

Section 2.3: Greenhouse Gas Emissions and Global Climate Change

Topic / Issue Description

Climate change and the role of anthropogenic (human-caused) greenhouse gas emissions continue to be discussed by scientists, policymakers, and interested citizens in the U.S. and around the world.¹

According to the U.N. Intergovernmental Panel on Climate Change (IPCC),² global mean surface air temperature increased about 1.44°F (0.76°C) during the 20th century.³ Surface temperature data from around the world show an “especially pronounced warming trend during the past 30 years,” with nine of the ten warmest years on record occurring in the past decade.⁴ As for the probable cause of the warming, the IPCC report states that it is “very likely” (at least 90% probability) to be the result of human activities—primarily, the combustion of fossil fuels and release of carbon dioxide into the atmosphere.⁵ This conclusion is endorsed by many in the scientific community, including the national academies of the G8 countries, the National Research Council, the American Meteorological Society, and the American Geophysical Union; however, there are those who challenge the assumption and argue that the current warming trend is the result of natural variability.⁶

Although projections of impacts from climate change are highly uncertain, historical and statistical evidence suggest that a warmer global climate could produce both harmful and beneficial effects, and these effects will vary by region. People in developing countries are likely more vulnerable to damaging effects than those in developed countries, largely because they have fewer resources for coping with impacts and also because some of these countries have large populations in concentrated regions vulnerable to a rise in sea

¹ In response to a mandate from Congress, the National Academy of Sciences has established a Climate Change Study Committee (<http://dels.nas.edu/basc/climate-change/background.shtml>) that will “investigate and study the serious and sweeping issues relating to global climate change and make recommendations regarding what steps must be taken and what strategies must be adopted in response to global climate change, including the science and technology challenges thereof.”

² The IPCC was established by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) in 1988. Its role “is to assess on a comprehensive, objective, open and transparent basis the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation”: <http://www.ipcc.ch/about/about.htm>.

³ Hegerl, G.C., F. W. Zwiers, P. Braconnot, N.P. Gillett, Y. Luo, J.A. Marengo Orsini, N. Nicholls, J.E. Penner, and P.A. Stott, 2007: Understanding and Attributing Climate Change, *in* Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, p. 683: http://ipcc-wg1.ucar.edu/wg1/Report/AR4WG1_Print_Ch09.pdf.

⁴ National Research Council, 2008, Understanding and Responding to Climate Change: Highlights of National Academies Reports: <http://dels.nas.edu/basc/climate-change/basics.shtml> (accessed August 2008).

⁵ Experts generally focus on six major greenhouse gases: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), and sulfur hexafluoride (SF₆). Water vapor is also an important greenhouse gas, but its atmospheric concentration is not generally affected by human activity.

⁶ CNN, 2007, Global warming: A natural cycle or human result?, by Manav Tanneeru: <http://www.cnn.com/2007/TECH/science/07/11/globalwarming.overview/index.html>.

level or flooding or in marginal agricultural lands vulnerable to drought. Warming would probably increase natural range of insect-borne diseases and also disrupt deep ocean currents that strongly influence global climate (thermohaline circulation). Very rapid changes in climate could have drastic impacts on plants and animals.⁷

As the scientific community works towards better understanding of climate change and its potential impacts, policymakers around the world are considering strategies for stabilizing and then reducing global GHG emissions. In the U.S., a variety of approaches are being advocated by the public, industry, interest groups, and policymakers (see summary of Congressional bills below under Existing Policies and Programs). These approaches can be distinguished in terms of (1) their scope—international, national, regional, or statewide—and (2) total cost to achieve the same level of reduction.

Scope—First, regarding the question of scope, it is perhaps important to reiterate the seemingly obvious point that global warming is a problem requiring an international, collective solution: greenhouse gas emissions cause equal harm to the global atmosphere no matter where they are emitted. Thus, in a global economy where nations and companies are increasingly forced to compete on cost, unilateral attempts to implement costly carbon regulation are unlikely to be successful. Moreover, as noted in a recent white paper prepared by the Congressional Budget Office: “One key factor that distinguishes climate change from other pollution problems our country has tackled is that *local* greenhouse gas emissions do not cause *local* environmental or health problems, except to the extent that the emissions contribute to *global* atmospheric concentrations.”⁸

