energy such as solar, wind, and biomass power in response to state or provincial governmental policies (as discussed in Chapter 2) or under utility-specific programs and initiatives.

In response to utility requirements under RPS policies, a large number of new and existing power generation companies are developing, installing, or operating renewable generation technologies for their own (if such companies are an integrated utility) or for other electric utilities for meeting renewable energy requirements. Some notable companies are AES Corporation, Edison Mission Group, FPL Energy, MidAmerican

[84] For Terasen's activities at http://www.terasengas.com/Promotions/Current+Promotions/RewardingRebates.htm and www.pollutionprobe.org/Happening/pdfs/gp_march06_van/hartman.pdf and for Enbridge's activities at http://www.enbridge.com/csr2006/environmental-performance/climate-change/

Energy Holdings Company, PPM Energy, NRG Energy, Inc., PPM Energy, AES Corporation, DTE Biomass Energy and…. Below are details of some of these examples.

- FPL Energy, a world leader of wind power generation, has developed and operates 47 wind farms in 15 states, consisting approximately 30 percent of the company's total generation. The total wind generation capacity exceeds 4,000 MW. The company also operates 360 MW of hydro in Maine and 310 MW of solar thermal power facilities in the Mohave Desert. The Southern California Edison purchases power from the solar facilities.
- BP, one of the world largest oil companies, has been investing in renewable energy generation. To date BP has developed 30 MW of wind power in the U.S. and plans to develop more than 400 MW of wind by 2008.[85] In addition, BP is one of the leading solar cell manufacturing companies and has currently approximately 200 MW production capacity worldwide including the U.S.
- MidAmerican Energy Holdings Company has various energy business subsidiaries that are involved in electric and natural gas distribution and transmission and electric power generation in several states in the U.S. and in other countries.[86] A subsidiary MidAmerican Energy Company has developed and owns and operates 360 MW of wind energy. The company also has additional 330 MW of wind under construction or under contract. The company also owns and operates run-of-river hydro facilities and purchase power from landfill gas projects. Approximately 9 percent of the MidAmerican Energy Company's existing electric generation comes from renewable energy source. Further other subsidiaries of the parent company operate about 320 MW of geothermal and 1,077 MW of hydro power plants. Electricity from its geothermal plants is purchased by the Southern California Edison.

There are also many electric utilities that do not build and own renewable generation but rather make contracts for power and/or RECs from renewable energy projects to meet RPS requirements. Investor owned utilities (Southern California Edison or SCE, San Diego Gas & Electric or SDG&E, and Pacific Gas and Electric or PG&E) in California are among leading utilities in promoting renewable energy. They have been aggressively procuring and contracting for renewable energy projects. In response to the state RPS, these companies recently contracted for power from between 2,100 and 3,600 MW of renewable energy facilities, with the major renewable sources being wind (around 580 to 780 MW), geothermal (around 290 to 500 MW), and solar thermal (around 900 MW to 1,900 MW).[87] Regarding solar thermal resources, both SCE and SDG&E contracted for the largest solar energy projects that utilize Stirling engine technologies to generate electricity.[88] The IOUs also have biomass and biogas projects. For example, PG&E recently made an agreement to purchase up to three billion cubic feet of renewable

[85] Edison Electric Institute, *The Power Partners℠ Annual Report*, January 2007, www.eei.org/industry_issues/environment/climate/**PowerPartners**_AR.pdf

[86] http://www.midamerican.com/html/environment6b.asp

[87] http://www.energy.ca.gov/portfolio/contracts_database.html

[88] SCE's project at http://www.renewableenergyaccess.com/rea/news/story?id=35263 and SDG&E's project at http://www.renewableenergyaccess.com/rea/news/story?id=40914

natural gas per year generated from manure at a cow diary farm.[89] This gas is used for generating electricity and estimated to meet the electricity needs of about 50,000 residential customers. Another notable utility is Xcel Energy that has regulated electric and natural gas supply operations in 8 Western and Midwestern states. Xcel Energy is a leading purchaser and supplier of wind energy to retail customers in the U.S. As of early 2006, Xcel had about 1,100 MW of wind energy capacity, and expects to increase its capacity to more than 2,300 MW by the end of 2007. Xcel plans to add another 1,700 MW of wind capacity by 2012.[90] Further, Nevada power is purchasing power and RECs from renewable energy generators. It has recently had an agreement to purchase power from a10 MW sola photovoltaic project and a 65 MW solar thermal plant that are expected to be on line in 2007.[91] To put these developments form a different perspective, the following table presents recent renewable energy developments by state.

Table 7. Recent Renewable Energy Development Supported by RPS Policies[92]

Texas—915 MW in 2001, 204 MW in 2003, and additional 700 MW in 2005.
Iowa—250 MW of wind. MidAmerican plans to add 310 MW of new wind.
Minnesota—705 MW wind and 33 MW of biomass.
California—IOUs contracted for 2,143 to 3,625 MW of new, repowered, or restarted facilities, of which 242 MW is online.
Wisconsin—140 MW, mostly wind; and more than 500 MW of new wind proposed.
Nevada—130 MW of wind, 97 MW of geothermal, and 50 MW of solar.
Arizona—7 MW of solar, 10 MW of landfill gas and biomass, 15 MW of wind, 20 MW of geothermal.
New Mexico—260 MW of wind in 2003-2004

