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Testimony

Statement of
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The Use of Agricultural Offsets to Reduce Greenhouse Gases

before the
Subcommittee on Conservation, Credit, Energy, and Research
Committee on Agriculture
U.S. House of Representatives

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Chairman Holden, Congressman Goodlatte, and Members of the Subcommittee, thank you for the invitation to testify on the use of agricultural offsets as part of a cap-and-trade program for reducing greenhouse gases.

H.R. 2454, the American Clean Energy and Security Act of 2009, which was passed by the House of Representatives, would set an annual limit, or cap, on greenhouse-gas emissions for each year between 2012 and 2050 and would distribute "allowances," or rights to produce those emissions. After the allowances were distributed, regulated entities—those that generate electricity or refine petroleum products, for example—would be free to trade them, so entities that could reduce their emissions at lower costs would sell allowances to others facing higher costs.

The provisions of H.R. 2454 reflect the fact that a variety of other actions—including changing agricultural practices and reducing deforestation—can also reduce the concentration of greenhouse gases in the atmosphere. Those actions have the potential to "offset" the extent to which more costly actions, such as reducing the use of fossil fuels, would have to be undertaken to meet a chosen target for total greenhouse-gas emissions. Under the bill, regulated entities would be allowed to use offsets—meaning reductions in greenhouse gases from activities *not* subject to limits on emissions—in lieu of reducing their emissions or purchasing allowances. Yet the difficulty of verifying offsets raises concerns about whether the specified overall limit would actually be met. Such concerns may be especially acute when, as under H.R. 2454, allowable offsets include actions taken outside the United States.

My testimony makes the following key points:

- Researchers have concluded that a cap-and-trade program that allowed for offsets—such as those that might be generated by changes in agricultural practices and forestry—could reduce greenhouse gases more cheaply than a cap-and-trade program that did not include offsets, but instead relied entirely on reducing the consumption of fossil fuels.

- Because of concerns that the use of offsets could undermine the environmental goals of a cap-and-trade program, four challenges would have to be addressed if offsets are to play a meaningful role in reducing the concentration of greenhouse gases in the atmosphere. In particular, offsets would have to bring about reductions in greenhouse gases that (1) would not have otherwise occurred; (2) could be quantified; (3) were permanent rather than merely a delay in the release of greenhouse gases into the atmosphere; and (4) accounted for "leakage," that is, higher emissions elsewhere or in different sectors of the economy as a result of the activities producing the offsets.

- On the basis of data from the Environmental Protection Agency (EPA), the Congressional Budget Office (CBO) expects that, under the provisions of H.R. 2454, most offsets would be generated by changes in forestry and agricultural practices. Of the offsets from those sectors, fewer than half would be produced domestically

in most years, and only about 10 percent of the domestically produced offsets would be from changes in agricultural practices. The remaining offsets from those sectors would come from international sources and would be more evenly split between agriculture and forestry.

- CBO estimates that the savings generated by offsets under H.R. 2454 would be substantial—reducing the price of allowances and the net cost of the program to the economy by about 70 percent. By CBO's estimates, regulated entities would use offsets for about 45 percent of the total emission reductions that they would be required to make over the 2012–2050 period covered by the policy.

- Any assessment of the use of offsets is subject to many uncertainties, which are inherent in the models used, about such things as the types of activities that would be eligible to generate offsets and the amount supplied by those activities, the prospects for concluding agreements with other nations to allow the use of international offsets, and the cost of ensuring that activities generating offsets actually reduce greenhouse gases.

Potential Benefits of Offsets in Reducing the Cost of Meeting a Target for Emissions

Offsets used as a part of a cap-and-trade program for greenhouse-gas emissions have the potential to reduce the cost of meeting the cap by substituting cheaper reductions in greenhouse gases for more expensive ones. The effect of greenhouse gases on the climate does not depend on where and how those gases are produced, but rather on the concentration of those gases in the atmosphere. Consequently, the cheapest way to reduce greenhouse gases by a chosen amount is to create a system that encourages reductions wherever and however they are least costly to make.

In principle, a comprehensive cap could apply to all sources of greenhouse gases. In practice, however, policies currently in effect in parts of the United States and in other countries, as well as those being considered by the Congress, cap only emissions from significant sources of greenhouse gases that can be easily and reliably measured.