As the history of the Kyoto Protocol suggests, establishing the framework and institutions for a truly global approach will be challenging and require a high level of political cooperation. It will also require a high level of participation, including participation by developing nations such as India and China. Among the many issues complicating the international approach are the widely varying costs of achieving GHG reductions and the dramatically different cost and benefit implications of climate change for different countries around the world—that is, the fact that there will be winners as well as losers.⁹ Nonetheless, broad participation is essential to success of any international framework and must include both developed and developing countries.^{10, 11}

⁷ Congressional Budget Office (CBO), 2003, *The Economics of Climate Change—A Primer: CBO Study*, April 2003: www.cbo.org. URL’s for this and other resources related to greenhouse gas policy and economics are available, under the “Resources” heading, on the KEC web site: <http://www.kec.kansas.gov/mga/index.htm>.

⁸ CBO, 2008, *Climate Change Legislation Design White Paper: Appropriate Roles for Different Levels of Government*, Committee on Energy and Commerce Staff, February 2008: <http://energycommerce.house.gov/Climate%5FChange/>.

⁹ CBO, 2003, p. 25: “In sum, policymakers may be faced with the extraordinarily complicated task of managing a resource that no one owns, that everyone depends on, and that provides a wide range of very different—and often public—benefits to different people in different regions over very long periods.”

¹⁰ Stavins, Robert N., *Beyond Kyoto: Getting Serious About Global Climate Change*, Presentation at the Department of Economics, University of Warsaw, Warsaw, Poland, Harvard Project on International Climate Agreements, November 13, 2007:

http://belfercenter.ksg.harvard.edu/publication/17698/beyond_kyoto.html.

To date, the U.S. has not implemented a national policy to reduce GHG emissions. Such a step is viewed by many as necessary to the establishment of a viable global framework, in part because the U.S. is responsible for roughly 21% of the annual global GHG emissions (China recently passed the U.S. as the nation with the greatest total annual emissions).¹²

At the national level, U.S. policymakers are considering regulation of GHG emissions.¹³ A federal approach would provide uniformity and a “level playing field,” so that GHG regulation would not create competitive disadvantages among the states nor strictly among U.S. companies. Many U.S. industries and businesses appear supportive of a national approach.

Unlike a national approach, state or regional initiatives are likely to be redundant and lack uniformity, which will undermine their effectiveness. In advance of federal regulation, many states have implemented or are considering policies and programs in an effort to show leadership on the issue. These state efforts are largely focused around non-market-based mandates and standards, which are generally viewed as less efficient and less likely to achieve the stated goals (see discussion of costs below), in part because, absent federal regulation, some GHG emitters will simply avoid doing business in carbon-regulated states. Regional efforts—such as the Climate Registry, the Midwestern Greenhouse Gas Reduction Accord, the Western Climate Initiative, and Regional Greenhouse Gas Initiative—are also underway and, while plagued with some of the same problems, are likely to be more effective than unilateral state actions.

Costs—Regarding the costs of the various policy options, there is widespread agreement that the most effective way to reduce carbon dioxide and other greenhouse gas emissions is to implement market-based initiatives, such as a carbon tax or cap-and-trade policy.¹⁴

¹¹ William Nordhaus, 2008, *A Question of Balance: Weighing the Options on Global Warming Policies*: Yale University Press, 234 p.

¹² A recent Congressional white paper highlights incentives in U.S. policy to encourage China and India to curb their emissions: *Climate Change Legislation Design White Paper: Competitiveness Concerns/Engaging Developing Countries*, prepared by the Committee on Energy and Commerce Staff, January 2008: <http://energycommerce.house.gov/Climate%20Change/> (accessed August 2008).