Green pricing programs: A green pricing program, when properly designed, can contribute to the increase of renewable generation. A green pricing program generally allows customers to pay a premium on their electric bills to cover the incremental cost of new renewable energy generation.[93] The impact of green pricing programs is not as significant as RPSs because it is a voluntary program. However, more and more electric companies are adopting this type of program across the United States and making small, but meaningful impact on the generation supply mix. To date, more than 600 utilities,

[89] http://www.renewableenergyaccess.com/rea/news/story?id=47442
[90] http://www.xcelenergy.com/XLWEB/CDA/0,3080,1-1-1_11824_12374_4561-866-0_0_0-0,00.html
[91] http://www.renewableenergyaccess.com/rea/news/story?id=43336; http://www.nevadapower.com/company/renewables/

[92] Wiser, Ryan, Kevin Porter, and Robert Grace *Evaluating Experience with Renewable Portfolio Standards in the United States*: Lawrence Berkeley National Laboratory, 2004; Nogee, Alan, *State Renewable Electricity Standards: Projections, Policy Details, & Experiences to Date*. Presentation to the Harvard Electricity Group Thirty-Ninth Plenary Session on May 20 2005; California Energy Commission, "Database of Investor-Owned Utilities' Contracts for Renewable Generation, Contracts Signed Towards Meeting the California Renewables Portfolio Standard Target, " 2007, http://www.energy.ca.gov/portfolio/contracts_database.html; and American Wind Energy Association, "Wind Energy Projects throughout the United States of America," 2006, http://www.awea.org/projects/

[93] Some other programs allow customers to pay contribution to a specific renewable energy project.

including investor-owned, municipal utilities and cooperatives, in 36 states offer a green pricing option.[94]

The customer premium typically ranges from less than a cent to 4 cents per kWh depending on utility programs. However, customers under some innovative utility programs ended up paying less than other customers who are not in green pricing programs. Such innovative programs exempting customers from paying fuel adjustment charges are operated by Xcel Energy, Edmond Electric, and OG&E Electric. Some other utilities that offer the same exemption are Austin Energy, Clallam County Public Utility District, and Eugene Water and Electric Board. The effective premiums from the programs by these utilities are not negative but are very small.

According to the U.S. Department of Energy, the participation rates among the top 10 utilities range from 4.5% to 13.6% of the total number of customers. Renewable energy sales among the top 10 utilities range from 64,000 MWh to 435,000 MWh per year.[95]

Developing new alternative technologies: Several electric and gas companies are also involved in the development of renewable energy and alternative technologies in different ways.

- In partnership with the National Renewable Energy Laboratory (NREL), Xcel Energy is working on a demonstration project to produce and store hydrogen using wind power during off-peak periods when wind is blowing but customer consumption is low. The company anticipates using hydrogen for generating electricity in fuel cell or as a transportation fuel.[96]
- DTE Energy, a parent company of regulated Detroit Edison electric company, has invested in fuel cell technology development in partnership with Plug Power and is conducting a hydrogen demonstration project sponsored by the U.S. Department of Energy.[97] In this project, DTE Energy is (1) producing hydrogen gas from tap water using electricity from solar and biomass power and from the electric grid; (2) compressing and storing the hydrogen on site; and (3) delivering electricity to a small office complex, and producing compressed hydrogen gas to power about three fuel cell vehicles per day
- Enbridge Inc. is involved in four wind power project developments totaling 270 MW in Canada. Enbridge is engaged in the business of natural gas distribution and pipeline transmission and crude oil pipeline in North America and other countries. In three projects, Enbridge is investing in wind power by creating an affiliate investment company Enbridge Income Fund.[98]
- Enbridge also has been involved in fuel cell technology development. It has been partnering with FuelCell Energy Inc. and Global Thermoelectric (acquired by

[94] http://www.eere.energy.gov/greenpower/markets/pricing.shtml?page=0
[95] http://www.eere.energy.gov/greenpower/resources/tables/topten.shtml
[96] Xcel Energy's response to the Carbon Disclosure Project report, http://www.cdproject.net/online_response.asp?cid=703
[97] http://www.dteenergyventures.com/initiatives.html
[98] http://www.enbridge.com/about/enbridgeCompanies/gasDistribution/emerging-tech.php

FuelCell Energy Inc. in 2003) and helping them develop various fuel cell technologies for residential, commercial and industrial applications. FuelCell Energy has developed its carbonate Direct FuelCell technology with support from the U.S. DOE and Enbridge Inc. In 2005, Enbridge and FuelCell Energy reached an agreement under which Enbridge will become a distributor of the Direct FuelCell—Energy Recovery Generation™.[99] The system combines a 1.2 MW Direct FuellCell (DFC) with a 1 MW unfired gas expansion turbine. This system uses natural gas in the pipeline that is often lost during lowering gas pressure to deliver gas to homes and businesses.[100]

III.H. Carbon storage technologies

A large number of electric companies are interested in achieving carbon dioxide reductions via a process called carbon sequestration. The term carbon sequestration covers two different types of activities. The first type is known as biological sequestration.

Biological Carbon Sequestration

Biological sequestration is the capture and storage of carbon dioxide in terrestrial and ocean ecosystems. This type of sequestration can be thought of as the enhancement of natural sinks. Carbon dioxide can be stored in vegetation and soils of a terrestrial ecosystem and it can also be stored in aquatic organisms as well as in deep water.[101] This type of storage is not permanent in that natural organisms and plants undergo respiration, seasonal transformations, and decomposition, activities which release carbon dioxide back into the atmosphere. While terrestrial sequestration techniques such as tree planting are relatively simple to execute and therefore fully developed and in use, ocean sequestration options are more complex and, therefore, still being explored.

