Greenhouse Gas Emission Reduction Timetables

This brief describes issues relevant to the timetable for reducing U.S. emissions of greenhouse gases (GHGs) under a cap-and-trade program. The first issue is whether reductions are sufficiently deep to have a meaningful effect on the global climate. Scientific evidence suggests that global reductions of 50 to 85% by 2050 are needed to avoid the most serious consequences of climate change, and policymakers need to decide what share of the global emission reduction burden will be shouldered by the United States. Second, while existing technologies can be used to make significant near-term emission reductions, new technologies will be needed to achieve deep long-term reductions. Policymakers can stimulate technology development with a sufficiently stringent timetable that covers several decades. Cost minimization is the third issue. Many existing technologies can be used to reduce emissions almost immediately at little cost. However, in some capital-intensive situations, such as a major change to a factory's production process, costs may be reduced if emission reduction requirements can be matched with the natural lifecycle of the equipment or similarly, if firms and consumers have time to adjust purchasing patterns to reflect higher prices for GHG-intensive goods. Fourth, when it comes to the mechanics of setting a reduction timetable, policymakers must specify not only the start and end dates for the reduction pathway, but also the target for each intervening year. Given the environmental importance of cumulative emissions, less aggressive near-term action will necessitate deeper reductions in later years. Policies enacted by others suggest a blended strategy: near-term reduction targets based on technical feasibility and long-term targets based on environmental objectives. Finally, while a multi-decade emission reduction timetable will provide regulatory certainty, enhance innovation, and minimize cost, the reality is that new scientific, technical, or economic data may necessitate changes to the timetable. Policymakers need to manage the trade-off between long-term predictability and the flexibility to adapt to new information.

The cornerstone of any U.S. national policy to address climate change will be mandatory reductions in greenhouse gas (GHG) emissions. To produce meaningful environmental benefits, such reductions must be sizeable. Market-based mechanisms—like a cap-and-trade program—can minimize the cost of achieving these reductions. A key component of a cap-and-trade program is the timetable that specifies the reductions in U.S. emissions to be made over the coming years. This Congressional Policy Brief discusses key policy design issues associated with setting the timetable for GHG emission reductions.

The Scientific Basis for Setting An Emission Reduction Timetable

The scientific basis for addressing climate change has become substantially stronger in the past year. In 2007, Working Group III of the Intergovernmental Panel on Climate Change (IPCC) released its Fourth Assessment with respect to mitigation of climate change. The Group found "high agreement" and "much evidence" about the change in global emissions needed to stabilize the concentration of GHGs in the atmosphere.[1] In particular, the Group determined that holding the global mean temperature increase at 2.0°C to 2.4°C (3.6°F to 4.3°F) over

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pre-industrial times—a level that many argue must be attained in order to have a good chance of avoiding the most serious consequences of climate change—requires stabilization at 445 to 490 ppm CO_2-equivalent (CO_2-e) for all GHGs. In turn, attaining this goal requires a 50 to 85% cut in global GHG emissions in 2050 when compared to 2000 emission levels.[2] Moreover, Working Group III found that to achieve this scenario, global emissions must peak and begin declining at some point before 2015.

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The urgency of the matter has been underscored by another IPCC report announcing that atmospheric GHG concentrations reached 455 ppm CO_2-e in 2005.[3] More recent reports find that GHG concentrations are rising faster in the current decade than in the 1990s due to a booming global economy, intensive fossil fuel use, and an apparent decline in the oceans' ability to act as a natural carbon sink.[4] Such findings emphasize the need for prompt and significant global reductions in GHG emissions.

Linking U.S. Emission Reductions to Global Environmental Results

National action to address future U.S. GHG emissions is only one part of international efforts to solve the global climate change problem. However, the link between U.S. emissions and global efforts to address climate change is direct and substantial. As one of the world's largest GHG emitters,[5] America's emissions have a material impact on atmospheric GHG concentrations. As the source of about 29 percent of cumulative global CO_2 emissions between 1850 and 2002,[6] the United States also bears significant responsibility for warming attributable to GHGs already in the atmosphere. In addition, aggressive national action by the United States is likely to accelerate global agreement on an effective approach to address climate change.