The electric power industry, for instance, which produces over one-third of all greenhouse gases in the United States, can use systems that continuously monitor emissions (such as methods currently required under the Acid Rain program) to accurately measure the release of carbon dioxide. In contrast, entities whose emissions are much less significant or more difficult to monitor systematically are generally excluded from existing and proposed caps. Nonetheless, some of those entities may be able to reduce greenhouse gases more cheaply than the electric power industry or other industries subject to a cap. Owners of livestock are one example. When livestock waste decomposes, methane (which is more damaging to the climate on a per-ton basis than carbon dioxide) is produced, but manure can be collected and processed with special bacteria in airtight holding tanks or covered lagoons that allow operators to trap and

recover methane. If capturing methane was cheaper than reducing carbon dioxide emissions from other sources by an amount that would have an equivalent impact on the climate, then taking steps to capture methane would reduce the cost of meeting a specified cap on greenhouse gases. As another example, greenhouse gases might be reduced at relatively low cost in developing countries through practices that would preserve existing forests and encourage reforestation.

The potential for reducing costs in a cap-and-trade program through the use of offsets would depend on the stringency of the cap over time and on the scope and amount of allowed offsets. The more stringent the cap, the greater the opportunity to reduce costs by using offsets. The sooner that significant emission reductions were required under the cap, the more expensive compliance would be (because there would be less time to develop and adopt new lower-emission technologies)—and the greater the opportunity to reduce costs by using offsets. Similarly, that opportunity grows with increases in the types of allowable offsets, the number of potential providers, and the proportion of compliance for which offsets could be used.

There are many potential types of offsets. Within the United States, offsets can be generated by changing forest management practices and planting trees to increase carbon storage or changing livestock management and crop production, among other methods. For example, farmers can alter various crop management practices to reduce the amount of nitrous oxide produced and released by soils through decreasing the use of fertilizers or adopting practices involving little or no tilling. Outside of the United States, in developing countries, important potential sources of offsets include reducing deforestation and changing forest management practices, planting trees, and reducing methane and nitrous oxide emissions from livestock, cropland, and rice paddies.

To illustrate the potential savings from reducing greenhouse gases partly through using offsets rather than exclusively through reducing emissions from carbon-intensive fuels, one can compare the estimated cost of emission reductions for cap-and-trade proposals that would allow the use of offsets and proposals that would not. Different researchers, using a number of different modeling approaches, have analyzed a variety of proposals and developed a range of estimated costs (see Figure 1). The pattern of the estimates is clear: When offsets are allowed, the costs of achieving a given reduction in greenhouse gases are lower—substantially so for large reductions.

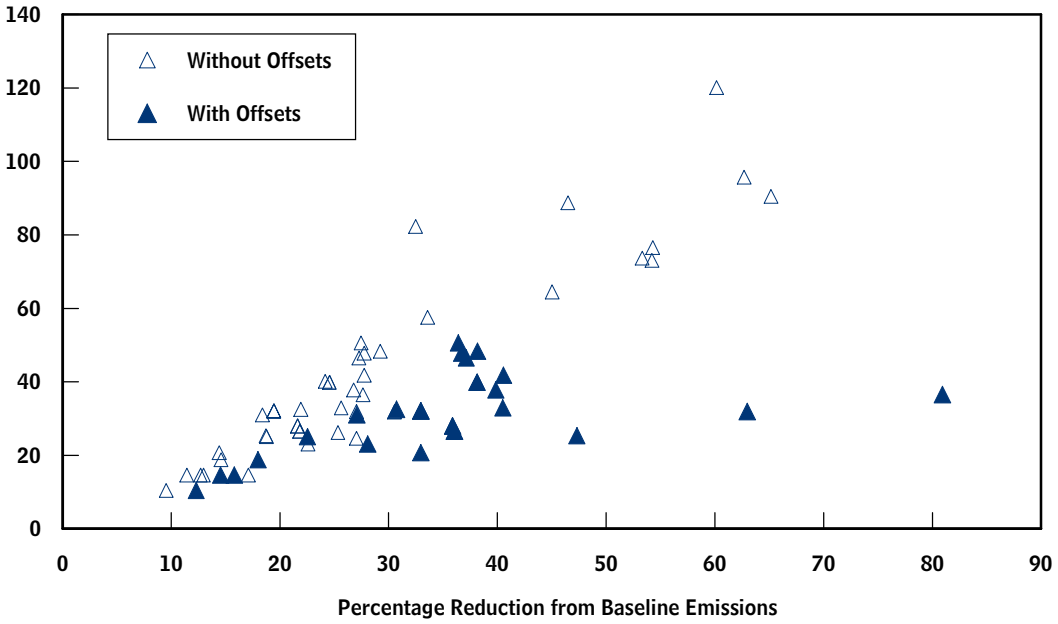
Potential Limitations of Offsets

Despite the large cost savings that may be realized from including offsets in a cap-and-trade program, some observers are concerned that the use of offsets can undermine the program's environmental goals. Those concerns arise because the reductions in greenhouse gases from offsets are generally more difficult to verify than the reductions from sources whose emissions are subject to the cap. Moreover, some types of offsets

Figure 1.