In general, gas and electric companies are currently investing more in biological sequestration than in geological sequestration. Specifically, many companies are engaging in terrestrial sequestration by setting aside funds to support reforestation initiatives. Four approaches to implementing reforestation programs are currently underway. One approach is for an individual company to reforest lands that they already own. For example, Entergy has created a Sustainable Forestry Plan to reforest company-owned land.[102] A second approach is for a company to partner with an environmental organization to identify and reforest an area. This land can be owned and managed by the environmental organization or can be acquired by the company as an extension to an existing refuge or as a new preserve. AEP's partnership with the Conservation Fund and the U.S. Department of the Interior's Fish and Wildlife Service (USFWS) to acquire,

[99] http://www.enbridge.com/about/enbridgeCompanies/gasDistribution/emerging-tech.php#2

[100] http://energy.seekingalpha.com/article/20139 and http://www.energyvortex.com/pages/headlinedetails.cfm?id=2526

[101] Policy: Carbon Sequestration. CarbonVentures. http://www.carbonventures.com/policy/sequestration.php

[102] Edison Electric Institute, *The Power Partners℠ Annual Report.* Jan 2007, page 52, http://www.eei.org/industry_issues/environment/climate/PowerPartners_AR.pdf

protect, and restore a forest near Catahoula Lake in Louisiana is a good example of this approach. AEP planted trees on its own as well as USFWS's portion of the property.[103] A third approach is for companies to partner with one another to undertake tree-planting initiatives. In 2004, 25 power generators including AEP, Duke Energy, Entergy, Excelon, PNM, and We Energies formed the PowerTree Carbon Company, committing $3 million towards reforestation projects.[104] Other utilities that are involved in reforestation initiatives include Cleco Corporation, DTE Energy, Detroit Edison, PacifiCorp and Southern Company. A fourth approach is for a company to leverage customer funding to support reforestation activities. This spring, PG&E will launch ClimateSmart, the first program that invites customers to offset their emissions by paying the cost of emissions from their energy use.[105]

Geological Carbon Sequestration

The second type of sequestration is known as geological sequestration which is commonly referred to as carbon capture and storage (or CCS). Geological sequestration involves separating and capturing carbon dioxide, compressing it, transporting it to storage reservoirs via pipeline or ship, and storing it in underground geological reservoirs. The Intergovernmental Panel on Climate Change estimated that CCS can contribute "15-55% to the cumulative mitigation effort worldwide until 2100".[106] However, the prospect of implementing CCS projects in the near future is uncertain as significant technological and cost barriers remain.

Many power companies envision the use of CCS for coal fired power plants. Integrated Gasification Combined Cycle (IGCC) is viewed as a viable power generating technology that can also be used to separate carbon from coal. While a large number of energy companies are interested in developing IGCC and several have been testing IGCC (see the table below detailing current demonstration plants), the reality is that few are testing all of the components of a CCS system including separation, capture, and storage. Given the absence of capture and storage solutions that are a critical part of a CCS system, IGCC technology can hardly be positioned as a climate change strategy today. Duke Energy captured the current state of the technology when it said that, "…The immediate benefits of deploying IGCC technology from the standpoint of reducing CO_2 emissions are relatively small…".[107] Southern Company, one of the largest producers of electricity in the US, is looking to carbon capture and storage (CCS) technologies rather than renewable electricity generation to reduce its greenhouse gas emissions in the face of mandatory caps, a company representative told a conference of US utility executives last week.[108]

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[103] Edison Electric Institute, The Power Partners[SM] Annual Report, page 52.

[104] Edison Electric Institute, The Power Partners[SM] Annual Report, page 52.

[105] ClimateSmart. PG&E, http://www.pge.com/about_us/environment/features/climatesmart.html

[106] IPCC Special Report on Carbon Dioxide Capture and Storage. Summary for Policymakers. http://arch.rivm.nl/env/int/ipcc/pages_media/SRCCS-final/SRCCS_SummaryforPolicymakers.pdf

[107] Duke Energy's 2004 response posted on the Carbon Disclosure Project website. http://www.cdproject.net/response_list.asp?id=4&exp=11&desc=FT+500&letter=D

[108] Point Carbon, "Carbon Market North America" January 31, 2007, page 5.

Table 8. IGCC Demonstration Plants[109]

Plant Name	Owner	Output (MW)	Feedstock	Gasifier Type	Combustion Turbine	Years of Operation
Facilities in the USA						
Cool Water	SoCal Edison	125	Bit Coal	Texaco	GE-7FE	1984-1988
LGTI	Dow Chemical	160	Sub Bit Coal	Dow (E-Gas)	W - 501	1987-1995
Polk County	Tampa Electric	250	Bit Coal	GE (Texaco)	GE-7FA	1996-current
Wabash River	Destec/PSI Energy	262	Bit Coal & Pet Coke	E-Gas	GE-7FA	1995-current
Pinion Pine	Sierra Pacific	100	Bit Coal	KRW	Siemens V94.2	1994-current
Facilities in Europe						
Willem – Alexander	Nuon	253	Bit Coal	Shell	Ge-6FA	1998
Puertollano	Elcogas	298	Bit Coal & Pet Coke	Prenflo (Shell)	Siemens V94.3	1998-current

The IGCC process is initiated by injecting a slurry of water mixed with fuel or a dry feed into a gasifier. When the feedstock is coal, the gasification process will produce a gas stream called syngas, largely consisting of carbon monoxide and hydrogen. This syngas can be cleaned of pollutants prior to combustion by using a shift reactor to convert the carbon monoxide to carbon dioxide and separate the carbon dioxide from the rest of the gas stream. The remainder of the syngas is sent to the turbine where it is burned to produce power. This gasification process can be applied to a number of fuels including coal, petcoke and biomass. However, the term IGCC is mostly used with reference to coal, likely due to the abundance of this relatively inexpensive fuel source in the US.