When it comes to setting a U.S. emission reduction timetable, it is important to recognize that the IPCC findings noted above (requiring a 50 to 85% cut in global emissions) are not directly applicable to any one country. Accordingly, choosing a national reduction timetable is also a decision about the share of the global reduction burden to be taken on by the United States. Several factors suggest that policymakers should consider implementing a domestic reduction target that reflects more than a simple pro rata share of the reduction needed globally.

First, as noted above, the United States has historically been a major source of the world's GHG emissions. Second, given its economic strength and experience with market-based tools, the United States is better positioned than developing countries to begin reductions now and drive innovations that help the rest of the world achieve larger reductions over time. Third, deeper reductions by developed countries make it easier to achieve stronger reduction efforts in developing countries. Finally, if the United States wishes to benefit from commercialization and export of climate-friendly technology, it needs to take action.

The climate change issue—as a "global commons" issue—does entail the potential for a phenomenon known by economists as the "free rider" problem. In this case, a free rider would be a country (or group of countries) that does not make emission reductions, yet enjoys the benefit of reductions made by other countries. However, a number of developed countries are taking on ambitious targets and commitments, and developing countries are signaling their willingness to engage as well. A strong domestic reduction timetable makes it easier for the United States to insist on meaningful action by other nations.

The link between U.S. emissions and global efforts to address climate change is direct and substantial.

A recent EPA analysis of the McCain-Lieberman bill (S.280) illustrates this point.[7] Were the United States to act unilaterally, EPA estimated that the global CO_2 concentration in 2095 would be only about 3 percent lower than it otherwise would have been—a seemingly trivial reduction. Of course, most developed countries are in fact taking steps to reduce their emissions in advance of U.S. action. Further, EPA's analysis showed that if accompanied by prompt action by developed countries and action beginning in 2025 by developing countries, the domestic reductions called for in the legislation would have a notably different outcome. In that scenario, the global CO_2 concentration in 2095 would be about 33 percent lower than it otherwise would have been (and would be held at 481 ppm).

In short, if the United States makes substantial emission reductions that are not ultimately matched by the rest of the world, then the environmental benefits of U.S. action would indeed be quite limited. On the other hand, if substantial U.S. emission reductions help trigger or contribute to meaningful action by both developed and developing countries—as many expect it will—then the environmental benefits of U.S. action would be significant.

Ultimately, the best assurance that all major emitting countries are contributing their fair share to the global effort is a new treaty setting fair, effective, and binding commitments. The global community—including the United States and developing countries—took an important step in this direction with the adoption of the Bali Roadmap at the December 2007 United Nations Climate Change Conference. The Roadmap provides a framework for an international negotiating process with the goal of achieving a new global climate agreement in 2009.

Technological Innovation and Diffusion

Large reductions in U.S. emissions will require the widespread deployment of both existing and new technologies throughout the economy. Existing technologies can be used to make significant emission reductions (e.g., enhanced energy efficiency in buildings), but other technologies need more development and demonstration before they can make a significant contribution (e.g., certain renewable energy sources or carbon capture and storage). Several aspects of the technology development process are relevant to setting a reduction timetable and are described below. In addition, policies beyond cap and trade aimed at spurring technological innovation are discussed in the Pew Center's Congressional Policy Briefs on complementary policies.

First, the timetable for near-term emission reductions can reflect currently available technologies, their potential market penetration, and the emission reductions they are likely to produce. Especially in light of the recent scientific findings noted above, which suggest that emissions need to peak very soon in order to achieve stabilization at lower GHG concentrations, it is important that existing technologies be deployed rapidly. The prospects for doing so can be greatly enhanced by a sufficiently stringent near-term reduction timetable. Near-term emission cuts too deep to be accommodated by existing or emerging technologies may, however, cause substantial economic and social disruption.

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Second, when it comes to development of new technologies needed to achieve deeper long-term cuts, it is generally accepted that market-based environmental programs typically spur additional, or induced, technological changes beyond those that happen in the normal course of business. Motivated by a cap-and-trade program for GHGs, and the associated opportunity to cut costs and/or increase revenues, market forces can be expected to "pull" new technologies into the market to reduce emissions. In turn, induced technological change means that an emission reduction timetable can specify deeper cuts over a longer timeframe than would be technically feasible if one looked only at existing technologies.