Various Estimates of the Costs of Reducing Greenhouse-Gas Emissions Under Cap-and-Trade Programs With and Without Offsets

(Allowance price in 2007 dollars per metric ton of CO_2e)



Source: Congressional Budget Office based on estimates from the National Commission on Energy Policy, the Environmental Protection Agency, the Energy Information Administration, the Nicholas Institute for Environmental Policy Solutions, and the Massachusetts Institute of Technology.

Notes: The figure shows, for 2030, the allowance prices and emission reductions under various cap-and-trade proposals, including variations on S. 280, the Climate Stewardship and Innovation Act of 2007, and S. 2191, America's Climate Security Act of 2007. Costs are reported in terms of the price per metric ton of carbon dioxide equivalent (CO_2e) emissions associated with achieving a given reduction in greenhouse gases. A metric ton of CO_2e is the amount of a given greenhouse gas (for example, methane or nitrous oxide) that makes the same contribution to global warming as a metric ton of carbon dioxide.

The estimates do not account for the costs of measures to address concerns about the credibility of offsets.

are more difficult to verify than others. For example, although it is relatively easy to measure the amount of methane captured in the United States from using special processes to treat animal waste, it is quite difficult to measure the amount of carbon removed from the atmosphere because of efforts to plant trees or avoid deforestation in developing countries.

Offsets are used by a number of existing climate programs, which employ a variety of strategies, varying in rigor and cost, for verifying the reductions in greenhouse gases claimed by an entity offering an offset.[1]

The Clean Development Mechanism was created in December 1997 under the United Nations Framework Convention on Climate Change, to assist countries in meeting the goal for reducing emissions under the Kyoto Protocol. Industrialized countries can purchase offsets from developing countries and use them to meet a portion of their commitment to reduce greenhouse gases.

The Regional Greenhouse Gas Initiative in the United States, established in 2005, requires power plants that rely on fossil fuels and are located in 10 Northeastern member states to reduce emissions. Members can purchase offsets generated in participating states and, under certain circumstances, elsewhere in the United States and internationally to meet a portion of their compliance obligation.

The Chicago Climate Exchange was established in 2003. Members have made voluntary, but legally binding, commitments to reduce their greenhouse gases. Members can use domestic and international offsets to help meet those commitments.

The Voluntary Carbon Standard was developed in 2007 to establish uniform and transparent standards for a worldwide voluntary market made up of a number of mechanisms through which buyers from the public and private spheres can achieve self-defined objectives by funding activities that reduce greenhouse gases. Projects that do so can have their offsets certified by adhering to the standards.

Verifying that offsets actually reduce greenhouse-gas emissions generally involves addressing four issues:

- Offsets would need to bring about *additional* reductions in greenhouse gases. That is, they would need to result in reductions that would not have occurred in the absence of the program that grants credit for offsets.

- Offsets would need to be *quantifiable* so that any reductions in greenhouse gases could be reliably measured.

- Offsets would need to be *permanent* rather than simply delay the release of greenhouse gases into the atmosphere.

1. See Congressional Budget Office, *The Use of Offsets to Reduce Greenhouse Gases,* Issue Brief (August 3, 2009).

- Offsets would need to be credited in a way that accounted for *leakage* in the form of higher emissions elsewhere or in different sectors of the economy as a result of the offset activity.

Identifying Additional Reductions Attributable to the Policy

Different climate programs use a variety to strategies to ensure that offsets credited in a cap-and-trade program satisfy "additionality"—that is, that they effect reductions in greenhouse gases that would not have occurred otherwise. Simple strategies for identifying reductions attributable to offset policies include accepting only activities that are not mandated by other laws, activities that reduce greenhouse gases after a specified date, and activities that are not common practice. Other possible strategies involve performance standards or the use of specific technologies. Still more complex assurances can be sought through demonstrations that the production of offsets—by planting trees, for example—would constrain an alternative use of resources that (apart from the value of the offsets) would be more profitable—such as using that land as pasture for livestock.