There are key aspects of geological sequestration which help to underscore why biological sequestration is currently more feasible than geological sequestration. First and foremost, the technological components of CCS (encompassing separation, capture and storage) are in various stages of development and use. While separation technologies like IGCC have been in use for years, research and testing of CO_2 storage options is still in its infancy. While physical properties of the most desirable storage reservoirs generally support storage of carbon dioxide for hundreds of years, testing needs to be undertaken in order to ensure that large-scale leakage does not occur. As a result, there here have been few opportunities to combine all of the components into a fully integrated system.[110] Secondly, experience with geological storage reservoirs needs to be further developed. For example, some CO_2 is being stored in depleted and still-producing oil

[109] Study of Potential Mohave Alternative/Complementary Generation Resources. Pursuant to CPUC Decision 04-12-016. Prepared for Southern California Edison. Feb 2006, http://www.synapse-energy.com/Downloads/SynapseReport.2006-02.SCE.Mohave-Alternative-Generation-Resources.05-020.pdf

[110] IPCC, *IPCC Special Report on Carbon Dioxide Capture and Storage: Summary for Policymakers*, 2005, http://www.mnp.nl/ipcc/pages_media/ccs-report.html and http://arch.rivm.nl/env/int/ipcc/pages_media/SRCCS-final/SRCCS_SummaryforPolicymakers.pdf

and gas reservoirs as well as in deep saline formations. However, successful storage of CO_2 at the commercial scale has not been attempted. Also, there is little to no experience with storage in unminable coal seams. Lastly, while net CO_2 emissions (taking into account the additional 10-40% more fuel it would take to run the IGCC plant with the use of CO_2 capture and storage technology) could be reduced by approximately 80-90% using IGCC technology, the cost of energy produced with this technology in place is expected to rise by 30-60%.[111]

Due to the challenges in developing CCS, power companies are working together to investigate CCS technologies. Southern Company and AEP, along with many other smaller electric utilities, are participating in the Department of Energy's Southeast Regional Carbon Sequestration Partnership for CO_2 capture and sequestration. The goal of this partnership is to determine the options that exist for sequestering carbon dioxide and validate the most promising opportunities via testing.[112] Additionally, 17 industry sponsors including AEP are participating in the Carbon Sequestration Initiative (or CSI), established to investigate the environmental impacts, technological approaches and economic issues associated with carbon capture and storage technologies.[113] Also, AEP is hosting a sequestration research project at their Mountaineer Plant in West Virginia to better understand the ability of deep saline aquifers to store CO_2.[114]

Though most initiatives tackle the issue of carbon capture separately from storage due to the differing development timelines these two solutions are on, one initiative is attempting to tackle both of these issues simultaneously. FutureGen, proposed by the Bush Administration in 2003, aims to develop a prototype of a zero emission coal-fueled electricity and hydrogen production plant equipped with IGCC technology and the means to capture and store carbon dioxide.[115] The more than $1 billion dollar project[116] is being led by a non-profit industrial consortium representing the coal and power industries and is slated to be operational by 2012.[117]

At this point in time, the expense and immature status of carbon capture and storage technologies likely explains why no utility in the United States is operating a commercial-scale IGCC plant *with* CO_2 capture and storage.[118] Mandatory greenhouse gas reduction legislation resulting in a sufficiently high allowance price or carbon tax is necessary for this to occur.

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[111] Carbon Capture and Storage. http://en.wikipedia.org/wiki/Carbon_capture_and_storage

[112] Southeast Regional Carbon Sequestration Partnership. http://www.secarbon.org/

[113] Carbon Capture and Sequestration Technologies @ MIT. http://sequestration.mit.edu/CSI/index.html

[114] AEP's 2004 response posted on the Carbon Disclosure Project website. http://www.cdproject.net/response_list.asp?id=4&exp=10&letter=A&desc=Electric+Utility

[115] Southern Company's 2004 response posted on the Carbon Disclosure Project website. http://www.cdproject.net/online_response.asp?cid=1269

[116] FutureGen Alliance. http://www.futuregenalliance.org/about.stm

[117] U.S. Department of Energy. FutureGen – Tomorrow's Pollution-Free Power Plant. http://www.fossil.energy.gov/programs/powersystems/futuregen/

[118] Carbon Capture and Storage. http://en.wikipedia.org/wiki/Carbon_capture_and_storage

III.I. Reducing emissions from natural gas distribution

Companies that provide both electricity and natural gas state that their greenhouse gas emissions result overwhelmingly from electricity generation and that the natural gas side of their business contributes relatively few emissions.[119] Nevertheless, some companies are exploring ways of reducing emissions from the natural gas portion of their business.

For example, Duke Energy is participating in US EPA's Gas STAR program, designed to reduce greenhouse gas emissions from pipelines. Through this program EPA works with companies that produce, process, and transmit and distribute natural gas to identify and promote the implementation of cost-effective technologies and practices to reduce emissions of methane. Over 40 gas distribution companies are participating in this voluntary program, along with many more companies that produce, process, and/or transport natural gas.