Third, studies suggest that induced technological change can be stimulated by clear and credible announcements regarding future policy requirements. As a consequence, technical innovation may accelerate and costs may be reduced if policymakers set timetables that extend over long periods and are unambiguous about the degree of required emission reductions.[8]

Fourth, some studies suggest that steep near-term reductions are needed to stimulate the technology development and deployment process. Other studies suggest, however, that because induced technological change can be expected to drive down the cost of emission reductions, it may be prudent to make only modest reductions in the near term while waiting for newer, less expensive technologies to become available. In addition to the fact that delaying action would make it harder to achieve the scenario where emissions peak by 2015, all studies reviewed for a Pew Center report on technology indicate that some emission reductions must begin now to jump-start the process of technological innovation and change.[9]

Finally, using a domestic emission reduction timetable to stimulate technological innovation can yield benefits when it comes to international trade. As countries around the world move to reduce emissions, there will be opportunities for international technology diffusion. If American industry develops and commercializes new technologies and processes to serve domestic markets, it will also likely be well positioned to exploit new export markets as well.

Reducing Costs when Setting a Reduction Timetable

The emission reduction timetable can have important consequences for program costs. A cap-and-trade program essentially puts a price on GHG emissions by requiring emitters (or their upstream suppliers) to hold a sufficient number of allowances to cover their emissions while at the same time limiting the number of available allowances. This price on GHGs in turn motivates each emitter to decide whether to continue its "business-as-usual" emissions or to reduce its emissions. The emitter's decision will take into account the financial impact of implementing reductions, buying needed allowances to cover residual emissions, and/or selling excess allowances.

These factors make GHG emission allowances a commodity—the more stringent the reduction timetable, the more scarce the commodity becomes. Scarcity, by the laws of supply and demand, makes the commodity more expensive. As allowance prices rise, GHG emitters will be motivated to make larger investments in emission reductions. These investments constitute the real resource cost of a cap-and-trade program. Policymakers thus will largely determine the cost of a cap-and-trade program when they specify the extent and timing of required emission reductions. (See Pew Center Congressional Policy Briefs on other program design features that affect program costs, including allowance allocation, cost containment, and offsets).

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While stringent reduction targets will make GHG allowances more scarce and more expensive, higher prices will also stimulate more technological innovation. Induced technological change can make emission reductions more cost effective (i.e., by reducing the cost of eliminating a given ton of emissions). As emission control costs fall (on a per-unit basis), the cost of achieving any particular national target will also drop relative to what it otherwise would have been.

Another cost consideration is the linkage between the emission reduction timetable and natural capital investment cycles. Many of the facilities, processes, and equipment that emit GHGs are capital assets with a natural lifecycle that extends over many years, and in some cases, over decades. Examples of capital assets include cars and trucks, energy-consuming equipment in commercial buildings and homes, and manufacturing facilities such as petroleum refineries and cement plants.

Reducing emissions in such situations can be appreciably more cost-effective if those reductions are synchronized with the natural lifecycle of the equipment. For example, manufacturing plants are often shut down every few years for major maintenance and overhaul. Installation of many emission reduction technologies and processes can be substantially more cost-effective if done during such shut-downs rather than at other times. Structuring the emission reduction timetable to allow some flexibility to firms to accommodate capital replacement cycles will thus likely reduce costs.

Conversely, there are many opportunities to reduce emissions almost immediately at little or no cost, especially in terms of energy efficiency. With relatively low initial costs, and often with energy cost savings during operation, such opportunities are sometimes referred to as “low hanging fruit.” Examples include energy efficient lighting, office equipment, home appliances, and heating and cooling systems, along with improved building insulation and windows.

Another way to reduce the cost of a cap-and-trade program is to eliminate—to the degree possible—uncertainty about what will be required of GHG emitters over the long run. Uncertainty is costly because it clouds investment decisions and inherently increases the risks of choosing one option over another. Clarity about target levels over long periods of time reduces uncertainty and the sooner future targets are announced, the cheaper they will be to attain. Such advance announcements “lubricate” carbon markets, stimulate innovation, and reduce regulatory risk in capital investment decisions.

The Mechanics of Setting an Emission Reduction Timetable

Several questions must be answered to define a specific emission reduction timetable.

What are the start and end dates for the emission reduction pathway?

Considerations in selecting the first year in which emissions are capped include determining how fast administrative structures can be put in place, how quickly issues related to integration of a federal program with existing state and regional GHG programs can be addressed, the speed with which emissions data can be assembled to support allowance allocation, and the amount of time needed to establish functioning allowance markets and allow market participants to become familiar with basic market operations and dynamics.

