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Climate Change: Greenhouse Gas Reduction Bills in the 110th Congress

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Climate Change: Greenhouse Gas Reduction Bills in the 110th Congress

Summary

A number of congressional proposals to advance programs that reduce greenhouse gases have been introduced in the 110th Congress. Proposals receiving particular attention would create market-based greenhouse gas reduction programs along the lines of the trading provisions of the current acid rain reduction program established by the 1990 Clean Air Act Amendments. This paper presents a side-by-side comparison of the major provisions of those bills and includes a glossary of common terms.

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Climate Change: Greenhouse Gas Reduction Bills in the 110th Congress

Introduction

Climate change is generally viewed as a global issue, but proposed responses generally require action at the national level. In 1992, the United States ratified the United Nations Framework Convention on Climate Change (UNFCCC), which called on industrialized countries to take the lead in reducing the six primary greenhouse gases to 1990 levels by the year 2000.[1] For more than a decade, a variety of voluntary and regulatory actions have been proposed or undertaken in the United States, including monitoring of power plant carbon dioxide emissions, improved appliance efficiency, and incentives for developing renewable energy sources. However, carbon dioxide emissions have continued to increase.

In 2001, President George W. Bush rejected the Kyoto Protocol, which called for legally binding commitments by developed countries to reduce their greenhouse gas emissions.[2] He also rejected the concept of mandatory emissions reductions. Since then, the Administration has focused U.S. climate change policy on voluntary initiatives to reduce the growth in greenhouse gas emissions. In contrast, in 2005, the Senate passed a Sense of the Senate resolution on climate change declaring that a mandatory, market-based program to slow, stop, and reverse the growth of greenhouse gases should be enacted at a rate and in a manner that "will not significantly harm the United States economy" and "will encourage comparable action" by other nations.[3]

A number of congressional proposals to advance programs designed to reduce greenhouse gases have been introduced in the 110th Congress. These have generally followed one of three tracks. The first is to improve the monitoring of greenhouse gas emissions to provide a basis for research and development and for any potential future reduction scheme. The second is to enact a market-oriented greenhouse gas reduction program along the lines of the trading provisions of the current acid rain reduction program established by the 1990 Clean Air Act Amendments. The third

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[1] Under the United Nations Framework Convention on Climate Change (UNFCCC), those gases are carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Some greenhouse gases are controlled under the Montreal Protocol on Substances that Deplete the Ozone Layer, and are not covered under UNFCCC.

[2] For further information, see CRS Report RL30692, *Global Climate Change: The Kyoto Protocol*, by Susan R. Fletcher.

[3] S.Amdt. 866, passed by voice vote after a motion to table failed 43-54, June 22, 2005.

is to enact energy and related programs that would have the added effect of reducing greenhouse gases; an example would be a requirement that electricity producers generate a portion of their electricity from renewable resources (a renewable portfolio standard). This report focuses on the second category of bills.

Proposed Legislation in 110th Congress

In the 110th Congress, six bills have been introduced that would impose controls on emissions of greenhouse gases. A comparison of major provisions is provided in **Appendix 1**.

S. 280, introduced January 12, 2007, by Senator Lieberman, would cap emissions of the six greenhouse gases specified in the United Nations Framework Convention on Climate Change, at reduced levels, from the electric generation, transportation, industrial, and commercial sectors — sectors that account for about 85% of U.S. greenhouse gas emissions. The reductions would be implemented in four phases, with an emissions cap in 2012 based on the affected facilities' 2004 emissions (for an entity that has a single unit that emits more than 10,000 metric tons of carbon dioxide equivalent); the cap steadily declines until it is equal to one-third of the facilities' 2004 levels. The program would be implemented through an expansive allowance trading program to maximize opportunities for cost-effective reductions, and credits obtained from increases in carbon sequestration, reductions from non-covered sources, and acquisition of allowances from foreign sources could be used to comply with 30% of reduction requirements. The bill also contains an extensive new infrastructure to encourage innovation and new technologies.

S. 309, introduced January 16, 2007, by Senator Sanders, would cap greenhouse gas emissions on an economy-wide basis beginning in 2010. Beginning in 2020, the country's emissions would be capped at their 1990 levels, and then proceed to decline steadily until they were reduced to 20% of their 1990 levels in the year 2050. The EPA has the discretion to employ a market-based allowance trading program or any combination of cost-effective emission reduction strategies. The bill also includes new mandatory greenhouse gas emission standards for vehicles and new powerplants, along with a new energy efficiency performance standard. The bill would establish a renewable portfolio standard (RPS) and a new low-carbon generation requirement and trading program.