¹³ By July 2008, more than 235 bills, amendments, and resolutions had been introduced in the 110th Congress relating to climate change and greenhouse gas emissions. In March 2007, the House created the Select Committee on Energy Independence and Global Warming. As of November 2008, the major proposals in play are the Kerry-Snowe *Global Warming Reduction Act*, Sanders-Boxer *Global Warming Pollution Reduction Act*, Bingaman-Specter *Low Carbon Economy Act*, Olver-Gilchrest *Climate Stewardship Act*, Boxer-Lieberman-Warner *Climate Security Act of 2008*, Dogget *Climate Market, Auction, Trust and Trade Emissions Reduction System Act of 2008*, Markey *Investing in Climate Action and Protection*, Waxman *Safe Climate Act of 2007*, and McCain-Lieberman *Climate Stewardship and Innovation Act*. All of the aforementioned acts promulgate a market-based cap-and-trade system; two additional bills supporting a carbon tax have been introduced but have less legislative support: Stark *Save Our Climate Act of 2007*, and Larson *America's Energy Security Trust Fund Act of 2007*. These two bills have proposed implementing an upstream \$10 tax per ton of carbon content and an upstream and midstream \$15 tax per ton of carbon dioxide content respectively.

¹⁴ Unless noted otherwise, information comes from the 2007 KEC staff review, *Greenhouse Gas Emissions—Policy and Economics: A Report Prepared for the Kansas Energy Council by Trisha Shrum*, August 3, 2007: http://www.kec.kansas.gov/reports/GHG_Review_FINAL.pdf.

In addition to being more likely to achieve the goal of reducing greenhouse gas emissions, market-based initiatives are much more efficient—that is, they achieve the same amount of reduction at a lower cost—than non-market mandates and standards.¹⁵ Market-based approaches, such as a carbon tax or cap-and-trade policy, put a monetary value on something that was previously external to market forces—for example, health and environmental costs caused by pollutants such as SO₂ or CO₂,¹⁶ and provide the best incentives for individuals and firms to find low-cost ways to reduce emissions through behavioral changes and innovative technologies.¹⁷

Even optimal policies represent very large revenue transfers from consumers to producers (if permits are given away) or to governments (if emissions are taxed).¹⁸ Although estimates of economic impact of GHG regulation vary, most economists concur that the benefits of acting today to mitigate greenhouse gas emissions outweigh the costs.¹⁹

Carbon Tax—The policy most widely supported by economists is an economy-wide tax on carbon and other GHG emissions. The tax is a direct incentive to reduce consumption and spur development of alternatives, both of which can stimulate further reductions in emissions. Slowly increasing the tax allows the economy to make lowest cost improvements first, followed by more substantial changes. This puts steady pressure on the markets to determine the best pathway towards emissions reduction.

One major advantage of a carbon tax is that it provides clear, more predictable prices. In a cap-and-trade system, permit prices fluctuate, with the potential of either extremely high permit prices causing debilitating compliance costs or extremely low permit prices creating insufficient incentive for emissions reductions. In addition, a carbon tax has much lower administrative costs and is more transparent than a cap-and-trade. Furthermore, since it does not create a new commodity (like the permits or allowances in the cap-and-trade system), a carbon tax is less vulnerable to profiteering and requires less oversight.

Although a carbon tax is likely to be more efficient than a cap-and-trade mechanism, taxes are always politically unpopular, and even more so in a time of economic recession. Among the proposals currently under consideration by Congress, almost all call for a cap-and-trade mechanism, instead of a tax (see discussion under Recommendation 1). It is

¹⁵ Regulatory mandates that focus on particular solutions increase demand for targeted products, which creates even higher prices for consumers and a possible subsidy for producers.

¹⁶ Non-market policies, on the other hand, mandate particular solutions and technologies or set centrally directed standards that must be met, possibly without regard for the costs and resultant benefits. Non-market policies tend to be less flexible, a one-size-fits-all approach that leaves less room for innovation and individualized decisions.

¹⁷ CBO, 2003.

¹⁸ See Nordhaus, 2008, p. 202: “The transfers in the optimal ... programs rise gradually to around 1 percent of consumption, which is itself a major change in fiscal structure. Given the squawks that often arise from relatively small tax or price increases, even a modest program ... is likely to prove politically arduous.”

¹⁹ Nobel laureate Kenneth J. Arrow concluded that the benefits of acting today outweigh the costs, even without the absurdly high rates of future discounting (as were used in the Stern Review); see Arrow, 2007, *Global Climate Change: A Challenge to Policy: Economist’s Voice*: www.bepress.com/ev (accessed April 2008).

worth noting that opposition to a carbon tax may be reduced if the policy were “revenue neutral”—that is, if carbon tax revenues were used to offset other taxes.²⁰ Tax revenues can also be used to mitigate the impact on low-income households.