The year in which emissions are first regulated does not have to be the same year that emissions are reduced relative to prior years. Though limited by a cap, emissions might be allowed to increase in the short run before being reduced. A desire to allow short-run increases in emissions (perhaps to avoid early retirement of capital equipment or to allow time for technology diffusion) is thus not a compelling reason to delay imposing a reduction timetable because increases can be addressed within the timetable. (As the science on the impacts of climate change becomes more compelling, however, an immediate freeze on emissions at current or near-current levels may be more prudent.)

The long-term target date (i.e., the last year in which reductions are specified) must be far enough in the future to allow time for meaningful emission reductions. It should also create a long-run policy environment with the stability needed to encourage investment in low-carbon technologies. A timetable covering only a few years will be insufficient on both counts.

How will baseline issues be addressed?

Most reduction timetables are defined in terms of a baseline year, with each reduction computed as a percentage of emissions in that year. Some proposals set 1990 as the baseline; others use 2005. The IPCC report noted above used the year 2000 as a baseline and the U.S. Climate Action

Partnership (USCAP)—a group of leading companies and non-governmental organizations—uses "today's levels" when describing the proposed reduction timetable in its *Call for Action* published in January 2007. To ensure comparability among policy proposals and the scientific, economic, and technology assessments being used by policymakers, it is important that baselines be consistent (or translated into consistent terms). If needed, adjustments can be made by reviewing historical emissions data and making the appropriate calculations.

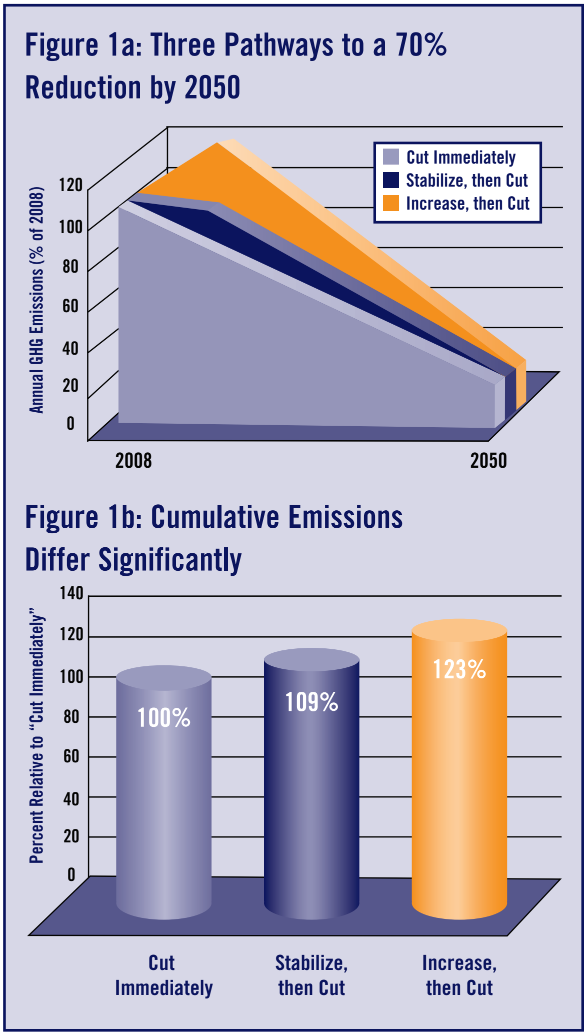
The "percent of baseline" approach—that is, expressing the emission limit for a particular year as a percentage of the emissions in the baseline year—may leave residual uncertainty since there can be revisions to historical data after enactment of legislation. An alternative is to avoid the "percent of baseline" method and express emission targets in natural units, such as tons of CO_2. Both approaches have been used in currently proposed legislation.

Finally, if a policy choice is made to exclude some sectors and/or types of emission sources from the cap-and-trade program, adjustments to the calculations may be needed. For example, if the national emission target (for all sectors) in a particular year is a ten percent reduction over some baseline year, but only two-thirds of the total emissions are covered by the cap-and-trade program, then other policy requirements would be needed to ensure that the necessary reductions are made outside the cap-and-trade program (or cuts inside the program need to be deeper), thereby assuring that the national aggregate target is achieved.

What are the design choices when setting an emission reduction timetable?