S. 317, introduced January 17, 2007, by Senator Feinstein, would cap greenhouse gas emissions from electric generators over 25 megawatts. Beginning in 2011, affected generators would be capped at their 2006 levels, declining to 2001 levels by 2015. After that, the emission cap would decline 1% annually until 2020, when the rate of decline would increase to 1.5%. The allowance trading program includes an allocation scheme that provides for an increasing percentage of all allowances to be auctioned, with 100% auctioning in 2036 and thereafter. The cap-and-trade program allows some of an entity's reduction requirement to be meet with credits obtained from foreign sources and a variety of other activities specified in the bill.

S. 485, introduced February 1, 2007, by Senator Kerry, would cap greenhouse gas emissions on an economy-wide basis beginning in 2010. Beginning in 2020, the country's emissions would be capped at their 1990 levels. After 2020, emissions economy-wide would be reduced 2.5% annually from their previous year's level until 2031, when that percentage would increase to 3.5% through 2050. The allowance trading system includes an allocation scheme that requires an unspecified percentage of allowances to be auctioned. The bill also includes new mandatory greenhouse gas emission standards for vehicles, along with a new energy efficiency performance standard. The bill would establish a renewable portfolio standard (RPS), increase biofuel mandates under the Renewable Fuels Standard, and mandate new infrastructure for biofuels. Finally, the bill expands and extends existing tax incentives for alternative fuels and advanced technology vehicles, and establishes a manufacturer tax credit for advanced technology vehicle investment.

H.R. 620, introduced February 7, 2007, by Representative Olver, is a substantially modified version of S. 280. Using the same basic structure as S. 280, the emission caps under H.R. 620 are more stringent. Reductions from affected sectors (electric generation, transportation, industrial, and commercial) would be set at 2004 levels in 2012 and then steadily decline until the cap is equal to about one-fourth of facilities' 2004 levels. Although H.R. 620 permits affected entities to comply with the reduction requirements with credits from foreign sources, sequestration, and reductions from non-covered entities, these sources are limited to 15% of the source's reduction requirement.

H.R. 1590, introduced March 20, 2007, by Representative Waxman, is similar to S. 485. H.R. 1590 would cap greenhouse gas emissions on an economy-wide basis beginning in 2010. Beginning in 2020, the country's emissions would be capped at their 1990 levels. After 2020, emissions economy-wide would be reduced by roughly 5% annually from their previous year's level through 2050, when emissions levels would be capped at 80% below 1990 levels. The allowance trading system includes an allocation scheme that requires an unspecified percentage of allowances to be auctioned. The bill also includes new mandatory greenhouse gas emission standards for vehicles, along with a new energy efficiency performance standard. The bill would also establish a renewable portfolio standard (RPS).