The United Nations Clean Development Mechanism, for example, employs all three of the simple checks. In addition, it requires that providers of offsets either document that their projects could not be implemented without the offset program's support or demonstrate that the projects are not prompted by intrinsic financial gains. To document the need for the program's support, offset providers must offer evidence of barriers to implementation. Those barriers may relate to investment (such as limited access to capital markets), technology (such as a lack of skilled labor or of access to materials and equipment), institutions (such as uncertain land ownership and tenure), or other factors. As evidence, the Clean Development Mechanism accepts market and statistical data, sector studies, legislative and regulatory information, and assessments by independent experts. Alternatively, offset providers can show that the financial benefits of producing the offsets (aside from selling them to entities subject to the cap) are less than the benefits available through alternative uses of the resources. Evidence must be based on standard market measures that are not linked to subjective expectations of profitability, and they must be bolstered by an analysis showing how the conclusions would vary with reasonable changes to key assumptions.

Quantifying Reductions

Processes employed by different climate programs for quantifying reductions vary in their level of detail, degree of transparency, and procedures for external verification. Depending on the activity, offsets may be estimated on the basis of general relationships (such as estimates of the amount of carbon storage expected when minimizing the extent to which soil is disturbed by agriculture in different geographic regions) or measured directly (for example, the amount of methane captured from the decomposition of animal waste in holding tanks). Direct measurement may provide greater certainty but often comes at greater cost. Quantification processes that are more transparent promote oversight by interested parties, and many programs require that third parties verify the reductions of greenhouse gases reported by offset providers.

The Regional Greenhouse Gas Initiative, for instance, requires that offset providers use preapproved, publicly available methodologies for calculating offsets, have quality control programs, and hire accredited third parties to validate the calculations. The initiative then follows those steps with a separate determination to award credit for offsets.

Ensuring That Reductions Are Permanent

Concerns about the permanence of reductions in greenhouse gases brought about by offsets are heightened if no one is liable for unintended or unforeseen releases. Ascertaining permanence is a particular challenge for carbon offsets generated from land use, because carbon stored in plants and soils can be released to the atmosphere by environmental changes such as forest fires and pest infestations as well as by human activities such as logging and plowing.

Climate programs address concerns about permanence in various ways. Some programs require legal assurances that carbon will remain stored. Others assign expiration dates to offsets, and once those dates have passed, entities subject to the cap can no longer use those offsets to meet compliance obligations and must replace them.[2] Some programs hold in reserve a portion of the credits earned by each offset activity and use that pooled reserve to compensate for any reversals of carbon storage.[3] For example, the Voluntary Carbon Standard calls for holding in reserve between 10 percent and 60 percent of the offsets produced by an agriculture or forestry project, depending on the project's risk of reversal. That risk is regularly reevaluated and the reserve amount adjusted as needed to account for changes in the project's financial, technical, and management situation; the economic risk of changing land values; the risk posed by regulatory and social instability; and the risk of natural disturbances.

Accounting for "Leakage," or Related Increases in Emissions

Leakage—increases in emissions elsewhere that stem from the activities producing offsets—diminishes the net effect of offsets in reducing greenhouse gases, but it can be hard to identify and quantify, which makes it extremely difficult to address. The smaller the scope of leakage—within the holdings of the offset provider, for example—the easier it is to account for, but when leakage occurs on a national or international level or in economic sectors other than the one generating the offset, accounting for it is a bigger challenge. For instance, offsets produced by capturing methane emissions from livestock waste may not result in increased emissions elsewhere; however, preserving trees in one location would reduce the supply of timber on the world market, thereby raising its price and encouraging increased production elsewhere, which would be difficult to prevent or measure.

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2. In addition to providing for the use of standard offsets, H.R. 2454 also provides for the use of expiring offsets generated by agricultural practices that sequester greenhouse gases.

3. H.R. 2454 lists that approach as one mechanism that regulators should consider using to address concerns about the permanence of reductions.

Programs try to deal with leakage in two ways: by requiring certain design features that minimize it and by applying discounts when issuing offsets to account for leakage that cannot be avoided. The Chicago Climate Exchange, for example, requires offset providers to manage their forestry holdings in a sustainable way. The program also requires projects to quantify leakage, but only within a developer's own land holdings. That approach ignores changes in land use that are less proximate to the offset but nonetheless attributable to the offset project.

