Greenhouse Gas Reduction: Cap-and-Trade Bills in the 110th Congress

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Summary

Multiple proposals to advance programs that reduce greenhouse gases have been introduced in the 110th Congress. **S. 2191** was reported May 20, 2008, from the Senate Committee on Environment and Public Works. An amended version of S. 2191 **S. 3036**, was considered by the Senate in June 2008, but a vote to invoke cloture failed. In general, these proposals 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 report presents a side-by-side comparison of the major provisions of those bills and includes a glossary of common terms (**Appendix C**).

Although the purpose of these bills is to reduce greenhouse gases (GHGs), the specifics of each differ greatly. Five bills (S. 280, S. 309, S. 485, H.R. 620 and H.R. 1590) cap greenhouse gas emissions from covered entities at 1990 levels in the year 2020. S. 317 places its first emissions cap at 2001 levels in 2015; S. 1766 targets reductions at 2006 levels in 2020; **S. 2191** as reported would cap GHGs at about 19% below 2005 levels in 2020; H.R. 4226 would limit 2020 emissions to 85% of their 2006 levels; H.R. 6186 would reduce emissions to 20% below 2005 levels by 2020, and H.R. 6316 would reduce emission to 20% below 1990 levels by 2020. Ten bills (S. 280, S. 317, S. 485, **S. 2191**, **S. 3036**, H.R. 620, H.R. 1590, H.R. 4226, H.R. 6186, and H.R. 6316) would establish cap-and-trade systems to implement their emission caps. In contrast, S. 1766 provides for two compliance systems—a cap-and-trade program and an alternative safety valve payment—and allows the covered entities to choose one or employ a combination of both. Finally, S. 309 provides discretionary authority to the Environmental Protection Agency (EPA) to establish a cap-and-trade program to implement its emission cap.

The differences continue with respect to entities covered under the programs. Three bills (S. 309, S. 485, H.R. 1590) provide discretionary authority to EPA to determine covered entities by applying cost-effective criteria to reduction options. In contrast, S. 317‘s emission cap is imposed solely on the electric generating sector. The other bills (S. 280, S. 1766, **S. 2191**, **S. 3036**, H.R. 620, H.R. 4226, H.R. 6186, and H.R. 6316) cover most economic sectors but not all (e.g., they exclude the agricultural sector). Thus, the overall reductions achieved by the bills depend partly on the breadth of entities covered.

Beyond the basics of these bills, each contains other important provisions. For example, S. 280 creates a new innovation infrastructure, while several—S. 1766, **S. 2191**, **S. 3036**, H.R. 4226, H.R. 6186, and H.R. 6316—encourage foreign countries to undertake comparable control actions and specify potential consequences for inaction. Other provisions include mandatory greenhouse gas standards for vehicles (S. 309, S. 485, H.R. 1590), and a renewable portfolio standard for the electric generating sector (S. 309, S. 485, H.R. 1590). This comparison should be considered a guide to the basic provisions contained in each bill. It is not a substitute for careful examination of each bill’s language and provisions.

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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 Congress should enact legislation establishing a mandatory, market-based program to slow, stop, and reverse the growth of greenhouse gases 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 is to enact energy and related programs that would have the added effect of reducing greenhouse gases[4]; 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. (For a review of additional climate change related bills, see CRS Report RL34067, *Climate Change Legislation in the 110th Congress*, by (name redacted) and (name redacted).)

[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 (name red acted).

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

[4] For discussions of relevant energy legislation, see CRS Report RL34294, *Energy Independence and Security Act of 2007: A Summary of Major Provisions*, by (name redacted), and CRS Report RL33812, *Energy Efficiency and Renewable Energy Legislation in the 110th Congress*, by (name redacted), (name redacted), and (name redacted).

Proposed Legislation in 110th Congress

In the 110th Congress, Members have introduced 12 bills that include provisions to impose or permit some form of market-based controls on emissions of greenhouse gases. General descriptions of those bills follow, beginning with S. 2191, which was reported, with amendments, on May 20, 2008, by the Senate Committee on Environment and Public Works.[5] The major provisions of the seven Senate bills are compared in **Appendix A**. The major provisions of the five House bills are compared in **Appendix B**.