Appendix A. Comparison of Key Provisions of Greenhouse Gas Reduction Bills

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Emission reduction/ limitation scheme	Absolute cap on total emissions from all covered entities in the electric power, transportation, industry, and commercial sectors.	Absolute cap on total emissions economy-wide.	Absolute cap on total emissions from covered electric generators.	Absolute cap on total emissions economy-wide.	Absolute cap on total emissions from all covered entities in the electric power, transportation, industry, and commercial sectors.	Absolute cap on total emissions economy-wide.
Responsible agency	Environmental Protection Agency (EPA).	EPA.	EPA.	EPA.	EPA.	EPA.
Greenhouse gases defined	Carbon dioxide, methane, nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6).	Same six gases as S. 280.	Same six gases as S. 280.	Same six gases as S. 280.	Same six gases as S. 280.	Same six gases as S. 280.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Specific emissions limits	Beginning in 2012, emissions from covered entities are capped at 6.13 billion metric tons, minus 2012 emissions from non-covered entities. Beginning in 2020, emission cap declines to 5.239 billion metric tons, minus 2020 emissions from non-covered entities. Beginning in 2030, emission cap declines to 4.1billion metric tons, minus 2030 emissions from non-covered entities. Beginning in 2050, emission cap further declines to 2.096 billion metric tons, minus annual emissions from non-covered entities.	Beginning in 2010, emissions economy-wide to be reduced 2% annually. Beginning in 2020, emission cap on economy-wide basis set at 1990 level, with declining emission caps of 26.7% below 1990 levels in 2030 and 53.3% in 2040. Beginning in 2050, emission cap set at 80% below 1990 levels.	Beginning in 2011, emissions from affected electric generators capped at 2006 levels. Beginning in 2015, emissions from affected electric generators capped at their 2001 levels, declining 1% annually from previous year's level from 2016 to 2020. Beginning in 2020, emission cap declines 1.5% annually from previous year's level.	Beginning in 2010, emissions economy-wide to be reduced by appropriate measures to cap emissions at 1990 levels by 2020. Beginning in 2021, emissions economy-wide to be reduced 2.5% annually from previous year's level. Beginning in 2031 through 2050, emissions economy-wide to be reduced 3.5% annually from previous year's level.	Beginning in 2012, emissions from covered entities are capped at 6.15 billion metric tons, minus 2012 emissions from non-covered entities. Beginning in 2020, emission cap declines to 5.232 billion metric tons, minus 2020 emissions from non-covered entities. Beginning in 2030, emission cap declines to 3.858 billion metric tons, minus 2030 emissions from non-covered entities. Beginning in 2050, emission cap further declines to 1.504 billion metric tons, minus annual emissions from non-covered entities.	Beginning in 2010, emissions economy-wide to be reduced by appropriate measures to cap emissions at 1990 levels by 2020. Beginning in 2021, through 2050, emissions economy-wide to be reduced roughly 5% annually from previous year's level. Beginning in 2050, emission cap set at 80% below 1990 levels.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Covered entities	In metric tons of carbon dioxide equivalents: any electric power, industrial, or commercial entity that emits over 10,000 metric tons carbon dioxide equivalent annually from any single facility owned by the entity; any refiner or importer of petroleum products for transportation use that, when combusted, will emit over 10,000 metric tons annually; and any importer or producer of HFCs, PFCs, or SF_6 that, when used, will emit over 10,000 metric tons of carbon dioxide equivalent.	EPA promulgates rule within two years of enactment that applies the most cost-effective reduction options on sources or sectors to achieve reduction goals.	Any fossil fuel-fired electric generating facility that has a capacity of greater than 25 megawatts and generates electricity for sale, including cogeneration and government-owned facilities.	EPA promulgates rule within two years of enactment that applies the most cost-effective reduction options on the largest emitting sources or sectors to achieve reduction goals.	In metric tons of carbon dioxide equivalents: any electric power, industrial, or commercial entity that emits over 10,000 metric tons carbon dioxide equivalent annually from any single facility owned by the entity; any refiner or importer of petroleum products for transportation use that, when combusted, will emit over 10,000 metric tons annually; and any importer or producer of HFCs, PFCs, or SF_6 that, when used, will emit over 10,000 metric tons of carbon dioxide equivalent.	EPA promulgates rule within two years of enactment that applies the most cost-effective reduction options on the largest emitting sources or sectors to achieve reduction goals.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
General allocating and implementing strategy	A tradeable allowance system is established: EPA shall determine allocations based on several economic, equity, and sector-specific criteria, including economic efficiency, competitive effects, and impact on consumers. Allowances are to be allocated upstream to refiners and importers of transportation fuel, along with producers of HFCs, PFCs, and SF_6, and downstream to electric generation, industrial, and commercial entities. Allocations to covered entities are provided at no cost.	Tradeable allowance system permitted. In implementing reduction program, EPA shall select the most cost-effective emission reduction strategies. EPA shall allocate to various sectors and interests any allowances that are not allocated to affected entities, including households, dislocated workers, energy efficiency and renewable energy activities, sequestration activities, and ecosystem protection activities.	Tradeable allowance system is established. Allocations to existing sources based on historic electricity output, and includes allowance allocations for incremental nuclear capacity and renewable energy, along with sequestration and early action provisions. From 2011 on, an increasing percentage of all allowances are to be auctioned, with 100% of allowances auctioned in 2036 and thereafter.	A tradeable allowance system is established. The President submits to Congress an allocation plan within one year of enactment that includes a combination of auctions and free allocation of allowances. To the maximum extent practicable, the allocation and revenues received should maximize public benefits, promote economic growth, assist households and dislocated workers, encourage energy efficiency and renewable energy activities, sequestration activities, and assist states in addressing the impact of climate change. Congress has one year to enact an alternative to the plan; otherwise, EPA shall implement it.	A tradeable allowance system is established: EPA shall determine allocations based on several economic, equity, and sector-specific criteria, including economic efficiency, competitive effects, and impact on consumers. Allowances are to be allocated upstream to refiners and importers of transportation fuel, along with producers of HFCs, PFCs, and SF_6, and downstream to electric generation, industrial, and commercial entities. Allocations to covered entities are provided at no cost.	A tradeable allowance system is established. The President submits to Congress an allocation plan within one year of enactment that includes a combination of auctions and free allocation of allowances. To the maximum extent practicable, the allocation and revenues received should maximize public benefits, promote economic growth, assist households and dislocated workers, encourage energy efficiency and renewable energy activities, sequestration activities, and assist states in addressing the impact of climate change. Congress has one year to enact an alternative to the plan; otherwise, EPA shall implement it.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Public sale/auction of allowances	EPA shall determine the number of allowances allocated to the Climate Change Credit Corporation (CCCC) (established by the bill). EPA shall allocate to the CCCC allowances before 2012 to auction to raise revenue for technology deployment and dissemination. The CCCC may buy and sell allowances, and use the proceeds to reduce costs borne by consumers and other purposes. (See "Revenue recycling" below.)	EPA may choose to provide for trustees to sell allowances for the benefit of entities eligible to receive assistance under the proposal (see above).	From 2011 on, an increasing percentage of all allowances are to be auctioned, with 100% of allowances auctioned in 2036 and thereafter. Revenues from the auction are to be deposited in the Climate Action Trust Fund created by the Department of the Treasury.	The President shall determine the number of allowances to be auctioned. The proceeds of the auction to be deposited with the Climate Reinvestment Fund created by the Department of the Treasury. (See "Revenue recycling" below.)	EPA shall determine the number of allowances allocated to the Climate Change Credit Corporation (CCCC) (established by the bill). The CCCC may buy and sell allowances, and use the proceeds to reduce costs borne by consumers and other purposes. (See "Revenue recycling" below.)	The President shall determine the number of allowances to be auctioned. The proceeds of the auction to be deposited with the Climate Reinvestment Fund created by the Department of the Treasury. (See "Revenue recycling" below.)