One way to design a reduction timetable is to set annual emission targets. Figure 1a shows three illustrative pathways to the same long-term target (in this case, a 70% reduction in 2050). Emissions could be allowed to increase for some period of time before being reduced; alternatively, emissions could be stabilized at current levels before reductions begin.

Figure 1 *Timetables with the Same Future Target Can Have Different Environmental Effects*



Finally, emission cuts could begin immediately upon program launch. These three scenarios—which are only for purposes of illustration—demonstrate that it is not enough to specify the target emission level in the final year of the program. Because there are many pathways from today's emission levels to those in a future target year, targets for each intervening year are a necessary component of a comprehensive climate change policy.

A second way to think about reduction timetables is to consider cumulative emissions. With the length of time that GHGs stay in the atmosphere, cumulative emissions are far more important than the emissions in any one year when it comes to determining the climate response. Accordingly, the three scenarios in Figure 1 are *not* environmentally equivalent. As shown in Figure 1a, they start in the same year and achieve the same target (i.e., a 70% reduction in 2050), but as shown in Figure 1b, cumulative emissions differ significantly among them. The scenarios are only illustrative, but cumulative emissions are 23% higher under the "Increase, then Cut" scenario than under the "Cut Immediately" scenario and the "Stabilize, then Cut" scenario has cumulative emissions that are 9% higher than when cuts begin immediately.

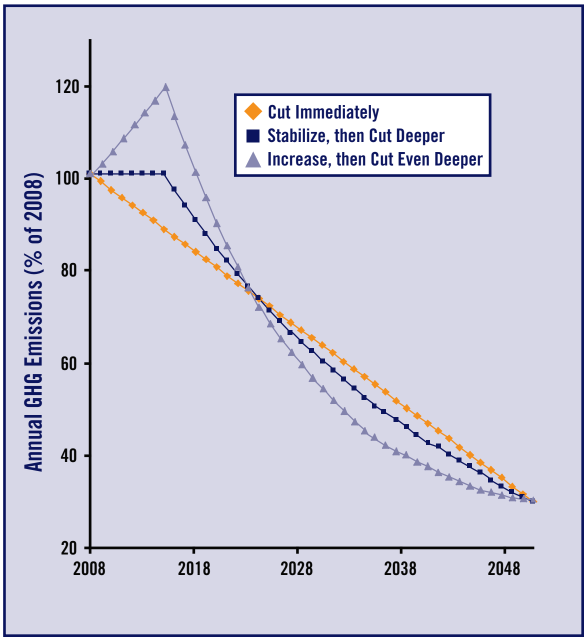
Figure 2 shows the effect of setting the reduction timetable so that cumulative emissions are the same in all three scenarios. The consequence of delaying emission cuts is even deeper reductions in later years. Timetables that allow significant increases beyond the early years undermine incentives for innovation, thereby potentially driving up overall costs and impeding emission reductions.

In addition, such timetables would shift more of the burden of addressing climate change to future generations and may limit the United States' ability to negotiate meaningful reductions by other countries. Finally, allowing emissions to grow excessively in the near term will make it harder to adjust targets if new science indicates that larger reductions are needed.

Under what circumstances might emissions deviate from the timetable?

In assessing the environmental and/or cost implications of any particular timetable, it is important to consider provisions in legislation that may cause actual emissions to differ from what is specified in the timetable. Some legislation, for example, includes an allowance "price cap" or "safety valve" that permits the

Figure 2 *Holding Cumulative Emissions Constant Can Mean Deeper Cuts in the Future*



issuance of additional allowances if allowance prices rise above a threshold. In such cases, emissions would exceed levels established by the cap and projected environmental benefits would not be achieved. See, for example, EIA's analysis of S.1766, the Bingaman-Specter "Low Carbon Economy Act of 2007," which shows a price cap being triggered in the early years of the program, thereby causing emission reduction targets not to be met.[10] In addition, if legislation makes domestic reduction targets contingent on action by other countries (as this bill and some others do), the possibility exists that U.S. emissions will not follow their prescribed path.

How can a single timetable cover six GHGs?

