offsets. Agriculture accounts for 12 to 14 percent of global greenhouse gas emissions and deforestation alone accounts for about 15 percent. Reducing emissions from these sources is even less expensive than reducing them in the United States, but several factors must be overcome and capacity must be built to bring these reductions to the market.

A well-functioning offset system needs to rise above some notable challenges. A critical concern is if offset credits are granted for reductions that do not occur, in which case the integrity of the transaction and the cap is undermined. Three basic issues of concern are: additionality, or whether these reductions produce incremental emission reductions rather than take credit for an emissions profile that would occur anyway under business as usual; leakage, which occurs when emission reductions generated by a project simply lead to emissions being shifted to some other ungoverned source; and permanence, which occurs when carbon that is stored in soils and biomass one period is released in a subsequent period, thus undermining the initial benefit. These problems are tricky but they are real and they must be dealt with to maintain the environmental and economic integrity of an offset program.

There are options to address these challenges. Offset policy has focused on these types of problems in two ways: first, the use of quality standards to account for or adjust for additionality, leakage or permanence, as well as measurement monitoring and verifying transactions. Congressional proposals all recognize the need for quality standards and have processes in place to develop them, drawing on examples from preexisting programs, and quantitative restrictions. Policymakers have tended to couple quality standards with quantitative restrictions on the use of offsets for compliance. For example, the European Union limits the share of compliance commitments that can be met with offset credits to approximately ten percent. The U.S. House bill would have similarly placed compliance limits on offsets of roughly 2 billion tons equally split between domestic and international sources.

In summary, agriculture and forests have a large potential impact on the balance of greenhouse gases. The climate problem would be much harder to solve without involving these sectors. These sectors are not included in the cap. Using them as an offset is a viable option.

[The prepared statement of Dr. Murray follows:]

PREPARED STATEMENT OF BRIAN C. MURRAY, PH.D., DIRECTOR FOR ECONOMIC ANALYSIS, NICHOLAS INSTITUTE FOR ENVIRONMENTAL POLICY SOLUTIONS, DUKE UNIVERSITY, DURHAM, NC

The Role of Agricultural and Forest Offsets in a Cap-and-Trade Policy

Thank you, Mr. Chairman, for inviting me to address the Subcommittee today. I have worked on the economics of land use and environmental policy for more than twenty years, and on various aspects of offsets policy for the last 10 years with colleagues on this panel and others. During that time, offsets have received much attention both positive and negative, as a policy option to address greenhouse gases and climate change. The agricultural community understandably wants to learn more about offsets, how such a system could work, what it could mean for producers, and how concerns about system integrity can be addressed. I will touch on each of those points briefly.

Defining Offsets

An offset is an agreement where one party agrees to reduce its emissions (or increase carbon storage in agricultural soils or forests) in exchange for a payment from another party. The paying party may be an electric power plant or other source obligated to reduce emissions either by law or as part of a voluntary program. For our discussion, the selling party is a farmer or forest owner who has no such obligation. Any action the farmer/forest owner takes to reduce emissions or increase sequestration can be viewed as a potentially creditable *offset*. The power plant can use the generated offset credits to help meet its compliance obligation rather than rely solely on cutting its own emissions. The underlying premise is that the farmer can cut emissions cheaper than the power plant can and will do so if paid more than the action costs.

All recent cap-and-trade proposals in the U.S. Congress have included offset provisions, drawing from examples elsewhere in the world, including the Clean Development Mechanism (CDM) of the Kyoto Protocol, the Regional Greenhouse Gas Initiative regulatory market in the Northeast U.S. states, and the Chicago Climate Exchange voluntary market. There have also been offset provisions in other environmental policies, such as wetlands mitigation.

The Rationale for Offsets

A unique characteristic of greenhouse gases (GHGs) is that they disperse uniformly about the Earth's atmosphere, in contrast to other pollutants that are found in higher concentrations near their sources. As a result, an emission reduction delivers the same benefit no matter where it takes place, whether it is from an electric power plant in the Ohio Valley, a cement plant in India, a soybean farm in Mississippi, or a forest in the Amazon. This uniformity enables emission trading as an approach to control greenhouse gases.