Cap-and-Trade—A cap-and-trade policy sets a limit on the quantity of carbon and other GHG emissions, issues permits equaling that quantity, and allows trading of the permits among entities that emit. This creates a market for greenhouse gas reductions, and, once that market is operational, a market-based price for each ton of emissions.

Because emissions are capped at a fixed level, regardless of the cost to achieve that level of reduction, permit prices are subject to large fluctuations and unpredictability, which may complicate decisions to invest in abatement technologies and strategies. However, as discussed below (see hybrid cap-and-trade), a cap-and-trade system can be designed so that it operates as efficiently as a carbon tax. Significant administrative oversight will be required to track emissions, ensure permit compliance, and monitor trading in a cap-and-trade system, all of which adds to the administrative and, thus, overall costs of reducing emissions.

Even though it is likely to cost consumers more, a cap-and-trade policy is generally favored by policymakers over a carbon tax. Industry has voiced considerable support for a cap-and-trade policy, though that support may depend on the design of the cap-and-trade mechanism and may wane if the permits are auctioned rather than given away for free.

Another advantage of the cap-and-trade system is that it lends itself to clearly stated annual emissions limits (or goals), and quantitative goals are attractive to policymakers. Although there is an assumption that quantitative limits will “ensure that the globe remains on the safe side of ‘dangerous interferences’ with the climate system,”²¹ it is important to remember that the greenhouse effect depends on the accumulation of GHGs, and, thus, annual emissions have only a small, incremental impact on atmospheric concentrations. It is possible that focusing on the quantity of annual emissions may actually detract from the goal of reducing atmospheric concentrations over time in the most cost-effective manner.

Hybrid Cap-and-Trade System—To address the potential political limitations of the tax and the economic efficiency issues of cap-and-trade approaches, some economists have proposed hybrid cap-and-trade systems that incorporate elements of a GHG tax scheme.²² One such proposal calls for an “upstream” cap-and-trade system in which “first sellers of

²⁰ Gregory Mankiw, One answer to global warming: A new tax, New York Times, September 16, 2007: <http://www.nytimes.com/2007/09/16/business/16view.html>. Mankiw summarizes another proposed tax shift: “Gilbert Metcalf, a professor of economics at Tufts, has shown how revenue from a carbon tax could be used to reduce payroll taxes in a way that would leave the distribution of total tax burden approximately unchanged.”

²¹ Nordhaus, 2008, p. 25.

²² See, for example, Robert Repetto, 2007, National Climate Policy: Choosing the Right Architecture; Congressional Budget Office, 2008, Policy Options for Reducing CO2 Emissions; and other resources available on the KEC’s GHG Policy Committee web page: <http://www.kec.kansas.gov/mga/index.htm>.

fossil fuels” are required to hold permits, with enforcement at the refinery gate for petroleum, at the first distribution point for natural gas, at the mine shipping terminus for coal, and at the port for imports.²³ Such a hybrid cap-and-trade approaches the comprehensiveness of a tax and is, thus, more efficient than proposals that concentrate only on some sectors. Other hybrid proposals create a fixed number of tradable, long-term emissions permits that equal long-term reduction goals as well as annual permits sold at a fixed price but in unlimited quantities. Like both the tax and cap-and-trade approaches, this hybrid proposal will help achieve the reductions where they are the cheapest.²⁴

In summary, nearly all economists agree that market-based policies, which put a price on carbon, are the best way to reduce greenhouse gas emissions. This agreement was highlighted in the recent (October 2008) “open letter” to policymakers signed by over 250 Canadian economists (as well as a similar letter from Canadian scientists), which calls for implementation of market-based policies that focus directly on the problem of all GHG emissions, instead of targeting a few solutions.²⁵ Moreover, market-based policies implemented at the federal level are more likely to be effective than such policies implemented at the state or regional level. However, this does not “lead to the conclusion that States, Tribes, or localities should not do anything to address climate change.”²⁶

Existing Policies and Programs

1. The Kyoto Protocol is an agreement made under the United Nations Framework Convention on Climate Change. Countries that ratified this protocol committed to reductions in their greenhouse gas emissions or to participation in emissions trading if emissions were not reduced. As of August, 2006, 165 countries and other governmental entities ratified the agreement. The United States and Australia, though signatories, did not ratify the agreement. The Kyoto Protocol has been criticized for having trivial short-term benefits without offering long-term solutions. In particular, the short-term emission targets for U.S. were viewed as overly ambitious; emission

²³ Repetto, 2007.