In 2005, Enbridge and FuelCell Energy reached an agreement under which Enbridge will become a distributor of the Direct FuelCell—Energy Recovery Generation™.[120] The system combines a 1.2 MW Direct FuellCell (DFC) with a 1 MW unfired gas expansion turbine. This system uses natural gas in the pipeline that is often lost during lowering gas pressure to deliver gas to homes and businesses.[121]

In the Northeast U.S., reducing methane emissions from natural gas transmission and distribution equipment is one of the offset options that states participating in the Regional Greenhouse Gas Initiative plan to explore.

III.J. Shaping public policy

Companies are taking an increasingly active and constructive role in the formulation of public policy pertaining to global warming at both the regional and national level. In general, companies with lower greenhouse gas intensity (greenhouse gas emissions per kilowatthour produced) have favored a mandatory greenhouse gas regulatory program (e.g. Exelon, PSEG). Only recently have companies with higher emissions intensity begun grudgingly to discuss element of a mandatory program. To date most of the discussion has focused on a mandatory cap program, though some companies indicate they would support carbon tax.

Numerous companies participated in hearings held in 2006 by the U.S. Senate Energy and Natural Resources Committee regarding the design of a mandatory cap and trade program. The Committee invited interested parties to prepare comments on specific questions associated with the design of a mandatory cap and trade program, and many companies participated. Companies presented positions ranging from enthusiastic endorsement of a mandatory cap and trade program (e.g. Exelon, Duke, Calpine), to urging a voluntary approach (AEP, Southern), to addressing only specific topics such as

[119] See, e.g. responses to Carbon Disclosure Project 4 for Exelon, and Duke Energy.

[120] http://www.enbridge.com/about/enbridgeCompanies/gasDistribution/emerging-tech.php#2

[121] http://energy.seekingalpha.com/article/20139 and http://www.energyvortex.com/pages/headlinedetails.cfm?id=2526

the distribution of allowances under a cap and trade program (Entergy). More recently several companies are participating in on-going legislative hearings in Congress (e.g. Duke, AEP, and PNM Resources).

Companies have also participated in regional and state policy development. For example, many power companies (including Keyspan and National Grid) have attended stakeholder meetings for the Regional Greenhouse Gas Initiative as well as regulations in California. Keyspan Energy, a natural gas distribution and generation company in Northeast has been actively participating in the RGGI meetings and presented their ideas as to how emission allocations should be.[122] The company has endorsed RGGI.

Beyond participating in specific legislative and regulatory activities, there are several corporate initiatives to formulate a policy position and recommendations. The US Climate Action Partnership (USCAP) supports a mandatory program for major emitting sectors (large stationary sources, transportation, and energy use in commercial and residential buildings). The group favors phased in requirements with near- mid- and long-term horizons, and a flexible approach that could include different methods for establishing price signal. The group also supports approaches that encourage action by other countries. Members of this group include Duke Energy, FPL Group, PG&E Corporation and PNM Resources.

Several companies participate in the Clean Air Policy Initiative (CAPI). This is an effort organized through the Clean Energy Group, a coalition of electric generating and electric distribution companies that was founded in 1997. Members of the Clean Air Policy Initiative support the adoption of federal legislation that incorporates a cap and trade mechanism with aggressive but achievable emission reduction requirements. They favor efficiency-based allowance allocation, incorporation of greenhouse gas offset programs, and investment in the development and deployment of advanced energy technologies. Over the past five years they have endorsed several multi-pollutant legislative proposals that would include carbon dioxide.[123] Members of the Clean Air Policy Initiative are Calpine Corporation, Entergy Coporation, Exelon Corporation, Florida Power and Light Company, PG&E Corporation, and Public Service Enterprise Group. They support adoption of a cap-and-trade program for electric generating sector as a first step on the way to an economy-wide regulatory system with updating output-based allocation (comments to Senate Natural Resources Committee, 2006).

Companies who participate in these initiative cite the following reasons cited for taking initiative: Compelling scientific evidence of climate change, delay in adopting a policy raises the risk of unavoidable consequences that could necessitate steeper reductions in the future and more costly solutions, earlier action preserves response options, and should

[122] See Keyspan, "RGGI CO2 Allocation: Recommended Approach", a presentation on April 7, 2006, www.dec.state.ny.us/website/dar/keyspan040706.pdf and Keyspan's response to Carbon Disclosure Project 4

[123] Information on the Clean Energy Group and the Clean Air Policy Initiative is available at the website: www.thecleanenergygroup.com

reduce costs of mitigation and adaptation, favoring regulatory certainty that would mitigate "stroke of the pen risk," the risk that a regulator or congressman signing a law can suddenly change the value of assets, and enabling companies to develop a favorable business position with respect to greenhouse gases.

Business trade groups have also taken positions in policy debates. Until recently, the Edison Electric Institute – the main trade group for electric companies—opposed a mandatory program favoring instead voluntary actions by individual companies. However, in early February EEI stated it would support economy-wide-legislation to address global warming that imposes a price on carbon and assures stable, long-term public/private funding to support the development and deployment of needed technology solutions.[124] In comments on Senator Bingaman's White Paper, the American Gas Association stated that it didn't support economy-wide "tax," but that if a cap and trade program was developed, it should include sector-specific programs, and upstream point of regulation.