S. 2191, as introduced October 18, 2007, by Senators Lieberman and Warner, would cap greenhouse gas emissions from the electric generation, industrial, and transportation sectors (for facilities that emit more than 10,000 metric tons of carbon dioxide equivalent—mtCO2e). As introduced, the cap is estimated by the sponsors to reduce emissions to 15% below 2005 levels in 2020, declining steadily to 63% below 2005 levels in 2050. The program would be implemented through an expansive allowance trading program to maximize opportunities for cost-effective reductions. Credits obtained from increases in carbon sequestration and acquisition of allowances from foreign sources could be used to comply with 30% of allowance requirements. The bill would also establish a Carbon Market Efficiency Board to observe the allowance market and implement cost-relief measures if necessary. (For recent action on S. 2191 and for modifications to the provisions, see the next section.)

S. 3036, introduced by Senator Boxer on May 20, 2008, is identical to the reported version of S. 2191, except that S. 3036 contains a budget amendment aimed at making the bill revenue-neutral. This would entail devoting a percentage of auction revenues—increasing from 6.1% in 2012 to 15.99% in 2031 and thereafter—to offset budget deficits that are projected to occur due to the cap-and-trade program.[6] This bill was considered by the Senate the week of June 2, 2008.

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. EPA has the discretion to employ a market-based allowance

[5] The bill was ordered reported December 5, 2007, by an 11-8 vote.

[6] See CBO, S. 2191, *America's Climate Security Act, with an Amendment* (April 10, 2008), at http://www.cbo.gov/ftpdocs/91xx/doc9120/s2191.pdf.

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.

S. 1766, introduced July 11, 2007, by Senator Bingaman, would set emissions targets on most of the country's greenhouse gas emissions. Greenhouse gas emitting activities such as methane emissions from landfills, coal mines, animal waste, and municipal wastewater projects, along with nitrous oxide emissions from agricultural soil management, wastewater treatment, and manure management, are not included under the targets, although credits for use by covered entities are available or may be generated by verified GHG reductions in these areas. Beginning in 2012, covered entities would have emissions targets set at their 2006 levels in 2020. The emissions targets would decline steadily until 2030 when the emission target would be set at the entities' 1990 levels. Compliance can be secured either through an allowance trading program or by paying a safety valve price (called a Technology Accelerator Payment or TAP). Under the trading program, allowances are allocated according to various categories, including covered entities; eligible facilities, such as coal mines and carbon-intensive industries; states; and sequestration activities. Initially, 24% of all allowances are auctioned, a percentage that increases over time. The TAP is set at $12 a metric ton of carbon dioxide equivalent; it increases 5% annually above the rate of inflation. The bill also requires countries that do not take comparable action to control emissions to submit special allowances (or their foreign equivalent) to accompany exports to the United States of any covered greenhouse intensive goods and primary products.

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 credits 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.

H.R. 4226, introduced November 15, 2007, by Representative Gilchrest, is a modified version of H.R. 620. Using the same basic structure as H.R. 620, emission limitations are based on percentages of 2006 emission levels. Reductions from affected sectors (electric generation, transportation, industrial, and commercial) would be set at 2006 levels in 2012 and then steadily decline until the cap is equal to about one-fourth of facilities' 2006 levels in 2050. The bill provides that the President may establish a program to require importers to pay the value of GHGs emitted during the production of goods or services imported into the United States from countries that have no comparable emission restrictions to those of the United States. The program's requirement may not be imposed on countries until negotiations to achieve agreement on such restrictions have been attempted. In addition, the bill also establishes a Carbon Market Efficiency Board to observe the allowance market and implement cost-relief measures if necessary.

H.R. 6186, introduced June 4, 2008, by Representative Markey, would cap emissions from covered sources at 930 million mtCO2e in 2050. Of the long-term reduction targets in the cap-and-trade bills, this is among the most stringent. H.R. 6186 would auction 94% of its emission allowances in 2012, increasing to 100% by FY2020. Almost 60% of the auction revenues would be distributed (via tax credits and rebates) to low- and middle-income households. The bill would direct EPA to develop emission performance standards for non-covered entities, which may include coal mines, landfills, wastewater treatment operations, and animal feeding operations. In addition, new (as defined in the bill) coal-fired power plants would be required to capture and geologically sequester not less than 85% of their CO2 emissions within a specified time frame.

H.R. 6316, introduced June 19, 2008, by Representative Doggett, would cap emissions from covered sources at 348 million mtCO2e in 2050. Of the long-term reduction targets in the cap-and-trade bills, this is the most stringent. In addition, the bill would direct EPA to develop regulations that prevent growth in emissions from non-covered entities. H.R. 6316 would auction 85% of its emission allowances in 2012, increasing to 100% by FY2020. Approximately 54% of the auction revenues would be distributed for consumer assistance: of this allotment, 66% would fund a healthcare coverage program (established by subsequent legislation); the remainder would provide rebates and tax relief to low- and moderate-income households. Domestic offsets and international allowances could combine to contribute up to 25% of covered source's allowance requirements. Similar to other bills, a Carbon Market Efficiency Board would observe the allowance market and implement cost-relief measures if necessary. The bill would also require countries that do not take comparable action to control emissions to submit special allowances (or

their foreign equivalent) to accompany exports to the United States of any covered primary product.