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Cost-limiting safety valve	No explicit provision.	No explicit provision. However, if the President determines a national security emergency exists, the President may temporarily adjust, suspend, or waive any regulation promulgated under this program (subject to judicial review).	No explicit provision. However, limited borrowing against future reductions is permitted if EPA determines allowance prices have reached and sustained a level that is or will cause significant harm to the U.S. economy. Also, EPA may increase to 50% the share of international credits that can be used in such cases.	No explicit provision.	No explicit provision.	No explicit provision.
Penalty for non-compliance	Excess emission penalties are equal to three times the market price for allowances on the last day of the year at issue.	Existing enforcement provisions of Section 113 of the Clean Air Act are extended to program.	$100 per excess ton indexed to inflation plus a 1.3 to 1 offset from future allowances. If the market price for an allowance exceeds $60, the penalty is $200 per excess ton, adjusted for inflation.	Excess emission penalties are equal to twice the market price for allowances as of December 31 of the year at issue, plus a 1 to 1 offset from next year's allowance allocation.	Excess emission penalties are equal to three times the market price for allowances on the last day of the year at issue.	Excess emission penalties are equal to twice the market price for allowances as of December 31 of the year at issue, plus a 1-to-1 offset from next year's allowance allocation.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Other market trading system features	Up to 30% of required reductions may be achieved through credits obtained through pre-certified international emissions trading programs, approved reduction projects in developing countries, domestic carbon sequestration, and reductions from non-covered entities. Borrowing against future reductions is permitted.	Market trading systems incorporated into Renewable Portfolio Standard, neew energy efficiency performance standard, and new low-carbon generation requirement. No limit on use of domestic biological sequestration to meet reductions requirements.	Up to 25% (50% for new affected units) of required reductions may be achieved with credits obtained through EPA-approved foreign government programs developed under United Nations Framework Convention on Climate Change (UNFCCC) protocols. Limited borrowing against future reductions is permitted if EPA determines allowance prices have reached and sustained a level that is causing or will cause significant harm to the U.S. economy. Also, EPA may increase to 50% the share of international credits that can be used in such cases.	Market trading systems incorporated into Renewable Portfolio Standard and new energy efficiency performance standard. No limit on use of domestic biological sequestration to meet reductions requirements.	Up to 15% of required reductions may be achieved through credits obtained through pre-certified international emissions trading programs, approved reduction projects in developing countries, domestic carbon sequestration, and reductions from non-covered entities. Borrowing against future reductions is permitted.	Market trading systems incorporated into new energy efficiency performance standard. No limit on use of domestic sequestration to meet reductions requirements.
Banking	Banking of allowances is permitted; allowances may be saved for use in future years.	No specific prohibition on banking.	Banking of allowances is permitted; allowances may be saved for use in future years.	Banking of allowances is permitted; allowances may be saved for use in future years.	Banking of allowances is permitted; allowances may be saved for use in future years.	Banking of allowances is permitted; allowances may be saved for use in future years.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Early reduction credits and bonus credits	Entities with registered emission reductions achieved before 2012 may receive allowances for them, including reductions achieved under more stringent mandatory state programs. For the time period 2012-2017, entities that have entered into an agreement with EPA to reduce emissions to 1990 levels by 2012 are entitled to additional allowances to cover their additional reductions and are allowed to achieve 40% of their reduction requirement (as opposed to 30%; see above) through international emissions trading and projects, sequestration, or reductions by non-covered entities.	Reductions previously achieved under state programs that are at least as stringent as a federal trading program may be recognized by the federal program. Entities that demonstrate reductions achieved early (but not before 1992) that are as verifiable as reductions under a federal trading program may be recognized by the federal program.	Entities with reductions achieved from 2000 through 2010 shall receive credits under specific criteria, including EPA rules that ensure reductions are real, additional, verifiable, enforceable, and permanent, and that they were reported under either 1605(b) of the 1992 Energy Policy Act, or according to a state or regional registry. Quantity of credits given is limited to 10% of the 2011 allowance allocation.	Recognizing and rewarding early reductions is a stated goal of the program.	