IV. Summary and conclusion

Although the United States and Canada have not adopted mandatory federal greenhouse gas emission reduction programs, companies in both countries are pursuing a wide variety of activities related to climate change risks and opportunities. They are pursuing these activities pursuant to state and provincial requirements, and/or on their own initiative as part of a corporate strategy.

Companies perceive risks and opportunities associated with climate change. The largest risk is associated with the impact of future regulations on existing assets, with the possibility that mandatory greenhouse gas reductions will render existing assets uneconomic. Other risks include variations in demand due to temperature changes and price variation, changes in competitive position relative to other companies in the market, and the difficulty of making investments in long-lived resources in an era of regulatory uncertainty. Conversely, opportunities include the likelihood that greenhouse gas regulation will increase the relative value of low carbon energy sources, improving the value of existing low carbon assets, and opening the market for new low carbon energy sources.

In response to these perceived risks and opportunities, companies have undertaken a wide range of activities that basically fall into the following categories:

- Avoiding greenhouse gas emissions through operation of low and zero greenhouse gas emitting generation,
- Reducing greenhouse gas emissions from existing assets through internal and process efficiency improvements,
- Developing experience and expertise in offsetting emissions,
- Developing experience and expertise in trading emissions,
- Exploring new low and zero emission energy resources,

[124] EEI press release February 9, 2007.

- Exploring options for removing greenhouse gases through carbon sequestration, and
- Participating in the development of climate change policy.

The current lack of mandatory federal policy on climate change is not indicative of corporate awareness and activity on climate change. Companies who are beginning to develop strategies are positioning themselves to be prepared for mandatory requirements. These companies are becoming increasingly sophisticated as they gain experience and make changes in their resources and management strategies. In general companies with a low carbon portfolio have been the leaders in urging mandatory greenhouse gas emission reductions; however, recently companies with higher carbon intensities have begun to participate in discussions about the development of mandatory programs rather than continuing to only support voluntary programs.

These companies are also providing examples that other companies can follow in developing strategies to respond to the risks and opportunities associated with climate change. Most companies that are responding to climate change issues are developing a multi-faceted approach that includes management of existing resources, development of new technologies and resources, new forms of planning for long-term investments and participation in public policy development. This sort of multi-faceted approach, that assembles a variety of initiatives into a corporate strategy, seems to be the most promising approach in an environment of uncertainty.

Appendices

Appendix 1: Summary of state greenhouse gas emission reduction targets

State	Reduction Target	Date of State Specific Target	Source	Cite	Participation in Regional Reduction Program
AZ	2000 levels by 2020; 50% below 2000 levels by 2040	September 7, 2006	EO 2006-13 - Climate Change Action	http://www.azgovernor.gov/dms/upload/EO_200613_90806_.pdf	Western Regional Climate Action Initiative, February 26, 2007
CA	2000 levels by 2010; 1990 levels by 2020; 80% below 1990 levels by 2050	June 1, 2005	Executive Order S-3-05 and AB 32	http://www.climatechange.ca.gov/	Western Regional Climate Action Initiative, February 26, 2007
CT	1990 levels by 2010; 10% below 1990 levels by 2020; 75% reduction by 2050.	October 1, 2004	NEG/ECP, RGGI. GA Substitute Bill 595 (An Act Concerning Climate Change) requires state to meet 75% reduction by 2050 in absence of NEG/ECP affirmative goal. Participating in RGGI	http://www.pewclimate.org/docUploads/CT-SB595%20climateactionplan%202004.pdf	Regional Greenhouse Gas Initiative, December 20, 2005
IL	1990 levels by 2020; 60% below 1990 levels by 2050.	February 13, 2007	Request to Advisory Group	http://illinois.gov/PressReleases/ShowPressRelease.cfm?SubjectID=2&RecNum=5715	
MA	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 1990 levels in the long term		NEG/ECP, RGGI		Regional Greenhouse Gas Initiative, Joined February 7, 2007
ME	1990 levels by 2010; 10% below 1990 levels by 2020; 75-80% below 2003 levels in the long term	June 26, 2003	H.P. 622 - L.D. 845 (An Act to Provide Leadership in Addressing the Threat of Climate Change) requires meeting NEG/ECP targets. RGGI	http://janus.state.me.us/legis/ros/lom/lom121st/5pub201-250/pub201-250-44.htm	Regional Greenhouse Gas Initiative, December 20, 2005
NH	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term		NEG/ECP, RGGI		Regional Greenhouse Gas Initiative, December 20, 2005
NJ	1990 levels by 2020; 80% below 2006 levels by 2050	February 13, 2007	Executive Order 54, RGGI	http://www.state.nj.us/governor/news/news/approved/20070213a.html	Regional Greenhouse Gas Initiative, December 20, 2005
NM	2000 levels by 2012; 10% below 2000 levels by 2020; 75% below 2000 levels by 2050	June 1, 2005	EO-05-033	http://www.governor.state.nm.us/orders/2005/EO_2005_033.pdf	Western Regional Climate Action Initiative, February 26, 2007
NY	5% below 1990 levels by 2010; 10% below 1990 levels by 2020		RGGI		Regional Greenhouse Gas Initiative, December 20, 2005
OR	Stabilize by 2010; 10% below 1990 levels by 2020; 75% below 1990 levels by 2050	April 13, 2005	Advisory Group Report "Oregon Strategy for Greenhouse Gas Reductions."	http://www.oregon.gov/ENERGY/GBLWRM/Strategy.shtml	Western Regional Climate Action Initiative, February 26, 2007
RI	1990 levels by 2010; 10% below 1990 levels by 2020		NEG/ECP, RGGI		Regional Greenhouse Gas Inititiave, joined February 7, 2006
VT	1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term	September 16, 2003	2003 Executive Order on reducing GHG from state buildings; 2006 Statute, NEG/ECP, RGGI		Regional Greenhouse Gas Initiative, December 20, 2005
WA	1990 levels by 2020; 25% below 1990 levels by 2035; 50% below 1990 levels by 2050	February 7, 2007	Executive Order No. 07-02	http://www.governor.wa.gov/execorders/eo_07-02.pdf	Western Regional Climate Action Initiative, February 26, 2007
BC	33% reduction by 2020	February 13, 2007	"Throne Speech"	http://www.leg.bc.ca/38th3rd/4-8-38-3.htm#	