Legislative Action in the 110th Congress

On May 20, 2008, the Senate Committee on Environment and Public Works' Subcommittee on Private Sector and Consumer Solutions to Global Warming and Wildlife Protection reported out a revised version of S. 2191. As reported from subcommittee, S. 2191 is estimated to reduce greenhouse gas emissions 19% below 2005 levels by 2020 (up from 15% as introduced) and 63% below 2005 levels by 2050. The increase in the estimated reductions in 2020 is the result of amended text that includes greenhouse gases from all natural gas uses under the overall emissions cap. Other amendments approved included modifications to eligibility requirements for the advanced technology vehicles manufacturing incentive program and the advanced coal generation technology demonstration program. Modifications were also made to the proposed allocation of allowances to help tribal communities respond to climate change and to encourage international forest carbon activities, along with 1% of allowances reserved for rural cooperatives and a corresponding reduction in allowances allocated to the rest of the electric power industry. The revised bill also added two new recipients of auction revenues: a Bureau of Land Management Emergency Firefighting Fund ($300 million) and a Forest Service Emergency Firefighting Fund ($800 million).

On December 5, 2007, the full committee ordered reported out a revised version of S. 2191 by an 11 to 8 vote. The bill was reported by the committee on May 20, 2008 (S.Rept. 110-337). The revised bill expands the greenhouse gas reduction program coverage by replacing the previous definition of covered facility based on the electric power, transportation, and industrial sectors with a comprehensive upstream definition for oil refineries, natural gas processing plants, and a downstream definition for coal consumers. Among the amendments agreed to by the full committee were a new low carbon fuel standard (LCFS) that would require the carbon intensity of transportation fuel to be frozen in 2011 and then reduced by 5% in 2015 and 10% in 2020. Other amendments agreed to would increase incentives for states to modify their utility regulatory structures to encourage energy efficiency, and would broaden the ability of states to use their allowance allocations to mitigate adverse economic impacts resulting from the bill's implementation. As ordered reported, S. 2191's emissions cap is estimated by its sponsors to require a 71% reduction from 2005 levels by 2050 from covered entities (estimated by the sponsors to account for 87% of total U.S. greenhouse gas emissions). Overall, the sponsors estimate that S. 2191 would reduce total U.S. greenhouse gas emissions by up to 66% from 2005 levels by 2050.

In April 2008, a proposed amendment to S. 2191 was submitted by the committee to the Congressional Budget Office (CBO) to be included in the scoring of the bill. The amendment would provide for some of the auctioned revenues to be put aside for deficit reduction purposes.

Senator Boxer introduced S. 3036 on May 20, 2008. This proposal combined the reported version of S. 2191 with the revenue-neutral amendment. The Senate considered S. 3036 the week of June 2, 2008. On June 6, 2008, a motion to invoke cloture failed on a roll call vote of 48 to 36, and bill supporters withdrew the bill from consideration.

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

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	S. 1766 (Bingaman)	S. 3036 (Boxer) / S. 2191 as amended (Lieberman)
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.	Emissions targets for all covered entities. Affected entities estimated to cover about 85%-90% of all U.S. GHG emissions.	Absolute cap on total emissions from all covered entities. Affected entities estimated to cover about 80%-87% of all U.S. GHG emissions.
Responsible agency	Environmental Protection Agency (EPA).	EPA.	EPA.	EPA.	To be determined by the President.	EPA.
Greenhouse gases defined	Carbon dioxide, methane, nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).	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.
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 4.1 billion metric tons, minus 2030 emissions from non-covered	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	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	In 2012, the emissions target for covered entities is set at 6.652 billion metric tons. Target is reduced annually thereafter until 2030. Emission target for covered sources in 2020 is 6.188 billion metric tons. Emission target for covered sources in 2030 is 4.819 billion metric tons. If the President determines that scientific, technological,	In 2012, emissions from covered entities are capped at 5.775 billion metric tons. Cap is reduced annually thereafter until 2050. Emission cap for covered sources in 2020 is 4.924 billion metric tons. Emission cap for covered sources in 2030 is 3.860 billion metric tons. Emission cap for covered sources in 2040 is 2.796 billion metric tons. Emission cap for covered sources in 2050 is 1.732 billion metric tons.