The argument in favor of emissions trading in general and offsets in particular is an economic one. Rather than designate which parties must undertake which reductions to achieve a collective target, it is more efficient to allow parties to contract among themselves to find who can achieve these reductions at the lowest cost, even if those less expensive reductions occur at sources (sectors, countries) not directly capped and thereby participate as offsets. Economic evidence supports this view. A recently published study by EPA of the Waxman-Markey cap-and-trade bill that passed in the House of Representatives this summer found that allowing offsets even subject to quantitative limits on their use reduces marginal compliance costs by about half. Other studies of different cap-and-trade proposals conducted by government agencies and other organizations consistently find large cost reduction from allowing offsets.

In addition to cost containment, offsets are seen as a potential source of economic stimulus for sectors such as agriculture not subject to a cap. Offsets can also produce environmental co-benefits through the deployment of less-polluting technologies and protecting soils, forests and grasslands, though care should be taken to ensure that offsets do not inadvertently damage other ecosystem values. An offset program can also put institutions in place to more effectively include all emission sources into a comprehensive economy-wide reduction program.

Agriculture and Forest Offsets

Agriculture currently accounts for about six percent of all greenhouse gas emissions in the United States. However, none of the cap-and-trade proposals now under consideration include placing a cap on those emissions. This means that any reductions in those sectors can, in principle, be included as offsets. Prominent offset opportunities in agriculture include:

- Soil carbon management (*e.g.,* tillage change to sequester carbon dioxide (CO_2))
- Nutrient management (to reduce nitrous oxide (N_2O) emissions)
- Manure management (to reduce methane (CH_4) emissions)
- Grazing/herd management (sequester carbon, reduce CH_4)

Our nation's forests are a net carbon sink, meaning they absorb more CO_2 from the atmosphere through forest growth than they emit to the atmosphere through forest clearing and other disturbances. Today this sink offsets about 14–15 percent of our country's greenhouse gas emissions, but this situation could be further improved through offset projects in such forestry activities as

- Afforestation.
- Forest management.
- Reduced deforestation.

There is also tremendous potential for agriculture and forestry as a source of biofuels induced by existing energy policies and climate proposals.

Research studies I have been involved in with colleagues at universities and government agencies show that a properly designed agricultural and forestry offsets program could produce emission reductions that counter as much as 1 billion tons of U.S. emissions (about 15% of today's totals) and thereby provide significant revenue potential for producers in those sectors. I believe Dr. McCarl will speak more about this work in his testimony.

Internationally, the potential is even larger for agriculture and forest offsets. Agriculture accounts for 14% of global greenhouse gas emissions and is the main emissions source in many developing countries. Deforestation alone accounts for about 15% of global emissions, or about the same as the global transport sector, and occurs mostly in the developing country tropics. Reducing emissions from agriculture and forests in developing countries is even less expensive than reducing them in the United States, but there are several factors that must be overcome and capacity-building to bring these reductions to market. I believe Dr. Sohngen will have more to say about these international opportunities in his testimony.

Potential Challenges

One common criticism of offsets is that they deflect effort from abatement in the capped sectors. In my view, this criticism is misdirected. Deflecting abatement from the capped sectors is exactly how offsets work to reduce costs. It should be the overall reductions we are interested in, not where they occur.

However, if offset credits are being given for reductions that do not actually occur, the transaction and the cap are illusory, which would be a very real problem. The validity of offset reductions is sometimes called into question because they are generated from sources that do not face an emissions mandate. This makes it difficult to determine how to give credits for emissions reductions—reductions compared to what? The answer typically comes in the form of a baseline that captures what the emissions level would be under a "business as usual" scenario. Reducing emissions below this baseline can be considered additional to reductions that would have occurred anyway.