Appendix 2: Requirements for Consideration of GHG Emissions in Electric Resource Decisions

Program type	State	Description	Date	Source
GHG value in resource planning	CA	PUC requires that regulated utility IRPs include carbon adder of $8/ton CO_2, escalating at 5% per year.	April 1, 2005	CPUC Decision 05-04-024
GHG value in resource planning	WA	Law requiring that cost of risks associated with carbon emissions be included in Integrated Resource Planning for electric and gas utilities	January, 2006	WAC 480-100-238 and 480-90-238
GHG value in resource planning	OR	PUC requires that regulated utility IRPs include analysis of a range of carbon costs. PUC will investigate CO_2 risk in resource planning (including value for base case, sensitivity cases, and 'trigger point values), and CO_2 risk in long-term resource procurement	Year 1993 Year 2007	Order 93-695 Order 07-002
GHG value in resource planning	NWPCC	Inclusion of carbon tax scenarios in Fifth Power Plan	May, 2006	NWPCC Fifth Energy Plan
GHG value in resource planning	MN	Law requires utilities to use PUC established environmental externalities values in resource planning	January 3, 1997	Order in Docket No. E-999/CI-93-583
GHG in resource planning	MT	IRP statute includes an "Environmental Externality Adjustment Factor" which includes risk due to greenhouse gases. PSC required Northwestern to account for financial risk of carbon dioxide emissions in 2005 IRP.	August 17, 2004	Written Comments Identifying Concerns with NWE's Compliance with A.R.M. 38.5.8209-8229; Sec. 38.5.8219, A.R.M.
GHG in resource planning	KY	KY staff reports on IRP require IRPs to demonstrate that planning adequately reflects impact of future CO_2 restrictions	2003 and 2006	Staff Report On the 2005 Integrated Resource Plan Report of Louisville Gas and Electric Company and Kentucky Utilities Company - Case 2005-00162, February 2006
GHG in resource planning	UT	Commission directs Pacificorp to consider financial risk associated with potential future regulations, including carbon regulation	June 18, 1992	Docket 90-2035-01, and subsequent IRP reviews
GHG in resource planning	MN	Commission directs Xcel to "provide an expansion of CO2 contingency planning to check the extent to which resource mix changes can lower the cost of meeting customer demand under different forms of regulation."	August 29, 2001	Order in Docket No. RP00-787

GHG in CON	MN	Law requires that proposed non-renewable generating facilities consider the risk of environmental regulation over expected useful life of the facility	2005	Minn. Stat. §216B.243 subd. 3(12)

Appendix 3: Renewable Energy Portfolio Targets by State

State	All-Resource Target	Set-Aside Target
Az	1.1% by 2007	0.66% solar by 2007
Cal.	20% by 2010	
Col.	10% by 2015	0.4% solar by 2015
Conn.	10% by 2010	
D.C.	11% by 2022	0.386% solar by 2022
Del	10% by 2019	
Hawaii	20% by 2020	
Iowa	105 MW	
Mass.	4% by 2009 (+ 1% annual increase)	
Md.	7.5% by 2019	
Maine	30% by 2000	
Minn.	10% by 2015 goal	
Mont.	15% by 2015	
N.J.	22.5% by 2021	2.12% solar by 2021
N.M.	10% by 2011	
Nev.	20% by 2015	1% solar and maximum 5% efficiency by 2015
N.Y.	24% by 2013	0.1542% customer-sited gen. by 2013
Penn.	18% by 2020 (8% is RE)	0.5% solar by 2015
R.I.	15% by 2020	
Tex.	5,880 MW by 2015 (about 5%)	
Vt.	Load growth between 2005 and 2012 (about 9%)	
Wisc.	10% by 2015	