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	entities. Beginning in 2050, emission cap further declines to 2.096 billion metric tons, minus annual emissions from non-covered entities.	cap set at 80% below 1990 levels.		economy-wide to be reduced 3.5% annually from previous year's level.	and international considerations suggest further reductions are warranted, his recommendations are to be considered by Congress under expedited procedures.	
Covered entities	In metric tons of carbon dioxide equivalents (CO2e): any electric power, industrial, or commercial entity that emits over 10,000 CO2e 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 SF6 that, when used, will emit over 10,000 CO2e.	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.	Regulated fuel distributors include petroleum refineries, natural gas processing plants, and imports of petroleum products, coke, or natural gas. Regulated coal facilities are entities that consume more than 5,000 tons of coal a year. Regulated nonfuel entities are importers of HFCs, PFC, SF6, N2O, or products containing such compounds, and adipic acid and nitric acid plants, aluminum smelters, and facilities that emit HFCs as a byproduct of HCFC production.	Assuming no capture of GHGs, any producer or importer of petroleum- or coal-based liquid or gaseous fuel that emits GHGs, or any facility that produces or imports more than 10,000 CO2e of GHG chemicals annually; any facility that uses more than 5,000 tons of coal annually; any natural gas processing plant or importer (including LNG); or, any facility that emits more than 10,000 CO2e of HFCs annually as a byproduct of hydrochlorofluorocarbon production.
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	Tradeable allowance system permitted. In implementing reduction program, EPA shall select the most cost-effective	Tradeable allowance system is established. Allocations to existing sources based on historic electricity output, and includes allowance allocations for incremental nuclear capacity and renewable	A tradeable allowance system is established. The President submits to Congress an allocation plan within one year of enactment that includes a	Two compliance systems are provided. Covered entities may choose which one to use or employ a combination of both. First, a tradeable allowance system is established. In 2012,	A tradeable allowance system is established. Off the top, a share of allowances are auctioned for deficit reduction increasing from 6.1% in 2012 to 15.99% in 2031 and thereafter. Then the "remainder allowances" are distributed in 2012 (adjusted in

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	impact on consumers. Allowances are to be allocated upstream to refiners and importers of transportation fuel, along with producers of HFCs, PFCs, and SF6, and downstream to electric generation, industrial, and commercial entities. Allocations to covered entities are provided at no cost.	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.	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.	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, renewable energy, and 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.	53% of allowances allocated to covered and eligible industrial entities; 23% allocated to States and for sequestration and early reduction activities; 24% are auctioned to fund low income assistance, carbon capture and storage, and adaptation activities. The percentage auctioned increases steadily, reaching 53% by 2030. Second, a Technology Accelerator Payment (i.e., safety valve) may be paid in lieu of submitting one or more allowances.	future years) as follows: 38% of allowances to covered electric utilities, industrial facilities, and coops, declining steadily to 0 in 2031; 10.5% to states for conservation, extra reductions, and other activities; 7.5% for various sequestration activities; 11% allocated for electricity and natural gas consumer assistance; 5% for early reductions; 0.5% for tribal governments; 1% for methane reduction projects and 21.5% (plus an early auction of 5%) auctioned to fund technology deployment, carbon capture and storage, low income and rural assistance, and adaptation activities, as well as program management. The percentage auctioned for CCCC activities increases steadily, reaching 69.5% by 2031 and thereafter.
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.	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	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	Beginning in 2012, 24% of available allowances are auctioned to fund low income assistance, technology, and adaptation activities. The percentage auctioned increases steadily, reaching 53% by 2030; after that it increases 1 percentage point annually through	Beginning in 2012, 6.1% of total allowances are auctioned for deficit reduction. Further, 21.5% of "remainder allowances" (plus 5% from an early auction of 2012 remainder allowances) are auctioned to fund the activities of the CCCC. This percentage increases steadily to 69.5% by 2031 and thereafter. Revenues from the auction are

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	The CCCC may buy and sell allowances, and use the proceeds to reduce costs borne by consumers and other purposes. (See "Revenue recycling" below.)		Department of the Treasury.	"Revenue recycling" below.)	2043. Revenues from the auction are to be deposited in one of three funds created by the Department of the Treasury: the Energy Technology Deployment Fund, the Climate Adaptation Fund, and the Energy Assistance Fund.	to be deposited in one of ten funds created in the Department of the Treasury: Deficit Reduction Fund, Technology Deployment, Energy Independence Acceleration Fund, Energy Assistance Fund, Climate Change Worker Training Fund, Adaptation Fund, and the Climate Change and National Security Fund, as well as a fund for program management and two Emergency Firefighting Funds.