²⁴ However, the annual permits sold for a fixed price (which can be adjusted as needed) place an upper limit on the cost of emissions reduction, thus preventing undue economic hardship. Basing the value of long-term permits on the long-term goal avoids the problem of setting an overly lax short-term cap. In addition, the annual permit price can be controlled to adjust the pressure towards further reductions.

²⁵ An Open Letter to the leaders of Canada’s Federal Political Parties: <http://www.econ-environment.ca/open-letter.html>. See also the letter from the Canadian scientists (<http://www.site.climateletter.org/>), which states “Economists around the world agree. There is only one way to deal with global warming. And that is to put a price on emissions. This can be done through either a carbon tax, a cap and trade system, or both.” It continues, “It is disingenuous to claim on the one hand that the carbon tax will cause an economic disaster and on the other hand advocate for a cap and trade system. They are equivalent economic instruments that have the same effect of pricing emissions. Ordinary Canadians deserve to be told this and not have the issue obscured in political rhetoric.”

²⁶ CBO, 2008, p. 12. The white paper offers the following conclusion on p. 25: “The appropriate roles for Federal, State, Tribal, and local governments in a comprehensive, national approach to climate change will be affected by the design of the underlying approach.”

targets in general were relaxed in 2001 in order to entice Canada, Japan, and Russia to join the agreement.²⁷

On December 14, 2007, the United Nations Framework Convention on Climate Change adopted the Bali roadmap, in which all participating countries acknowledged the findings of the IPCC 2007--that global climate change is happening and delaying action increases the risks of more severe climate change impacts. Furthermore, the Bali roadmap creates the Ad Hoc Working Group on Long-term Cooperative Action, which is charged with creating a new Kyoto Protocol-type agreement by the end of 2009.²⁸

2. The European Union's Emissions Trading Scheme (EU ETS) began on January 1, 2005, and included 25 countries. The program began with a "warm-up" phase ending December 31, 2007, during which only carbon dioxide was regulated and only four sectors—iron and steel, minerals (cement, glass, etc.), energy, and pulp and paper—were included in the emissions trading. Each country was required to submit an allocation plan for approval by the European Commission to ensure that permit allocation requirements were met. Banking and borrowing of credits was allowed within and between periods, with the flexibility for each country to restrict banking between the first and second phases. Penalties for exceeding allowances were set at €40 per ton of CO₂ during the first phase, in addition to requiring the offset of excess emissions in the phase subsequent to the violation. The EU ETS suffered from an over-allocation of allowances in the first phase, which precipitated a dramatic crash in the price of carbon permits to below €0.30 in May 2007, compared with €1.50 in April 2006. Phase two of the scheme began in January of 2008, and to date 2008-vintage allowances have experienced less price volatility, fluctuating from a year-to-date high of €29.33 in July to a low of €17.63 in October. The EU ETS also allows for the U.N.'s Clean Development Mechanisms (CDM) and Joint Implementation credits to be converted into allowances suitable for trading. CDM and Joint Implementation credits are given to companies who invest in greenhouse-gas-reducing technologies in developing countries and allow for greenhouse gas reductions at lower costs than would be available domestically. However, these offsets have also provided opportunities for gaming and outright fraud.²⁹

²⁷ For further discussion of the failures of the Kyoto Protocol, and what sorts of mechanisms any agreement in the future should contain, see Stavins, 2007, *Beyond Kyoto: Getting Serious about Global Climate Change*.

²⁸ See United Nations' Framework Convention on Climate Change, December 2007, Revised Draft Decision -/CP.13: <http://unfccc.int/resource/docs/2007/cop13/eng/107r01.pdf> (accessed December 2008).