The Effect of Offsets on the Cost of H.R. 2454

In analyzing the cap-and-trade program in H.R. 2454, the American Clean Energy and Security Act of 2009, which was passed by the House of Representatives, CBO estimates that the availability and use of offsets would reduce the net cost of complying with the cap by about 70 percent between 2012 and 2050. The net cost includes the gross cost of complying with the cap minus the sum of the allowance value that would be returned to U.S. households and the net revenues resulting from the domestic production of offsets.[4]

H.R. 2454 would allow regulated entities to substitute offsets in lieu of up to 2 billion greenhouse-gas allowances each year. By comparison, total greenhouse-gas emissions in the United States were about 7 billion tons in 2007. Under the bill, domestic offsets could be used in place of up to 1 billion allowances per year and international offsets, in place of an additional 1 billion allowances. In recognition of the greater challenge of verifying international offsets, after 2017 the legislation would require 1.25 tons of reductions from international offsets to substitute for an allowance representing 1 ton of emissions—thus discounting international offsets by 20 percent. If fewer than 900 million domestic offsets were used, the use of international offsets could be increased to make up the shortfall but could never substitute for more than 1.5 billion allowances in a given year. In no case could domestic and international offsets together substitute for more than 2 billion allowances.

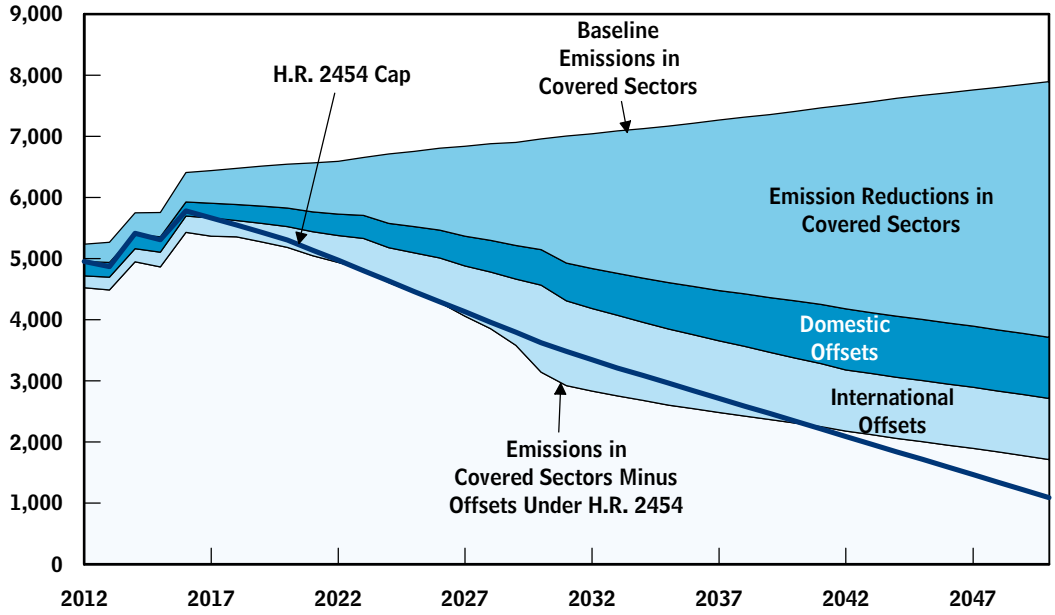
CBO expects that regulated entities would take advantage of those provisions when the costs were less than those for other methods of compliance—such as reducing their own emissions or purchasing allowances. CBO estimates that regulated entities would use domestic offsets in place of about 230 million allowances in 2012 and about 300 million allowances in 2020. Annual use of domestic offsets would probably not reach the limit of 1 billion tons until after 2040. Regulated entities would use international offsets in place of about 190 million allowances in 2012 and about 340 million allowances in 2020. The constraint of 2 billion metric tons on the overall use of offsets would become restrictive for the first time shortly after 2030. Over the 2012–2050 period, by CBO's estimates, offsets would account for about 45 percent

4. The net cost represents the loss in purchasing power that households would experience as a result of the policy. See Congressional Budget Office, *The Economic Effects of Legislation to Reduce Greenhouse-Gas Emissions* (September 2009) for a discussion of how the loss in purchasing power resulting from H.R. 2454 would be distributed among households in different income brackets.

Figure 2.

Estimated U.S. Emissions Under H.R. 2454, the American Clean Energy and Security Act of 2009

(Millions of metric tons of CO_2e)



Source: Congressional Budget Office.

Notes: CO_2e = carbon dioxide equivalent.

The figure includes both cap-and-trade programs specified under H.R. 2454: the one for hydrofluorocarbons and the one for all other greenhouse gases.

of the total emission reductions resulting from the cap, including reductions made by regulated entities as well as those made through offsets. A little fewer than half of those offsets would be produced domestically (see Figure 2).