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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.	A Technology Accelerator Payment (TAP) (i.e., safety valve) may be paid in lieu of submitting one or more allowances. For 2012, the TAP price is set at $12 per metric ton, rising 5% above inflation annually thereafter. If the President determines the TAP should be increased or eliminated to achieve the act's purposes, his recommendations are to be considered by Congress under expedited procedures.	A Carbon Market Efficiency Board is established to observe the allowance market and implement cost-relief measures if necessary. Measures include permitting increased allowance borrowing from future allocations; increased offsets and foreign allowance use; expanded payback period for such allowances; lower interest charged for borrowed allowances; and expanded total borrowed allowances. Increased borrowing limited to 5% of emission cap and repayment schedule can not be longer than 15 years. 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).
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 emissions penalties are equal to three times the TAP price for that calendar year. In addition, civil penalties are $25,000 a day for violating provisions of the act.	Excess emission penalties per ton are equal to the higher of $200 or three times the mean market price for allowances during the year the allowance was due, plus a 1-to-1 offset from a future year allocation.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	S. 1766 (Bingaman)	S. 3036 (Boxer) / S. 2191 as amended (Lieberman)
Offset treatment and other flexibility mechanisms	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.	Market trading systems incorporated into Renewable Portfolio Standard, new 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. EPA may increase to 50% the share of international credits, if EPA determines allowance prices have reached and sustained a level that is causing or will cause significant harm to the U.S. economy.	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.	If the President determines that emission credits issued under foreign programs or foreign offset projects are comparable to U.S. ones, he may promulgate rules allowing such credits or offsets to be used to meet the act's emission targets. No more than 10% of an entity's emissions target can be met through foreign offset project credits. Establishes program to provide credits obtained through verified reductions from non-covered activities. No limit on their use to meet reduction targets.	Up to 15% of allowance requirement may be achieved through credits obtained through agricultural sequestration, land use change, forestry, manure management, and other specified activities. Percentage may be increased by the Carbon Market Efficiency Board Up to 15% of allowance requirement may be achieved through allowances obtained through certified foreign allowance markets. Percentage may be increased by the Carbon Market Efficiency Board.
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)	S. 1766 (Bingaman)	S. 3036 (Boxer) / S. 2191 as amended (Lieberman)
Borrowing	Borrowing against future reductions is permitted.	No specific provision.	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.	No specific provision.	No specific provision.	The Carbon Market Efficiency Board may permit borrowing against future reductions in certain cases.
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.	One percent of allowances available from 2012 through 2020 are allocated to early reductions reported under the 1992 Energy Policy Act's 1605(b) program, EPA's Climate Leaders Program, or a State-administered or privately administered registry. Geologic sequestration projects built from 2008 through 2030 receive bonus allowances for the first 10 years of operation.	Five percent of "remainder allowances" established for 2012 (declining steadily to 0 in 2017) are allocated to early reductions reported under the 1992 Energy Policy Act's 1605(b) program, EPA's Climate Leaders Program, a State-administered or voluntary program. Four percent of remainder allowances established for 2012 through 2035 available on a steadily declining basis from 2012 through 2039 for geologic sequestration projects for electric generating plants built from 2008 through 2035. The bonus allowances are limited to the first 10 years of operation.

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	S. 1766 (Bingaman)	S. 3036 (Boxer) / S. 2191 as amended (Lieberman)
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 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. Adaptation 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 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, renewable energy, and sequestration activities, and assist states in addressing the impact of climate change.	A new Energy Technology Deployment Fund is funded by TAPs received and some auction proceeds. Activities to be funded include zero- or low-carbon energy, advanced coal and sequestration, cellulosic biomass, and advanced technology vehicles. A new Climate Adaptation Fund is funded by some auction proceeds. Activities to be funded include coastal, arctic, and fish and wildlife impact mitigation. A new Energy Assistance Fund is funded by some auction proceeds. Activities to be funded include low-income and rural energy assistance, and weatherization.	Off the top, a growing share of allowances are auctioned for deficit reduction. Revenues received by "remainder allowance" auctions are to be received by the Climate Change Credit Corporation (CCCC). Activities to be funded include technology deployment activities (including zero- or low-carbon energy, advanced coal and sequestration, cellulosic biomass, and advanced technology vehicles); assistance activities (including low income, weatherization, and rural assistance); worker transition assistance; and adaptation activities (including wildlife conservation and restoration, aquatic ecosystems, and coastal habitats). Revenues would also fund a Climate Change and Natural Security Council to report annually on the ramifications of climate change for national security. Such sums as are necessary to maintain a fund of $1.1 billion is directed toward wildland fire suppression activities by the Bureau of Land Management and the Forest Service.
Other key provisions	Provisions include studies of research on abrupt climate change and	Provisions include mandatory	Establishes program to encourage offsets from the agricultural sector.	Provisions include mandatory greenhouse gas	Provisions include periodic review of the activities of the nation's	Provisions require new appliance standards in 2012 and provide for new model