Source: DSIRE 2006, available at http://www.dsireusa.org/

Appendix 4: 2004 Energy Efficiency Program Spending and Savings

	Total Spending			Cumulative Savings	
	$1000	Per capita	% revenues	GWh	% sales
Alabama	438	$0.10	0.0%	382	0.4%
Alaska	103	$0.16	0.0%	3	0.1%
Arizona	4,000	$0.70	0.1%	106	0.2%
Arkansas	231	$0.08	0.0%	32	0.1%
California	380,009	$10.60	1.3%	19,590	7.8%
Colorado	13,715	$2.98	0.4%	687	1.5%
Connecticut	58,098	$16.60	1.8%	2,651	8.3%
Delaware	NA	NA	NA	0	0.0%
District of Columbia	2,200	$3.97	0.3%	251	2.3%
Florida	72,014	$4.14	0.4%	5,951	2.7%
Georgia	1,356	$0.15	0.0%	291	0.2%
Hawaii	9,190	$7.28	0.5%	85	0.8%
Idaho	7,023	$5.03	0.6%	813	3.7%
Illinois	3,000	$0.24	0.0%	130	0.1%
Indiana	2,062	$0.33	0.0%	812	0.8%
Iowa	28,833	$9.76	1.1%	1,310	3.2%
Kansas	0	$0.00	0.0%	0	0.0%
Kentucky	4,146	$1.00	0.1%	161	0.2%
Louisiana	324	$0.07	0.0%	25	0.0%
Maine	13,118	$9.98	1.1%	33	0.3%
Maryland	50	$0.01	0.0%	2,221	3.3%
Massachusetts	133,326	$20.81	2.2%	3,514	6.3%
Michigan	8,000	$0.79	0.1%	1	0.0%
Minnesota	55,784	$10.95	1.4%	4,791	7.6%
Mississippi	497	$0.17	0.0%	83	0.2%
Missouri	928	$0.16	0.0%	22	0.0%
Montana	8,002	$8.63	1.0%	560	4.3%
Nebraska	4,348	$2.49	0.3%	56	0.2%
Nevada	8,473	$3.63	0.3%	75	0.2%
New Hampshire	15,120	$11.64	1.2%	340	3.1%
New Jersey	92,753	$10.68	1.2%	3,234	4.2%
New Mexico	2,000	$1.05	0.1%	26	0.1%
New York	147,193	$7.63	0.8%	4,772	3.4%
North Carolina	3,722	$0.44	0.0%	12	0.0%
North Dakota	465	$0.73	0.1%	0	0.0%
Ohio	16,195	$1.41	0.2%	394	0.3%
Oklahoma	316	$0.09	0.0%	91	0.2%
Oregon	62,888	$17.51	2.2%	2,940	6.4%
Pennsylvania	3,446	$0.28	0.0%	16	0.0%
Rhode Island	13,990	$12.95	1.6%	492	6.2%
South Carolina	4,920	$1.17	0.1%	107	0.1%
South Dakota	542	$0.70	0.1%	0	0.0%
Tennessee	10,937	$1.86	0.2%	441	0.4%
Texas	80,000	$3.56	0.3%	6,229	1.9%
Utah	16,450	$6.80	1.2%	762	3.1%
Vermont	14,000	$22.54	2.2%	400	7.1%
Virginia	0	$0.00	0.0%	166	0.2%
Washington	88,522	$14.26	1.9%	5,974	7.5%
West Virginia	992	$0.55	0.1%	23	0.1%
Wisconsin	53,734	$9.76	1.1%	3,233	4.8%
Wyoming	0	$0.00	0.0%	0	0.0%
USA TOTAL	1,447,453	$4.93	0.5%	74,286	2.1%

Appendix 5: State Requirements[125]

GHG emission targets

AZ: 2000 levels by 2020; 50% below 2000 levels by 2040

CA: 2000 levels by 2010; 1990 levels by 2020; 80% below 1990 levels by 2050

CT: 1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term

MA: 1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 1990 levels in the long term

ME: 1990 levels by 2010; 10% below 1990 levels by 2020; 75-80% below 2003 levels in the long term

NH: 1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term

NJ: 3.5% below 1990 levels by 2005

NM: 2000 levels by 2012; 10% below 2000 levels by 2020; 75% below 2000 levels by 2050

NY: 5% below 1990 levels by 2010; 10% below 1990 levels by 2020

OR: Stabilize by 2010; 10% below 1990 levels by 2020; 75% below 1990 levels by 2050

RI: 1990 levels by 2010; 10% below 1990 levels by 2020

VT: 1990 levels by 2010; 10% below 1990 levels by 2020; 75-85% below 2001 levels in the long term

Caps and offset requirements (as of February 2006)

CA: Caps emissions from electricity retailers and, over the longer term, from natural gas utilities as well.

MA: Caps emissions from six older fossil fuel power plants at approximately 10 percent below 1997-1999 levels by 2006-2008 (deadlines vary according to compliance method chosen). Also requires new power plants to make a monetary contribution intended to fund projects to offset 1 percent of the plant's CO2 emissions over 20 years.

NH: Caps emissions from the state's three existing fossil fuel power plants at 1990 levels by 2006.

[125] These data are from Pew Center on Global Climate Change, http://www.pewclimate.org/ and http://www.pewclimate.org/what_s_being_done/in_the_states/index.cfm

OR: Requires new power plants to offset approximately 17 percent of anticipated CO2 emissions.

WA: Requires new power plants to offset approximately 20 percent of anticipated CO2 emissions.

GHG Registries

Lake Michigan Air Directors Consortium (LADCO): Provides technical assessments for and assistance to its member states on air quality problems. The organization also serves a forum for its member states to discuss air quality issues. LADCO is currently developing a framework for a voluntary registry of greenhouse gas emissions among its member states.

Eastern Climate Registry: These states are collaborating with Northeast States for Coordinated Air Use Management (NESCAUM) to develop a voluntary GHG emission registry for the Northeast

NJ: Requires entities that report other air emissions to the state Department of Environmental Protection to also report CO2 and CH4 emissions.

WI: Requires entities that emit 100,000 or more tons of CO2 to report their emissions to the state Department of Natural Resources.

CA, WI and NH: Have established registries to which entities can report voluntary GHG emission reductions.