²⁹ For example, 28% of CDM's offsets credits (in excess of \$6.5 billion) were awarded for programs designed to reduce emissions of the very potent greenhouse gas HFC-23, emitted in the manufacture of industrial refrigerants. However, the simple technology needed to capture these HFC-23 emissions costs less than \$150 million. The end result of credits given for this purpose was the creation of incentives within the developing world to produce excess amounts of HFC-23 simply to capture wastes for huge profits. See Michael Wara and David Victor, April 2008, *A Realistic Policy on International Carbon Offsets*, Freeman Spogli Institute for International Studies at Stanford University: http://pesd.stanford.edu/publications/a_realistic_policy_on_international_carbon_offsets/ (accessed 2008); see also Michael Wara, 2007, *Is the global carbon market working?: Nature*, vol. 445, p. 595-596. Numbers converted from Euros at a rate of 1.4195 Dollars per Euro.

3. On September 10, 2008, the New Zealand parliament approved the “Emissions Trading and Renewable Preference” bill, which establishes the first nation-wide mandatory cap-and-trade program outside of the EU. Trading of carbon permits under the New Zealand Emission Trading Scheme (NZ ETS) will begin in 2009 for the forestry and transportation industry, with other sectors of the economy gradually phased in through 2013. The NZ ETS targets emissions reductions from a variety of sources: forestry, transportation, electrical production, non-energy industrial processes, and agricultural uses.
4. Carbon taxes have been implemented by a number of nations. Sweden began taxing carbon emissions in 1991. Currently, the tax is equivalent to \$150 per ton of carbon dioxide, though fuels used for electricity generation are exempted and industries are required to pay only 50% of the tax (however, non-industrial consumers pay a separate tax on electricity). Because fuels from renewable sources such as ethanol, methane, biofuels, peat, and waste are exempted, Sweden has seen a great expansion of the use of biomass for heating and industry. The Swedish Ministry of Environment projected that the tax policy lowered carbon dioxide emissions in 2000 by 20 to 25% from 1990 levels. Following Sweden’s lead, Finland, Norway, and Denmark enacted carbon taxes in the early 1990’s. Following the Kyoto Protocol, Germany, Japan, the United Kingdom, and the Netherlands enacted various types and levels of carbon taxes or taxes on electricity.

In North America, Quebec implemented a carbon tax on October 1, 2007, affecting hydrocarbon fuels such as petroleum, coal, and natural gas. The tax is equivalent to about \$13 per ton of carbon (\$3.55 per ton of carbon dioxide) and adds 3.4 cents to the price of a gallon of gasoline. On July 1, 2008, British Columbia also implemented a carbon tax on hydrocarbon fuels; this tax is initially based on a rate of \$10 per ton of carbon (\$2.72 per ton of carbon dioxide) and will increase by \$5 a year to \$30 a ton by 2012. The city of Boulder recently enacted the first U.S. tax on carbon emissions from electricity. The tax is equivalent to \$7 per ton of carbon (\$1.91 per ton of carbon dioxide) and will cost the average household about \$1.33 per month. The revenues, expected to be about \$1 million, will be used to fund Boulder’s “climate action plan.” Other U.S. cities have begun to implement policies to reduce greenhouse gas emissions, often working together with other cities through programs such as the International Council for Local Environmental Initiatives and the U.S. Mayors Climate Protection Agreement.³⁰

5. The 1990 Clean Air Act established a market-based permit trading system to control the levels of sulfur dioxide emissions from power plants, which contribute to the formation of acid rain. The initial permits are allocated for free (i.e., at a zero price) based on fixed emissions rates established by law and by historic fossil fuel use. Allowance banking and trading is permitted, and strict fines, not subject to appeals or waivers, are levied on plants that exceed the emissions allowed by the permits they

³⁰ See Pew Center on the States, October 2007, Climate Change 101: Understanding and Responding to Global Climate Change: http://www.pewcenteronthestates.org/report_detail.aspx?id=32912 (accessed November 2008).

held through allocation or trading. Significantly, there is a “hands-off” approach to how the reductions are achieved: the regulators closely track emissions results, but they are only concerned with compliance with the cap. Additionally, there is public access to actual emissions and trading data, which gives transparency to the process. The current SO₂ cap-and-trade program is widely considered to be a success. Not only have emissions been reduced to the targeted levels, but the actual cost of reductions has been only half of what was expected when the program was enacted. Furthermore, it is estimated that the market-based approach saves \$1 billion annually over a command-and-control regulatory policy.