By reducing the cost of complying with the cap, the use of offsets would have a significant effect on allowance prices. Together, the provisions allowing the use of domestic and international offsets would decrease the price of greenhouse-gas allowances by about 70 percent over the 2012–2050 period because they would provide a cheaper alternative for reducing greenhouse gases than relying exclusively on reductions from regulated entities.[5]

5. Under H.R. 2454, regulated entities would be allowed to hold for later use as many allowances as they chose. Thus, their profit-maximizing behavior would cause the price of an allowance to increase at the same rate as the return they expected to receive on comparable alternative investments. As a result, even though the composition of reductions in greenhouse gases (that is, from regulated entities, from domestic offsets, and from international offsets) would change over time, the use of offsets would lower the price of allowances in any given year by the same amount.

Domestic offsets would probably come predominantly from the forestry sector, where producers would find it profitable to make changes in forest management and increase the planting of trees to increase carbon storage. Only about 10 percent of the offsets generated in the United States would come from agriculture. In the supply of international offsets, ones deriving from agriculture would probably be roughly equal in importance to ones from forestry. Those agricultural offsets would be generated primarily through the reduction of methane and nitrous oxide emissions from livestock, cropland, and rice paddies.

Estimating the Supply of Offsets

CBO's approach to estimating the supply of offsets incorporates three factors: the direct costs of an activity that produces an offset, such as the cost of planting trees; the forgone value of other uses of the land; and the costs associated with verifying and bringing offsets to the market.

CBO's analysis drew on data from the Environmental Protection Agency, which are the most comprehensive available.[6] The data incorporate direct costs and the forgone value of other uses of the land. EPA's estimates of the costs of offsets supplied by the agriculture and forestry sectors in the United States and by the forestry sector outside the United States were generated by models that simulate profit-maximizing decisions by landowners and acknowledge, to different degrees, the choices that they face among different land uses (including different strategies for generating offsets) and the market responses associated with those choices. For example, a landowner takes into account information on how the value of the current use of the land compares with that of, say, growing crops for biofuels or growing trees to store carbon if a climate program is in place. EPA's estimates of the number of offsets supplied by the agriculture sector outside the United States came from engineering studies that focus on direct costs—for which the quality of data varies by region and by practice—and are less effective at accounting for alternative uses of resources that may be more profitable to landowners.[7]

CBO adjusted EPA's data for the costs of verifying and bringing offsets to the market, in two ways. First, for both international and domestic offsets, CBO added an

6. See the data annex for EPA's analysis of H.R. 2454 in the 111th Congress, the American Clean Energy and Security Act of 2009, available at www.epa.gov/climatechange/economics/economicanalyses.html. The data sources are described in three publications: Environmental Protection Agency, *Greenhouse Gas Mitigation Potential in U.S. Forestry and Agriculture*, EPA 430-R-05-006 (November 2005); Environmental Protection Agency, *Global Mitigation of Non-CO_2 Greenhouse Gases*, EPA 430-R-06-005 (June 2006); and Brent Sohngen and Robert Mendelsohn, "A Sensitivity Analysis of Carbon Sequestration," in *Human-Induced Climate Change: An Interdisciplinary Assessment*, edited by Michael E. Schlesinger and others (Cambridge: Cambridge University Press, 2007).

7. Estimates of the supply of offsets from outside the agriculture and forestry sectors, both within and outside of the United States, have also been derived from those engineering models.

estimated verification cost of $5 per metric ton of carbon dioxide equivalent (CO_2e).[8] (By way of comparison, that $5 verification cost is less than 10 percent of CBO's estimate of what the allowance price would be in 2012 *without* offsets.) CBO's estimate reflects information from the few available studies that use data from pilot projects involving offsets and projects in the agriculture, forestry, waste, and energy sectors, but there is no consensus on how to define, quantify, and predict such costs.[9] The studies define costs differently and may include expenses for feasibility studies, technical assistance, verification, administration, regulatory approval, and efforts to locate offset buyers and sellers and negotiate transactions.[10] Those costs, which vary by type of project and region, are lower in more mature markets—indicating a potential benefit in adopting verification procedures with which there is some familiarity gained through existing offset markets. Some researchers have found, however, that the apparent influence of a mature market on the costs is actually attributable to economies of scale and that projects generating greater numbers of offsets are simply the ones that have lower per-ton verification costs.