"Additionality" is a necessary condition for the reductions to be real. Additionality may be more apparent in some cases such as methane capture from livestock manure management or afforestation of cropland because these are not prevalent practices for farmers under business as usual. But in practice it can be difficult to determine additionality because once a project starts, the baseline itself is unobservable. This can become a matter of guesswork that varies in sophistication—from complex data analysis to simply asking the party to provide evidence the project is additional. If a party has too much freedom to set its own baseline, there is legitimate concern about its validity and whether the reductions are therefore truly additional. This is why rules are important to ensure offset validity as I will discuss more below.

Another potential problem with offset transactions is "leakage," which occurs when emissions reductions generated by a project in one location simply lead to emissions being shifted to some ungoverned source elsewhere. An example might be if cropland in one location were retired into permanent grassland or forests, but this simply causes other grassland or forests to be cleared to help fill the supply gap.

A third problem, "permanence," comes specifically from offsets generated by biological sequestration of carbon in forests and agricultural soils. These projects create value by removing CO_2 from the atmosphere and storing it in biomass and soils. The stored carbon, however, can be re-emitted by natural disturbances, such as fire, or intentional management actions. If this occurs, the original benefits of the project have been negated and the offset accounting shortfall needs to be addressed. This so-called *reversal risk* can be addressed with monitoring and clear, enforceable rules designating liability, but this comes with a cost. Another way to deal with liability is through private insurance or a public insurance pool or "buffer" requirement.

Possible Solutions

Offset policy has focused on addressing additionality, leakage, and permanence in two ways.

(1) Quality Standards

Each of the problems identified here can be dealt with by imposing offset quality standards. The Kyoto Protocol's Clean Development Mechanism follows this approach by restricting the activities eligible for offsets and requiring an Executive Board to approve all projects. All CDM projects must meet standards for additionality, address leakage, and address impermanence. This was deemed necessary to get political buy-in from parties who were skeptical of offset integrity. The

results have been mixed. Indeed, it has been challenging to get many CDM projects approved, thereby restricting supply. But the logjam is loosening and some projects that have been approved have been criticized for generating questionable reductions despite quality standards being in place. Refinement of standards is an ongoing process.

In the current legislative proposals in Congress, the need for offset quality standards is well-recognized. The lead agency, whether it is USDA or EPA will be responsible for establishing offset rules that address additionality, leakage and permanence and the use of any early offset credits will rely on pre-existing protocols from the voluntary markets that address these issues as well.

(2) Quantitative Restrictions

Policymakers have tended to couple quality standards with quantitative restrictions on the use of offsets for compliance. For example, the EU limits the share of compliance commitments that can be met with offset credits to approximately ten percent (with some variation across countries within the EU). The U.S. House bill would have similarly placed compliance limits on offsets, 2 billion tons per year, which is much larger than ten percent of U.S. compliance. These restrictions implicitly suggest that policymakers are lured by the appeal of offsets, but they only trust them so far.

Summary

Offsets are neither a panacea nor a pox. Agriculture and forests together have a large impact on the global balance of greenhouse gases; solving the climate problem would be much more difficult without involving these sectors. Absent including these sectors under a cap, using them as offsets is an alternate solution. Done well, offsets expand emissions reduction opportunities and lower the cost of achieving reduction targets, and provide income opportunities for farmers, forest owners and other uncapped entities. But offsets can create a number of accounting problems for a cap-and-trade program. Rigorous standards for their inclusion are essential if the system is to have environmental and economic integrity. Nonetheless, some flexibility is necessary to ensure that high-quality offsets are not left out of the system because of overly burdensome requirements. This tradeoff is as much art as science. Quantitatively limiting offsets for compliance is not an ideal solution, but it may be necessary, at least at first when offset quality is highly uncertain. The CDM, warts and all, has shown that offsets can be generated at scale of hundreds of millions of tons globally, but more would be needed if offsets are to remain a critical element of a post-Kyoto global agreement and U.S. climate and energy legislation.

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