Topic	S. 280 (Lieberman)	S. 309 (Sanders)	S. 317 (Feinstein)	S. 485 (Kerry)	S. 1766 (Bingaman)	S. 3036 (Boxer) / S. 2191 as amended (Lieberman)
	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, adaptation, sequestration, and related activities. Requires periodic review of target adequacy by the Under Secretary of Commerce for Oceans and Atmosphere.	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 (NAS).	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.	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 NAS.	5 largest trading partners, an NAS assessment of the status of the science and control technologies, and energy security implications. Beginning in 2019, requires foreign countries that do not take comparable emission reduction actions to submit international reserve allowances (or foreign equivalents) to accompany exports of any covered greenhouse gas intensive goods and primary products to the United States. Least developed nations or those that contribute no more than 0.5% of global emissions are excluded. Proceeds from the sale of such reserve allowances are to be deposited in an International Energy Deployment Fund to encourage and finance international technology development.	building efficiency standards by 2010. Beginning in 2018, requires annual review of foreign countries' GHG control actions. Beginning in 2019, requires foreign countries that do not take comparable emission reduction actions to submit international reserve allowances (or foreign equivalents) to accompany exports of any covered greenhouse gas intensive goods and primary products to the United States. Least developed nations or those that contribute no more than 0.5% of global emissions are excluded. Requires periodic review of the bill's implementation and purposes by the NAS. Establishes a separate cap-and-trade program to limit U.S. consumption of hydrofluorocarbons. Establishes a low carbon fuel standard (LCFS) requiring transportation fuels to have, on average, 10% lower lifecycle emissions per unit energy by 2020.