Carbon dioxide (CO_2) is the primary greenhouse gas, but five other anthropogenic gases—methane, nitrous oxide, sulfur hexafluoride, perfluorocarbons, and hydrofluorocarbons—contribute substantially to global climate change. Multiple gases can be combined under a single timetable using a concept known as Global Warming Potential (GWP). Typically expressed as the cumulative warming effect of a gas over a 100 year period relative to CO_2, a GWP can be calculated for each GHG. By convention, the GWP of CO_2 is set at 1.0 and the GWPs, for example, of methane and nitrous oxide are 25 and 298, respectively.[11] It is the GWP that allows discussion of total GHGs in terms of "CO_2-equivalent"—the amount of each gas is translated to the amount of CO_2 that would have the same GWP.

In specifying GWPs, one alternative is for Congress to fix in legislation the GWP for each gas; alternatively, the process of setting and updating GWPs could be delegated to a federal agency such as EPA. A hybrid approach would be for Congress to initially set the GWPs in legislation, but grant a federal agency the rulemaking authority to update them in light of new scientific information.

It is important to recognize that if GWPs are revised in light of new scientific evidence, allowance prices could be affected since a different number of allowances would be needed to emit GHGs other than carbon dioxide (CO_2's GWP would presumably remain at 1.0). To minimize uncertainty and risk for allowance holders, it is important that policymakers specify how changes to GWPs will affect allowance requirements. Retroactive adjustments to the number of allowances already surrendered for prior emissions would likely be infeasible. Going forward, ensuring the transparency of the GWP-revision process and allowing sufficient time between GWP revisions and new allowance submission requirements will be key to minimizing disruption of the allowance markets.

What are some examples of timetables?

To date, emission reduction timetables have not been enacted at the federal level. Many states, however, have moved to control GHG emissions and their actions are indicative of the potential approaches to this issue. Table 1 summarizes state and regional emission reduction timetables. In addition, as shown in Table 2, many of the legislative proposals related to climate change that are pending in Congress contain specific emission reduction timetables.

Table 1 *State & Regional Emission Reduction Targets*

Entity/Scope	Targets and Timetables
Arizona: State-wide	2000 levels by 2020; 50% below 2000 by 2040
California: State-wide	2000 levels by 2010; 1990 levels by 2020; 80% below 1990 by 2050
Connecticut: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 80% below 2001 levels by 2050
Florida: State-wide	2000 levels by 2017; 1990 levels by 2025; 80% below 1990 levels by 2050
Hawaii: State-wide	1990 levels by 2020
Illinois: State-wide	1990 levels by 2020; 60% below 1990 levels by 2050
Maine: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 75-80% below 2003 long-term
Massachusetts: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 75-85% below 2001 long-term
Minnesota: State-wide	15% below 2005 levels by 2015; 30% below 2005 levels by 2025; 80% below 2005 levels by 2050
New Hampshire: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 75-85% below 2001 long-term
New Jersey: State-wide	1990 levels by 2020; 80% below 2006 levels by 2050
New Mexico: State-wide	2000 levels by 2012; 10% below 2000 by 2020; 75% below 2000 by 2050
New York: State-wide	5% below 1990 by 2010; 10% below 1990 by 2020
Oregon: State-wide	Stabilize by 2010; 10% below 1990 by 2020; 75% below 1990 by 2050
Rhode Island: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 75-85% below 2001 long-term
Utah: State-wide	2005 levels by 2020
Vermont: State-wide	1990 levels by 2010; 10% below 1990 by 2020; 75-85% below 2001 long-term
Virginia: State-wide	30% below business as usual by 2025
Washington: State-wide	1990 levels by 2020; 25% below 1990 levels by 2035; 50% below 1990 levels by 2050
New England Governors and Eastern Canadian Premiers: Regional economy-wide	1990 levels by 2010; 10% below 1990 by 2020
Regional Greenhouse Gas Initiative: CO_2 emissions from power plants	Cap emissions at current levels in 2009; reduce emissions 10% by 2019
Western Climate Initiative	15% below 2005 levels by 2020

Source: Pew Center on Global Climate Change, http://www.pewclimate.org/states-regions

Table 2 *Greenhouse Gas Cap-And-Trade Proposal Reduction Targets in the 110th Congress*