6. The April 2007 Supreme Court ruling stated that carbon dioxide and other greenhouse gas emissions fall unambiguously under the definition of air pollutants set out in the 1990 Clean Air Act. The Court directed the EPA to review its response to petitions from state and local governments asking for EPA regulation of carbon dioxide emissions—the EPA had previously held that it did not have jurisdiction to regulate such emissions. If the EPA finds that greenhouse gas emissions such as carbon dioxide lead to climate change, it is obligated by the Clean Air Act to regulate such emissions.³¹ Although the EPA has not released its decision regarding carbon dioxide emissions (as of December 2008), EPA’s Environmental Appeals Board recently blocked the Agency from issuing a permit for a proposed coal plant in Utah, based on the EPA’s Denver office failing to require controls for carbon dioxide emissions. This ruling stops the permitting process of perhaps 100 proposed coal plants. Because of this, the EPA is expected to make its decision regarding carbon dioxide and other greenhouse gases in early 2009.³²
7. The Midwestern Greenhouse Gas Reduction Accord, released in November 2007, is a regional collaboration between the Governors/Premier of Iowa, Illinois, Kansas, Manitoba, Michigan, Minnesota, and Wisconsin. Through the accord, each participating state agreed to establish a collaborative program reducing greenhouse gas emissions in each participating state/province. The governors of Indiana, Ohio, South Dakota, and the premier of Ontario have joined the accord as observers. Details of the accord are currently being discussed by several advisory groups. Computer modeling of different scenarios—reductions of 10%, 15%, and 25% below 2005 levels by 2020—is expected to be completed by February 2009 and a draft plan will be presented to the Governor’s by the end of 2009.³³
8. The Western Climate Initiative (WCI) is another regional collaboration, launched in February 2007, between the Governors of Arizona, California, New Mexico, Oregon,

³¹ It should be noted that the EPA did not dispute that man-made greenhouse gases causes climate change while the case was being heard; see *Massachusetts et al. v. Environmental Protection Agency et al.*, 549 U.S. 497 no. 05-1120: <http://laws.findlaw.com/us/000/05-1120.html> (accessed December 2008).

³² See Josef Hebert, November 2008, Utah coal plant permit blocked by EPA panel, Associated Press story: http://www.google.com/hostednews/ap/article/ALeqM5gSt_gge-bueZU2rGVTx1SPZzbkAwD94ECPU04 (accessed December 2008).

³³ Midwestern Governors Association, 2007, Governors Sign Energy Security and Climate Stewardship Platform and Greenhouse Gas Accord: <http://www.midwesterngovernors.org/govenergynov.htm> (accessed December 2008).

and Washington. Participating states are identifying, evaluating, and implementing collective and cooperative ways to reduce greenhouse gases in the region. In April 2007, British Columbia joined the Initiative. Other states and provinces, including Kansas, have joined as observers.³⁴

9. The Regional Greenhouse Gas Initiative, or RGGI, is a cooperative effort by ten Northeastern and Mid-Atlantic states to reduce carbon dioxide emissions from power plants. Under RGGI, all ten signatory states have established individual cap-and-trade programs, based on an agreed-upon model rule and linked through a program of allowance reciprocity—thus a credit issued in New York can be used by a company to meet obligations in Vermont. The initial cap is high, but gradually tightens until 2018, when the cap level will be 10% lower than the initial auction level. Like the EU ETS system, RGGI allows for the use of offsets, but limits the allowable offsets as well as their use (3.3% of a power plant’s total obligation).³⁵

RGGI conducted its first carbon dioxide allowance auction on September 29, 2008, with 59 companies from the electrical, financial, and environmental sectors participating. All allowances were sold at a price of \$3.07 per ton of carbon dioxide, resulting in over \$39.5 million in proceeds. These proceeds will be distributed to the six member states that offered allowances: Connecticut, Maine, Maryland, Massachusetts, Rhode Island, and Vermont and used to support “low-carbon-intensity solutions,” such as programs promoting increased energy efficiency and renewable electrical generation. Delaware, New Hampshire, New Jersey, and New York did not issue allowances during the first auction period.