Entities with registered emission reductions achieved before 2012 may receive allowances for them. For the time period 2012-2017, entities that have entered into an agreement with EPA to reduce emissions to 1990 levels by 2012 are entitled to additional allowances to cover their additional reductions and are allowed to achieve 35% of their reduction requirement (as opposed to 15%; see above) through international emissions trading and projects, sequestration, or reductions by non-covered entities.	Recognizing and rewarding early reductions is a stated goal of the program.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Revenue recycling	Revenues generated by allowance auctions and trading proceeds are received by a new Climate Change Credit Corporation (CCCC). Activities to be funded include mechanisms to reduce consumer costs and to assist dislocated workers, low-income persons, and affected communities, along with programs to encourage deployment of new technology and wildlife restoration. Allocations to the CCCC are to be determined by EPA based on the funding needs of the advanced technologies demonstration and deployment programs. Further, at least 50% of revenue received must be used for technology deployment.	Allowances may be allocated by EPA to households, dislocated workers, energy efficiency and renewable energy activities, sequestration activities, and ecosystem protection activities.	Revenues generated from the auction are to be deposited in the Climate Action Trust Fund created by the Department of the Treasury. Activities to be funded include an Innovative Low- and Zero-emitting Carbon Technologies Program, a Clean Coal Technologies Program, and an Energy Efficiency Technology Program, along with research and development. Adaption and mitigation activities to be funded include affected workers and communities, and fish and wildlife habitat.	Revenues generated by allowance auctions and penalties are received by a new Climate Reinvestment Fund created by the Department of the Treasury. Activities to be funded include mechanisms to reward early reductions, maximize public benefits, promote economic growth, assist households and dislocated workers, encourage energy efficiency and renewable energy activities, sequestration activities, and assist states in addressing the impact of climate change.	Revenues generated by allowance auctions and trading proceeds are received by a new Climate Change Credit Corporation (CCCC). Activities to be funded include mechanisms to reduce consumer costs and to assist dislocated workers and affected communities, along with programs to encourage deployment of new technology and wildlife restoration.	Revenues generated by allowance auctions and penalties are received by a new Climate Reinvestment Fund created by the Department of the Treasury. Activities to be funded include mechanisms to reward early reductions, maximize public benefits, promote economic growth, assist households and dislocated workers, encourage energy efficiency and renewable energy activities, sequestration activities, and assist states in addressing the impact of climate change.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	H.R. 620 (Olver)	H.R. 1590 (Waxman)
Other key provisions	Provisions include studies of research on abrupt climate change and impact of climate change on the world's poor, among others, and creation of a national greenhouse gas database. A new Innovation Infrastructure is created, along with program initiatives to promote less carbon- intensive technology, adaption, sequestration, and related activities. Requires periodic review of target adequacy by the Under Secretary of Commerce for Oceans and Atmosphere.	Provisions include mandatory greenhouse gas emission standards for vehicles by 2010, for new electric powerplants that begin operation after December 31, 2011, and a new energy efficiency performance standard. Establishes a Renewable Portfolio Standard and credit program. Establishes a new low-carbon generation requirement and trading program. Requires periodic review of target adequacy by the National Academy of Sciences.	Establishes program to encourage offsets from the agricultural sector. Offset credits available for agricultural, forestry, grazing, and wetlands management, sequestration projects, or practices that meet specific criteria in the proposal. Offset credits also available for approved emission reduction offset projects from a variety of activities listed in the proposal. Requires periodic review of target adequacy by EPA taking into account the recommendations of a newly established Climate Science Advisory Panel.	Provisions include mandatory greenhouse gas emission standards for vehicles by 2010, and a new energy efficiency standard beginning in 2009. Establishes a Renewable Portfolio Standard and credit program. Increases biofuel mandates under the Renewable Fuels Standard, and mandates infrastructure for biofuels. Expands and extends existing tax incentives for alternative fuel and advanced technology vehicles, and establishes manufacturer tax credit for advanced technology vehicle investment. Establishes new National Climate Change Vulnerability and Resilience Program. Requires periodic review of target adequacy by the National Academy of Sciences.	Provisions include studies of the impact of climate change on coastal ecosystems and communities, and the world's poor, among others; assessment of adaptation technologies; and creation of a national greenhouse gas database. Requires periodic review of target adequacy by the Under Secretary of Commerce for Oceans and Atmosphere.	Provisions include mandatory greenhouse gas emission standards for vehicles by 2010, and a new energy efficiency standard beginning in 2010. Establishes a Renewable Portfolio Standard.