Bill	2010–2019 Cap	2020–2029 Cap	2030–2050 Cap
Boxer-Lieberman-Warner S. 3036 – June 2008 Lieberman-Warner Climate Security Act of 2008 Substitute ammendment to S. 2191 considered by full Senate	4% below 2005 level in 2012	19% below 2005 level in 2020	37% below 2005 level in 2030 55% below 2005 level in 2040 71% below 2005 level in 2050
Bingaman-Specter S. 1766 – July 2007 Low Carbon Economy Act	Start at 2012 level in 2012	2006 level in 2020	1990 level in 2030 President may set long-term target ≥60% below 2006 level by 2050 contingent upon international effort
Kerry-Snowe S. 485 – February 2007 Global Warming Reduction Act	Start at 2010 level in 2010	1990 level in 2020 2.5%/year reduction from 2020-2029	3.5%/year reduction from 2030-2050 62% below 1990 level in 2050
Sanders-Boxer S. 309 – January 2007 Global Warming Pollution Reduction Act	Start at 2010 level in 2010 2%/year reduction from 2010-2020	1990 level in 2020	27% below 1990 level in 2030 53% below 1990 level in 2040 80% below 1990 level in 2050
McCain-Lieberman S. 280 – January 2007 Climate Stewardship and Innovation Act	2004 level in 2012	1990 level in 2020	20% below 1990 level in 2030 60% below 1990 level in 2050
Markey H.R. 6186 – June 2008 Investing in Climate Action and Protection Act	2005 level in 2012	20% below 2005 levels in 2020	85% below 2005 levels in 2050
Waxman H.R. 1590 – March 2007 Safe Climate Act of 2007	2009 level in 2010 2%/year reduction from 2011-2020	5%/year reduction from 2020-2029	5%/year reduction from 2030-2050 80% below 1990 levels in 2050
Olver-Gilchrest H.R. 620 – January 2007 Climate Stewardship Act	2005 level in 2012	1990 level in 2020 1990 level in 2020	22% below 1990 level in 2030 70% below 1990 level in 2050

Source: Pew Center on Global Climate Change, http://www.pewclimate.org/docUploads/Cap-and-Trade-Chart.pdf

In addition, USCAP's *Call for Action* has recommended the following emission pathway:

- ***Between 100-105% of today's levels within five years of rapid enactment,***
- ***Between 90-100% of today's levels within ten years of rapid enactment,***
- ***Between 70-90% of today's levels within fifteen years of rapid enactment, and***
- ***A "target zone" of reducing emissions by 60 to 80% from current levels by 2050.***[12]

Another example of an emission reduction timetable is provided by the European Union, which has committed to a 20% reduction in emissions by 2020, as compared with 1990. The EU has offered to increase the reduction to 30% if other developed countries take specific steps to reduce emissions. The EU has also proposed that all developed countries collectively reduce their emissions by 60 to 80% by 2050, compared to 1990.[13]

Absolute versus Intensity Targets

In lieu of limits on the absolute level of GHG emissions, an alternative is to set a target for emissions or energy "intensity." Intensity is the ratio of emissions or energy consumption to economic output. In 2002, President Bush announced a non-binding goal of reducing emissions intensity by 18% by 2012 and, in September 2007, the United States and other participants in the Asia-Pacific Economic Cooperation Summit agreed on an aspirational goal of reducing energy intensity by 25% by 2030.

Intensity targets minimize economic impact by allowing emissions to change with economic output. A sufficiently stringent intensity target could theoretically produce a reduction in absolute emissions. Such targets, however, still cannot guarantee that a given level of environmental protection will be achieved since protection is measured in relation to GDP. For example, even though GHG intensity decreased in the United States over the last two decades, emissions generally increased during the same period. Because of energy efficiency improvements, introduction of new information technologies, and continued transition from heavy industry to less energy-intensive industries, greenhouse gas intensity fell by 21% in the 1980s and by 16% in the 1990s.

In other words, total GHG emissions can—and often do—increase even as emission intensity falls, an outcome at odds with a significant reduction in aggregate emissions.

Source: Pew Center on Global Climate Change, www.pewclimate.org/policy_center/analyses/response_bushpolicy.cfm

Strategies for Setting and Adjusting an Emission Reduction Timetable

Initially setting and then potentially adjusting emission reduction timetables over time requires balancing environmental, technological, and cost considerations. Rather than viewing these as distinct factors, it may be possible to think about them in a more integrated, strategic fashion.

How can near-term and long-term considerations be reflected in the initial emission reduction timetable?

While it is important to maintain a multi-decade perspective on the emission reduction pathway, this pathway can be conceptualized in two phases: the first, or near-term phase, might cover the next decade or two while the second, long-term phase, might extend through 2050.