Second, CBO adjusted EPA's projected supplies of international offsets to account for the challenges of bringing offsets to the cap-and-trade market. Under H.R. 2454, developing countries generating international offsets for the market would have to be party to an agreement with the United States. CBO expects that such agreements would address developing countries' institutional and technical capacity to verify offsets, that negotiating the agreements would take a significant amount of time, and that it would not be possible to reach agreements to produce carbon offsets from the energy sectors of developing countries. CBO concluded that the number of agreements and the scope of their coverage would increase over the 2012–2050 period covered by the legislation but that throughout the period the supply of offsets would be lower than that estimated by EPA.[11] CBO's assessment, which is subject to significant uncertainty, is based on indicators of regulatory bodies' capacity to verify offsets and

8. A metric ton of carbon dioxide equivalent is the amount of a given greenhouse gas, such as methane or nitrous oxide, that makes the same contribution to global warming as a metric ton of carbon dioxide.

9. See Oscar Cacho and others, *Economic Potential of Land-Use Change and Forestry for Carbon Sequestration and Poverty Reduction,* Technical Report 68 (Australian Center for International Agricultural Research, 2008); Camille Antinori and Jayant Sathaye, *Assessing Transaction Costs of Project-Based Greenhouse Gas Emissions Trading* (Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division, January 25, 2007); Neeff Till and others, *Update on Markets for Forestry Offsets* (Tropical Agricultural Research and Higher Education Center, September 2007); and Axel Michaelowa and Frank Jotzo, "Transaction Costs, Institutional Rigidities, and the Size of the Clean Development Mechansim," *Energy Policy,* vol. 33, no. 4 (March 2005), pp. 511–523.

10. Verification costs estimated by the four studies range from $0.10 to $4.30 per metric ton of carbon dioxide equivalent.

11. CBO's adjustment also takes into account provisions for allocations of allowances to support emission reductions from reduced deforestation. Under H.R. 2454, entities receiving such support would be prohibited from generating offsets for direct sale into the U.S. market.

on information from the Department of State, EPA, and outside experts on negotiating agreements.[12]

The Projected Use of Offsets

To illustrate the role of offsets under H.R. 2454, CBO has estimated their impact in 2030 after making adjustments for the costs of verifying and bringing offsets to the market and taking into account the fact that other developed countries would also wish to purchase international offsets (see Table 1). The legislation would establish a cap on greenhouse-gas emissions in 2030 of 3,427 million metric tons of CO_2e, so the government would distribute 3,427 million allowances in that year. Without offsets, 3,555 million metric tons of emissions would occur in 2030, CBO estimates, which would be equal to the number of allowances distributed that year plus 128 million allowances that entities would have banked in previous years and chose to use in 2030.

With offsets, as allowed for in the bill, sources with compliance obligations would emit 5,031 million metric tons and purchase offsets for 1,790 million metric tons—about one-third supplied domestically and about two-thirds supplied internationally, CBO estimates. About 60 percent of those domestic offsets would come from forestry and agriculture—the vast majority (roughly 90 percent) from forestry. About 80 percent of those international offsets would come from agriculture and forestry—the majority (roughly 60 percent) from agriculture.

If the offsets represented true incremental reductions, then net emissions would be 3,241 million metric tons (5,031 minus 1,790). The sources subject to the cap would use 3,241 million allowances to cover their net emissions and would bank 186 million allowances (3,427 distributed minus 3,241 used) to cover future emissions.

The Impact of Offsets on Net Costs and the Price of Allowances

The substantial use of offsets would significantly reduce the net cost of the cap-and-trade program that H.R. 2454 would establish. Without offsets, net costs would be an estimated $248 billion in 2030 (expressed in 2007 dollars), or about 1 percent of gross domestic product in that year. By CBO's estimate, the availability of offsets would reduce those costs by about 60 percent during that year—to an estimated $101 billion. On average during the overall period that the legislation would be in effect, offsets would reduce net costs by about 70 percent.

12. CBO also modified EPA's projected supply of offsets to reflect the judgment that activities producing offsets could not be undertaken at negative cost—that is, there are no extensive opportunities for suppliers to adopt practices that would reduce greenhouse gases while also yielding a profit. In EPA's data, the projected availability of offsets at negative cost, which probably derives from not accounting for some barriers to adoption or from omitting some costs, is particularly significant for the practice of controlling methane and nitrous oxide emissions from livestock and cropland in developing countries.

Table 1.