Appendix B. Common Terms

Allocation schemes (upstream and downstream). Regulatory approaches to allocating allowances (as opposed to auction schemes) can choose different points and participants along the production process to assign allowances and the resulting compliance responsibility. *Upstream allocation schemes* establish emission caps and assign allowances at a production, importation, or distribution point of products that will eventually produce greenhouse emissions further down the production process. For example, in the natural gas sector, emission caps could be established and allowances assigned at processing facilities where facilities and participants shrink from about 400,000 wells and 8,000 companies to 500 plants and 200 companies. In contrast, *downstream allocation schemes* establish emission caps and assign allowances at the point in the process where the emissions are emitted. In the case of the natural gas industry, to achieve the same coverage as the upstream scheme, this would involve assigning allowances to natural gas-fired electric generators, industry, and even residential users. Thus, some downstream proposals choose either to exempt certain sectors (such as residential use) from a cap-and-trade program or to employ a hybrid allocation scheme where some of the allowances are allocated upstream and others downstream (such as the electric generators).

Allowance. An allowance is generally defined as a limited authorization by the government to emit 1 ton of pollutant. In the case of greenhouse gases, an allowance generally refers to a metric ton of carbon dioxide equivalent. Although used generically, an *allowance* is technically different from a *credit.* A credit represents a ton of pollutant that an entity has reduced in excess of its legal requirement. However, the terms tend to be used interchangeably, along with others, such as *permits*.

Auctions. Auctions can be used in market-based pollution control schemes in several different ways. For example, Title IV of the 1990 Clean Air Act Amendments uses an annual auction to ensure the liquidity of the credit trading program. For this purpose, a small percentage of the credits permitted under the program are auctioned annually, with the proceeds returned to the entities that would have otherwise received them. Private parties are also allowed to participate. A second possibility is to use an auction to raise revenues for a related (or unrelated) program. For example, the Regional Greenhouse Gas Initiative (RGGI) is exploring an auction to implement its public benefit program to assist consumers or pursue strategic energy purposes. A third possibility is to use auctions as a means of allocating some, or all, of the credits mandated under a GHG control program. Obviously, the impact that an auction would have on cost would depend on how extensively it was used in any GHG control program, and to what purpose the revenues were expended.