Appendix B. Comparison of Key Provisions of House Greenhouse Gas Reduction Bills

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
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 all covered entities in the electric power, transportation, industry, and commercial sectors.	Absolute cap on total emissions from all covered entities in the electric power, transportation, industry, and commercial sectors. Also includes emission performance standards that would apply to specific non-capped sectors.	Absolute cap on total emissions from all covered entities in the electric power, transportation, industry, and commercial sectors.
Responsible agency	EPA	EPA	EPA	EPA	Treasury Department
Greenhouse gases defined	Same six gases as S. 280. (Carbon dioxide, methane, nitrous oxide (N2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6).)	Same six gases as S. 280.	Same six gases as S. 280.	Same six gases as S. 280, plus nitrogen trifluoride (NF3).	Same six gases as S. 280.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
Specific emissions limits	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 roughly 2% annually 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.	Beginning in 2012, emissions from covered entities are capped at 2006 levels, minus 2012 emissions from non-covered entities. Beginning in 2020, emission cap declines to 85% of 2006 levels, minus 2020 emissions from non-covered entities. Beginning in 2030, emission cap declines to 63% of 2006 levels, minus 2030 emissions from non-covered entities. Beginning in 2050, emission cap further declines to 25% of 2006 levels, minus annual emissions from non-covered entities.	Beginning in 2012, emissions from covered entities are capped at 6.098 billion metric tons; Cap is reduced annually thereafter until 2050. Emission cap for covered sources in 2020 is 4.983 billion metric tons. Emission cap for covered sources in 2030 is 3.633 billion metric tons. Emission cap for covered sources in 2040 is 2.283 billion metric tons. Emission cap for covered sources in 2050 is 0.930 billion metric tons.	Beginning in 2012, emissions from covered entities are capped at 6.351 billion metric tons; Cap is reduced annually thereafter until 2050. Emission cap for covered sources in 2020 is 6.087 billion metric tons. Emission cap for covered sources in 2030 is 3.508 billion metric tons. Emission cap for covered sources in 2040 is 1.928 billion metric tons. Emission cap for covered sources in 2050 is 0.348 billion metric tons.
Covered entities	In metric tons of carbon dioxide equivalent: any electric power, industrial, or commercial entity that emits over 10,000 metric tons carbon dioxide equivalent (mtCO2e) 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 mtCO2e annually; and any importer or producer of HFCs, PFCs, or SF6 that, when used, will emit over 10,000 mtCO2e.	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 equivalent: any electric power, industrial, or commercial entity that emits over 10,000 mtCO2e 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 mtCO2e annually; and any importer or producer of HFCs, PFCs, or SF6 that, when used, will emit over 10,000	Any electric power or industrial facility that emits over 10,000 mtCO2e; any producer or importer of petroleum or coal-based liquid products that, when combusted, will emit over 10,000 mtCO2e annually; local distribution company that delivers natural gas that, when combusted, will emit over 10,000 mtCO2e annually; producer or importer of HFCs, PFCs, SF6, or NF3 [that when used, will	Assuming no capture of GHGs, any producer or importer of petroleum- or coal-based liquid or gaseous fuel that emits GHGs, or any facility that produces or imports more than 10,000 CO2e of GHG chemicals annually; any facility that uses more than 5,000 tons of coal annually; any natural gas processing plant or importer (including LNG); or, any facility that emits more than 10,000 CO2e of HFCs annually as a byproduct of hydrochlorofluorocarbon production.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
			mtCO2e.	emit] over 10,000 mtCO2e; a site at which CO2 is geologically sequestered on a commercial scale.	
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 SF6, 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, renewable energy, and 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 SF6, and downstream to electric generation, industrial, and commercial entities. Allocations to covered entities are provided at no cost.	A tradeable allowance system is established; although the vast majority of the allowances would be auctioned, between 2012 and 2019, 6% of allowances would be distributed to manufacturers of "trade-exposed primary goods," including (per bill text) aluminum, cement, iron/steel, glass, and paper; EPA would develop distribution system. Auction revenues distributed (in FY2010-FY2019) as follows: 58.5% to middle- and low-income households as tax credits and/or rebates; 12.5% for development and promotion of low-carbon technology; 12.5% for energy efficiency programs; 4.5% for biological sequestration; 1.5% for worker transition assistance; 2% for domestic adaptation efforts; 1.5% for protection of natural resources; 1.5% for	A tradeable allowance system is established. Beginning in 2012, 5% of the allowances are allocated to electric generators, declining to 0% in 2020; 10% are allocated to energy intensive industries, declining to 0% in 2020. Remaining allowances are auctioned by the Treasury Department with 15% of revenues transferred to the Deficit Reduction Trust Fund and 85% transferred to the Citizen Protection Trust Fund.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
				international forest protection; 3.5% for international clean technology; 2% for international adaptation efforts.	
Public sale/auction of allowances	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 are 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.)	Between 2012 and 2019, 94% of allowances auctioned; 100% auctioned thereafter.	Beginning in 2012, 85% of allowances are auctioned. This increases steadily to 100% in 2020 and thereafter.
Cost-limiting safety valve	No explicit provision.	No explicit provision.	A Carbon Market Efficiency Board is established to observe the allowance market and implement cost-relief measures if necessary. Measures include permitting increased allowance borrowing from future allocations; expanded payback period for such allowances; lower interest charged for borrowed allowances; and expanded total borrowed allowances. Increased borrowing limited to 5% of emission cap and repayment schedule cannot be longer than 15 years.	No explicit provision.	A Carbon Market Efficiency Board is established to observe the allowance market and implement cost-relief measures if necessary. Measures include increasing available allowances by up to 5% in a given year, by making a compensating reduction in allowance availability in future years, and by permitting increased use of offsets and foreign allowances in a given year by covered entities. 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).