Enacted policies suggest a blended strategy: Near-term targets based on technical feasibility & long-term targets based on environmental objectives.

In the near term, existing technologies will have to carry much of the load with respect to emission reductions. Fortunately, there is more certainty about the availability and performance of such technologies, and policymakers can have more confidence in the feasibility of specific reduction targets. Policymakers also need to balance quick emission reductions—which stimulate innovation and create real environmental progress—with the goal of allowing time for reductions to be synchronized with capital replacement cycles and for firms and consumers to adjust their purchasing patterns to reflect higher prices for GHG-intensive goods.

Long-term targets are also crucial to a cap-and-trade program. Given the magnitude of emission reductions needed to stabilize the global climate, it will take decades to fully implement the required mitigation measures. Long-term targets help create a stable policy environment which facilitates long-range planning for investments in the development and deployment of new technologies. Because, however, the ability to achieve substantial long-term emission reductions depends in large measure on the deployment of as yet unproven technologies, policymakers do face a more uncertain task when it comes to assessing the cost and feasibility of long-term targets. Fortunately, induced technological change will help deliver these technologies to market and periodic reviews (discussed below) provide the opportunity for mid-course corrections in long-term targets.

When it comes to balancing near-term and long-term considerations in the initial design of an emission reduction timetable, policies enacted by states and other countries suggest a blended strategy: Near-term reduction targets based on what is technically feasible now and long-term targets based on the environmental objective of preventing dangerous climate change.

How can the objectives of flexibility and predictability be balanced in the long run?

While sound climate policy requires prompt enactment of a clear multi-decade emission reduction timetable, the practical reality is that changes to the timetable may be required in the future. Such changes may be necessitated by new scientific, technical, or economic data. Accordingly, policymakers need to manage trade-offs between the desirability of long-term predictability of timetables and the need for flexibility to adapt to new information. One approach is to provide for periodic review of the latest data and an assessment of its implications for the existing reduction timetable. The Regional Greenhouse Gas Initiative, for example, includes a mid-course comprehensive program review that will take place in 2012.[14]

The United States could rely on the National Academies (e.g., the National Academy of Science or the National Research Council), or another entity, to conduct the reviews. The review could also be conducted under the auspices of one agency, such as the Environmental Protection Agency, or could be overseen by an interagency group. Membership in such a group could be specified in legislation or determined by the Executive Branch. A Congressional agency—such as the Government Accountability Office—might also be given responsibility for conducting and/or overseeing a parallel review.

Irrespective of the entity responsible for the review, policymakers would also need to specify its scope. The review could simply assess the evolving science with respect to climate change and its impacts. Alternatively, the review could assess the environmental consequences of specific revisions to the emission reduction timetable. The review might also address the implications for the timetable of observed technological innovation and diffusion. Finally, policymakers would need to decide whether the review would also cover the costs and economic impacts of the emission reductions already implemented as of the date of the review.

A final element in designing any review process is specifying what happens with the results of the review. Is the review simply advisory? Or does it—by design—trigger a policy process for revising the emission reduction timetable? If so, policymakers must determine whether authority to adjust emission reduction timetables in response to such reviews will be delegated to a federal agency or reserved for legislative action. Either way, to maximize the efficiency of carbon markets and enhance implementation of the cap-and-trade program, it will be important to clarify how the review process will work, the timing of reviews, and how adjustments to the reduction timetable will be made.

Key Design Questions

The process of setting an emission reduction timetable is an integral component in the design of a successful cap-and-trade program. Policymakers must balance multiple policy objectives while simultaneously considering both near-term and long-term factors. Doing so entails addressing several key questions:

- When will emissions first be limited? How far into the future will limits be imposed?
- What is the pathway of reductions from today's emission levels to the future target?
- Will the timetable prevent the most serious consequences of climate change?
- Will the United States assume an appropriate share of the global emission reduction burden?
- Will required reductions stimulate technological innovation sufficient to achieve the timetable?
- Have costs been minimized without jeopardizing the environmental objective?
- Does the domestic reduction timetable enable the United States to play a constructive role in global negotiations?
- Are near-term emission cuts deep enough to stimulate innovation and benefit the climate while balancing the need to allow sufficient time for technical and economic adjustment?
- Does the long-term emission reduction timetable strike a balance between the flexibility to respond to new scientific findings and providing as much policy certainty to stakeholders as possible?

End Notes

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