10. The Climate Registry is a non-profit organization governed by members appointed from the 60 participating U.S. and Mexican states, Canadian provinces, and Indian tribes. It was formed in March 2007, with the goal of establishing consistent and transparent standards for the reporting of greenhouse gas emissions throughout North America. Currently, 281 businesses and government entities voluntarily report and verify their greenhouse gas emissions to the Registry.
11. Twenty-eight states have adopted policies outlining steps to reduce emissions of greenhouse gases. Twelve of these 28 states—Arizona, California, Connecticut, Oregon, New Mexico, New York, New Jersey, Rhode Island, Massachusetts, New Hampshire, Vermont, and Maine—have also implemented emissions targets for their state. California made its emissions target (1990 levels by 2020) enforceable under state law.
12. On March 21, 2008, Governor Sebelius issued Executive Order 08-03, which created the Kansas Energy and Environmental Policy (KEEP) Advisory Group. This advisory

³⁴ Western Climate Initiative, 2008, Home: <http://www.westernclimateinitiative.org/> (accessed December 2008).

³⁵ See Regional Greenhouse Gas Initiative, About RGGI: <http://www.rggi.org/about> (accessed December 2008); see also RGGI Inc., September 2008, RGGI States’ First CO₂ Auction Off to a Strong Start: http://www.rggi.org/docs/rggi_press_9_29_2008.pdf (accessed December 2008).

group is charged with exploring opportunities to reduce greenhouse gas emissions at the state level within all sectors of the economy and is facilitated by the Center for Climate Strategies. They will submit a preliminary report by January 12, 2009, and a final written report by early January 2010.

13. The Chicago Climate Exchange (CCX) is a voluntary, but contractually binding, emissions trading system for all six greenhouse gases. Members include the states of New Mexico and Illinois, a few counties, and numerous cities (including Melbourne, Australia), businesses, NGOs, and universities. During Phase I, members pay a fee to join the exchange and agree to reduce emissions by 4% relative to a baseline of 1998-2001. Phase II calls for a further 6% reduction. Members who do not meet these reductions purchase “Carbon Financial Instruments”(CFIs) contracts—each representing 100 metric tons of carbon dioxide equivalent—from those members who exceeded these reductions; however, because most members met their initial targets, the exchange has had more sellers than willing buyers. The CCX also offers CFIs for certain offset projects including methane destruction, agricultural practices, forestry practices, mitigation in Brazil, renewable energy, and Clean Development Mechanisms credits established in the Kyoto Protocol.³⁶ Some question whether some of the offsets available for purchase actually represent “additional” reductions that would not otherwise be undertaken. CFI prices reached record high levels of \$7.40 in May 2008, but have since fallen to \$1.55 on November 28, 2008.³⁷
14. In 2006, the Chicago Climate Exchange (CCX) launched the Chicago Climate Futures Exchange (CCFE) to meet the needs of companies facing environmental regulation. Unlike the CCX, the CCFE does not ask members to participate in a voluntary cap-and-trade program. Instead, the CCFE offers standardized future and option contracts on carbon allowances issued under the EU ETS and RGGI, as well as on EPA sulfur and nitrogen allowances issued through the Clear Air Act.³⁸ The Green Exchange operated by the New York Mercantile Exchange (NYMEX) will begin trading similar products in the first quarter of 2009. Many of the world’s largest brokerage houses—such as Morgan Stanley, Credit Suisse, JP Morgan Chase—are named as partners in the exchange.³⁹

³⁶ See Chicago Climate Exchange, 2007, Overview: <http://www.chicagoclimatex.com/content.jsf?id=821> (accessed December 2, 2008); see also Chicago Climate Exchange, 2007, CCX Offsets Program: <http://www.chicagoclimatex.com/content.jsf?id=23> (accessed December 2, 2008).

³⁷ Some suggest the recent price changes stem from the perception that a national cap-and-trade program is inevitable, making investors question whether the CCX offset program, with all of its flaws, offers a good model for a mandatory federal scheme. See Carbon Positive, December 2008, VER prices soften in November: <http://www.carbonpositive.net/viewarticle.aspx?articleID=1326> (accessed December 2008).

³⁸ Chicago Climate Futures Exchange, 2007, About Chicago Climate Futures Exchange: http://www.ccfex.com/about_ccfe/ (accessed December 2008).

³⁹ New York Mercantile Exchange, 2007, The Green Exchange Initiative: <http://nymex.greenfutures.com/overview/> (accessed December 2008).