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
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.	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 per ton are equal the greater of $200 or three times the mean market price for allowances during the year the allowance was due; In addition, the covered facility is required to offset excess emissions at a 1-to-1 ratio in the following year (or longer period prescribed by EPA).	Excess emission penalties per ton are equal the greater of $200 or three times the mean market price for allowances during the year the allowance was due; In addition, the covered facility is required to offset excess emissions at a 1-to-1 ratio in the following year (or longer period prescribed by EPA).
Offset treatment and other flexibility mechanisms	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.	Market trading systems are incorporated into new energy efficiency performance standard. No explicit provision on use of domestic or international offsets to meet reduction requirements. However, one goal of program is to encourage sequestration of carbon in the forest and agricultural sectors.	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.	Covered entities permitted to use domestic offsets to meet up to 15% of their allowance submissions; Covered entities may use either international emission allowances, international offsets, or some combination thereof to satisfy another 15% of their allowance submission;	Use of domestic offsets is limited to no more than 10% of a covered entity's allowance submission; certain agricultural projects are subject to review by the National Academy of Sciences and ultimately limited to 5% of allowance submission; Use of foreign allowances is limited to 15% of a covered entity's allowance submission; Use of international forest allowances is limited to 15% of a covered entity's allowance submission; Overall limitation: covered entities permitted to use a combination of domestic offsets and foreign allowances to meet up to 25% of their allowance submissions.
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.	Banking of allowances is permitted; allowances may be saved for use in future years.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
Borrowing	Borrowing against future reductions is permitted.	No specific provision.	Borrowing against future reductions is permitted.	Borrowing against future reductions is permitted, but limited.	The Carbon Market Efficiency Board may permit borrowing against future reductions in certain cases.
Early reduction credits and bonus credits	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.	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.	Under certain conditions, EPA may issue credits for offset projects that are developed before the 2012.	One percent of revenues allocated to the Citizen Protection Trust Fund is to be distributed to facilities making reductions from 1994 to enactment. Eligibility to be determined by EPA regulations.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
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 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, renewable energy, and 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. Bill specifies that 25% of allowances allocated to the CCCC be used to restore large-scale freshwater aquatic and estuarine ecosystems.	Auction revenues distributed (in FY2010-FY2019) as follows: 58.5% to middle- and low-income households as tax credits and/or rebates; 12.5% for development and promotion of low-carbon technology; 12.5% for energy efficiency programs; 4.5% for biological sequestration; 1.5% for worker transition assistance; 2% for domestic adaptation efforts; 1.5% for protection of natural resources; 1.5% for international forest protection; 3.5% for international clean technology; 2% for international adaptation efforts.	Revenues generated by allowance auctions and penalties are deposited by the Treasury Department into two funds: 15% to the Deficit Reduction Trust Fund and 85% to the Citizen Protection Trust Fund. Distribution to the Citizen Protection Trust Fund are as follows: 54% for consumer assistance (66% of which goes towards providing health insurance coverage, the remainder for rebates and tax relief), 7% for natural resource adaptation, 1% for early action; 2.7% for states and tribes; 11.4% for international activities, 4% for worker assistance, 3% for forestry and agricultural activities, 0.4% for education, 7.5% for energy efficiency, 2% for transportation alternatives, and 7% for green energy research.

Topic	H.R. 620 (Olver)	H.R. 1590 (Waxman)	H.R. 4226 (Gilchrest)	H.R. 6186 (Markey)	H.R. 6316 (Doggett)
Other key provisions	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. Requires periodic review of target adequacy by the NAS.	The President may establish a program to require importers to pay the value of GHGs emitted during the production of goods or services imported into the United States from countries that have no comparable emission restrictions to those of the United States. The program's requirement may not be imposed on countries until negotiations to achieve agreement on such restrictions have been attempted. 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; creation of a national greenhouse gas database; and an outreach initiative to inform agriculture of the bill's revenue opportunities. Requires periodic review of target adequacy by the Under Secretary of Commerce for Oceans and Atmosphere.	Establishes a program to require importers to purchase "international reserve allowances" to account for GHG emissions from the production of "trade-exposed goods" (e.g., iron/steel, cement, aluminum) from countries that have no comparable emission restrictions to those of the United States; least developed nations or those that contribute less than 0.5% of global emissions are excluded; Requires NAS to conduct a periodic review of climate change science and the performance of the act; directs GAO to periodically review the effectiveness of auction revenue distribution, both for domestic and international objectives; Directs EPA to develop emission performance standards for non-covered entities that exceed 10,000 mtCO2e per year; such sources may include coal mines, landfills, wastewater treatment operations, and animal feeding operations; agricultural soil management and forest management would be specifically excluded; Creates a performance standard for coal-fired power plants that commence construction on or after January 1,	Establishes a program to require importers to purchase "international reserve allowances" to account for GHG emissions from the production of "primary goods" (e.g., iron/steel, cement, aluminum) from countries that have no comparable emission restrictions to those of the United States; least developed nations or those that contribute less than 0.5% of global emissions are excluded; Requires EPA to promulgate regulations within two years of enactment requiring that emissions in uncovered sectors do not grow (no baseline specified).

Appendix C. 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 facilities 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 allowances established 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, as well as the breadth of covered entities within a covered sector.

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).

Hybrid Program. Generally a greenhouse gas reduction program that allows emitters to choose between complying with the reduction requirement of a cap-and-trade program or paying a set price (safety valve price) to the government in lieu of making reductions.

Leakage. Decreases in greenhouse gas-related reductions or benefits outside the boundaries set for defining a project's or program's net greenhouse gas impact resulting from mitigation activities. For example, emissions could be reduced in an area with greenhouse gas controls by moving an emitting industry to an area without such controls.

"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 additional 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.

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