Effects of H.R. 2454, the American Clean Energy Security Act, With and Without Offsets, 2030

	With Offsets	Without Offsets
	Billions of 2007 Dollars	
Net Cost[a]	101	248
	Million Metric Tons CO_2e	
Net Cap on Greenhouse Gases	3,427	3,427
Emissions from Sources Subject to Limits	5,031	3,555
Allowances Banked[b]	186	-128 [c]
Emissions Covered by Offsets	1,790	0
	Dollars/Metric Ton CO_2e	
Allowance Price	40	138

Source: Congressional Budget Office.

Notes: Emissions are represented in terms of carbon dioxide equivalent (CO_2e). A metric ton of CO_2e is the amount of a given greenhouse gas (for example, methane or nitrous oxide) that makes the same contribution to global warming as a metric ton of carbon dioxide.

Whereas the dollar figures in this table (as well as the text) are reported in constant 2007 dollars, those in CBO's cost estimates, including the one for H.R. 2454, the American Clean Energy and Security Act of 2009, as reported by the House Committee on Energy and Commerce on May 21, 2009 (June 5, 2009), are in nominal dollars.

a. As measured here, the United States' net cost includes the gross cost of complying with the cap minus the sum of the allowance value that would be returned to U.S. households under H.R. 2454 and the net revenues resulting from the domestic production of offsets. The net cost also represents the loss in purchasing power that households would experience as a result of the policy. As measured here, the net cost does not include the costs that some current investors and workers in sectors of the economy that produce energy and energy-intensive goods and services would incur as the economy moved away from the use of fossil fuels or the full range of effects on the economy, nor does it include the benefits of the reduction in greenhouse gases and the associated slowing of climate change. For more information, see Congressional Budget Office, *The Economic Effects of Legislation to Reduce Greenhouse-Gas Emissions* (September 2009).

b. Under H.R. 2454, allowances could be banked and used to cover future emissions. (Borrowing future allowances for current use could also occur for up to five years, with certain restrictions.)

c. The negative amount indicates that entities would be using allowances that they banked in previous years.

With offsets, more emissions would be allowed from sources subject to the cap, thus making allowances less valuable. Without offsets, the price of an allowance in 2030 would be $138 per metric ton (in 2007 dollars), CBO estimates; with offsets, the allowance price would be only $40 per metric ton.

Finally, if international offsets were not available to regulated entities, the use of domestic offsets would expand. Entities subject to the cap would use an estimated 891 million domestic offsets in 2030 (more than the use of domestic offsets projected under H.R. 2454 but not as much as the use of international offsets under the legislation), and the allowance price and the net cost of the policy would be greater than that under the legislation. This alternative would benefit offset producers in the domestic agriculture and forestry sectors, but the program would be less effective at lowering net costs to the economy as a whole.

Sources of Uncertainty

The potential for offsets to reduce net costs depends critically on the types and sources of offsets allowed and on the costs of producing and verifying offsets. H.R. 2454 provides neither detailed specifications for the types and sources of offsets to be included in the cap-and-trade program nor the methodologies necessary to verify those offsets; it assigns primary responsibilities for those determinations to two federal agencies. For domestic offsets from changes in agriculture and forestry, that responsibility would fall to the Department of Agriculture, which would take into account the recommendations of its Greenhouse Gas Emission Reduction and Sequestration Advisory Committee, established under the legislation. For all other offsets, that responsibility would fall to EPA. That agency would consult with appropriate federal agencies; take into account the recommendations of the Offsets Integrity Advisory Board, also established by the legislation; and accept international offsets only if the country providing them had negotiated an agreement or arrangement with the United States.

CBO's estimates of the costs to produce offsets are based on data from EPA that take into account a wide range of types and sources of activities that could generate offsets. CBO adjusted those data to reflect its best judgment of how regulators might identify classes of offsets and how methodologies required for verification might affect costs. Actual developments might turn out quite differently.

There are uncertainties inherent in the modeling used to generate initial estimates of the supply of offsets—such as the extent to which they are able to account for competition among different land uses and other market responses.[13] Moreover, the data used in modeling are themselves uncertain. For example, recently revised estimates of past deforestation rates imply lower potential for generating offsets through avoided deforestation. Also, the types and sources of offsets that would ultimately be allowed

13. One consideration is the potential for concentration of market power in the hands of a limited number of offset providers—if, for instance, a few parties control significant expanses of forests or if requirements for verification significantly limit entry into the offset market.

under a cap-and-trade program in the United States could be different from those envisioned in EPA's data and CBO's estimates. Verification costs, too, are uncertain because of a lack of relevant experience. All of those factors have implications for the ultimate impact of offsets on the net cost of the policy to reduce the concentration of greenhouse gases that would be established by H.R. 2454.