Banking. Although allowances are generally allocated on an annual basis, most cap-and-trade programs do not require participants to either use the allowance that year or else lose it. Under many proposals, allowances can be banked by the receiving participant (or traded to another participant who can use or bank it) to be used or traded in a future year. Banking reduces the absolute cost of compliance by making annual emission caps flexible over time. The limited ability to shift the

reduction requirement across time allows affected entities to better accommodate corporate planning for capital turnover, allow for technological progress, control equipment construction schedules, and respond to transient events such as weather and economic shocks.

Bubble. A bubble is a regulatory device that permits two or more sources of pollutants to be treated as one for the purposes of emission compliance.

Cap-and-trade program. A cap-and-trade program is based on two premises. First, a set amount of pollutant emitted by human activities can be assimilated by the ecological system without undue harm. Thus, the goal of the cap-and-trade program is to impose a ceiling (i.e., an emissions cap) on the total emissions of that pollutant at a level below the assimilative capacity. Second, a market in pollution licenses (i.e., allowances) between polluters is the most cost-effective means of reducing emissions to the level of the cap. This market in allowances is designed so that owners of allowances can trade those allowances with other emitters who need them or retain (bank) them for future use or sale. In the case of the sulfur dioxide program contained in the 1990 Clean Air Act Amendments, most allowances were allocated free by the federal government to utilities according to statutory formulas related to a given facility's historic fuel use and emissions; other allowances have been reserved by the government for periodic auctions to ensure market liquidity.

Carbon tax. A carbon tax is generally conceived as a levy on natural gas, petroleum, and coal according to their carbon content, in the approximate ratio of 0.6 to 0.8 to 1, respectively. However, proposals have been made to impose the tax downstream of the production process when the carbon dioxide is actually released to the atmosphere. In contrast to a cap-and-trade program, in which the quantity of emissions is limited and the price is determined by an allowance marketplace, with a carbon tax, the price is limited and the quantity of emissions is determined by the participants based on the cost of control versus the cost of the tax.

Coverage. Coverage is the breadth of economic sectors covered by a particular greenhouse gas reduction program.

Emissions cap. A mandated limit on how much pollutant (or greenhouse gases) an affected entity can release to the atmosphere. Caps can be either an *absolute cap*, where the amount is specified in terms of tons of emissions on an annual basis, or a *rate-based cap*, where the amount of emissions produced per unit of output (such as electricity) is specified but not the absolute amount released. Caps may be imposed on an entity, sector, or economy-wide basis.

Generation performance standard (GPS). Also called an *output-based allocation*, allowances are allocated gratis to entities in proportion to their relative share of total electricity generation in a recent year.

Grandfathering. Grandfathering generally refers an allocation scheme in which allowances are distributed to affected entities on the basis of historic emissions. These allowances are generally distributed free-of-charge by the government to the affected entities. Grandfathering can also refer to entities that

because of age or because they have met an earlier standard, or other factors, are exempted from a new regulatory requirement.

Greenhouse gases. The six gases recognized under the United Nations Framework Convention on Climate Change are carbon dioxide (CO_2), methane (CH_4) nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFC), and perfluorocarbons (PFC).

"No regrets" policy. A "no regrets" policy is one of establishing programs for other purposes that would have concomitant greenhouse gas reductions. Therefore, only those policies that reduce greenhouse gas emissions at no cost are considered.

Offsets. Offsets generally refer to emission credits achieved by activities not directly related to the emissions of an affected source. Examples of offsets would include forestry and agricultural activities that absorb carbon dioxide, and reduction achieved by entities that are not regulated by a greenhouse gas reduction program.

Revenue recycling. Some greenhouse gas reduction programs create revenues through auctions, compliance penalties, or imposition of a carbon tax. Revenue recycling refers to how a program disposes of those revenues. How a program handles revenues received can have a significant effect on the overall cost of the program to the economy.

Safety valve. Devices designed to prevent or to respond to unacceptably high compliance costs for greenhouse gas reductions. Generally triggered by prices in the allowance markets, safety valve approaches can include (1) a set price alternative to making reductions or buying allowances at the market price, (2) a slowdown in tightening the emissions cap, and (3) lengthening of the time allowed for compliance. Depending on the interplay between the emissions cap and safety valve and actual compliance costs, a safety valve can affect the integrity of the emissions cap.

Sequestration. Sequestration is the process of capturing carbon dioxide from emission streams or from the atmosphere and then storing it in such a way as to prevent its release to the atmosphere.