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My name is Brent Yacobucci, and I am joined by Larry Parker. On behalf of the Congressional Research Service (CRS), we would like to thank the Committee for its invitation to testify here today. I have been asked by the Committee to present a short introduction of cap-and-trade policy, including key concepts and terms, and relate those to S. 2191, the Lieberman-Warner Climate Security Act of 2008. Attached to my opening statement is a brief glossary of key terms presented in this discussion.

As suggested by its name, a cap-and-trade system imposes an emissions ceiling or **cap** on the total annual greenhouse gas emissions of entities covered by the system. The level of the cap is equal to the number of emissions permits or **allowances** distributed each year. The allowances are distributed to entities through an **allocation scheme**. At the end of the year, for each ton of carbon dioxide equivalent[1] emitted by a **covered entity**, that entity must submit one allowance to the agency regulating the program.[2] In general, a cap-and-trade system achieves emissions reductions by decreasing the number of allowances allocated in successive years. For the same cap, the wider the **coverage**, that is the more economic sectors (and entities within sectors) under the cap, the more stringent the program. Also, the steeper the annual reduction in allowances, the more stringent the program. S. 2191, as ordered reported by the Senate Committee on Environment and Public Works,[3] would establish a mandatory cap-and-trade system, reducing overall emissions by 66% from 2005 levels in 2050, according to the bill's sponsors. S. 2191 would limit emissions from all petroleum refiners and importers, natural gas processors, entities that produce or import fluorinated gases and other greenhouse gases, and facilities that use more than 5,000 tons of coal per year. Sponsors estimate that S. 2191 would cover 87% of the country's greenhouse gas emissions.

Allowances — each of which represents a limited authorization to emit one metric ton of carbon dioxide equivalent — may be used to comply with the cap, banked for use in a future year, or traded to someone else. This is the trade aspect of a cap-and-trade program. A key component of trading is the fact that some participants will have lower reduction costs than others. To the extent that two firms have different costs, it makes the most economic sense for the firm with higher reduction cost to pay the firm with lower costs to further reduce its emissions. An illustrative example of this concept is attached (**Appendix**). In a national reduction program, these sorts of trades could occur among entities, sectors, and countries (within certain limitations).

A key element in designing a cap-and-trade system is the point at which emissions are regulated (**point of regulation)**. That is, where are emissions measured, and thus, who must submit allowances to comply with the program. Greenhouse gases can be controlled **downstream**, at the point where they are emitted into the atmosphere, or they can be controlled **upstream**, requiring

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[1] In general, greenhouse gas reduction bills address emissions of all six greenhouse gases recognized under the United Nations Framework Convention on Climate Change: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), hydrofluorocarbons (HFC), and perfluorocarbons (PFC).

[2] The U.S. Environmental Protection Agency in most proposals.

[3] Available on Senator Lieberman's website: http://lieberman.senate.gov/documents/lwcsa.pdf.

allowances from firms that produce or supply fuel and other products that will ultimately lead to emissions. A key advantage of downstream regulation is that the entity causing emissions has the responsibility for reductions. A key advantage of an upstream system is that it may simplify the regulatory process and help limit the number of covered entities.[4] S. 2191 achieves its broad coverage through an upstream regulation mandate on petroleum, natural gas, and fluorinated gas producers and importers, and a downstream mandate on coal consumers, such as electric generators.

The **point of regulation** should not be confused with how, and to whom, allowances are **allocated**. Allowances may be given at no cost to the covered entities. For example, that is how the sulfur dioxide cap-and-trade program of the Clean Air Act allocates allowances. In contrast, allowances could be given to anyone — for example, states — who may sell them to covered entities and use the proceeds for specified or unspecified purposes. Finally, allowances may be **auctioned** by the federal government and the proceeds used for various purposes related or unrelated to greenhouse gas reduction. For example, those funds could be used to lessen the economic burden of the program on affected workers, industries, and regions, to promote the development of new technology, or to adapt systems to a changing climate. Further, those revenues could be used for non-climate-related purposes such as deficit reduction or tax relief.

S. 2191 uses a mix of all of these options, allocating roughly 35% of allowances in 2012 to covered sectors, roughly 35% to unregulated or **non-covered** entities, and auctioning the rest. In successive years, the percentage of allowances given to covered entities decreases to zero, while the share of auctioned allowances increases. With respect to revenues, S. 2191 allocates a large share of auction revenue to keep the bill revenue-neutral, to speed deployment of new technology, to provide assistance to energy consumers, and to promote adaptation efforts.

Within a cap-and-trade system, three flexibility mechanisms are key to determining the ultimate cost of the program:

- The first is banking. Banking is the ability to retain allowances either received or purchased for future use or sale. (It is a provision included in S. 2191.) This allows smoother transitions and can promote early reductions.
- The second flexibility mechanism is the availability of domestic **offsets**. Offsets are emissions reductions achieved by **non-covered** entities, such as the agricultural sector. These non-covered entities can sell offsets to covered entities, who may use them in lieu of an allowance, within certain limits. Effectively, offsets increase the supply of available allowances — under S. 2191, up to 15% of a covered entity's allowance requirement can be met through submission of domestic offsets.
- A third flexibility mechanism is the availability of international credits. International credits are emissions reductions achieved by other countries that may be used by covered entities to comply with a U.S. cap-and-trade program. Under S. 2191, up to 15% of a covered entity's allowance requirement can be met through submission of international allowances from eligible foreign cap-and-trade systems.

In addition to flexibility mechanisms, cap-and-trade approaches may contain other techniques to limit costs. These include a safety valve like that in S. 1766 which allows a covered entity to choose to comply with a cap-and-trade program by paying a safety valve fee instead of submitting

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[4] A useful example is the automotive sector. While the purpose of the cap-and-trade program would be to have motor vehicle owners make reductions by driving less or purchasing more efficient vehicles, it would be a massive regulatory undertaking to install emissions monitors on the millions of cars and trucks on U.S. roads, and to demand that every driver submit emissions allowances at the end of the year.

allowances. However, this would allow emissions to exceed the cap. Another way to control costs is S. 2191's Carbon Market Efficiency Board, with authority to increase (within certain bounds) the pool of available allowances without increasing overall emissions.

To conclude, the relative costs of a cap-and-trade program are largely driven by three factors, as we call them, the "Three T's": tonnage, time, and techniques.

- Tonnage refers to the stringency of the cap, as well as the breadth of coverage. The more stringent the cap (that is, the fewer the tons allotted), the higher the cost.
- Time refers to the rate of decrease in allowances. The faster the cap decreases, the more expensive the program will be.
- Techniques refers to the flexibility and cost-control mechanisms used. Banking is arguably the most important mechanism to limit volatility in allowance markets. Other techniques that will decrease costs include the availability of domestic offsets and international credits — effectively increasing the supply of allowances.

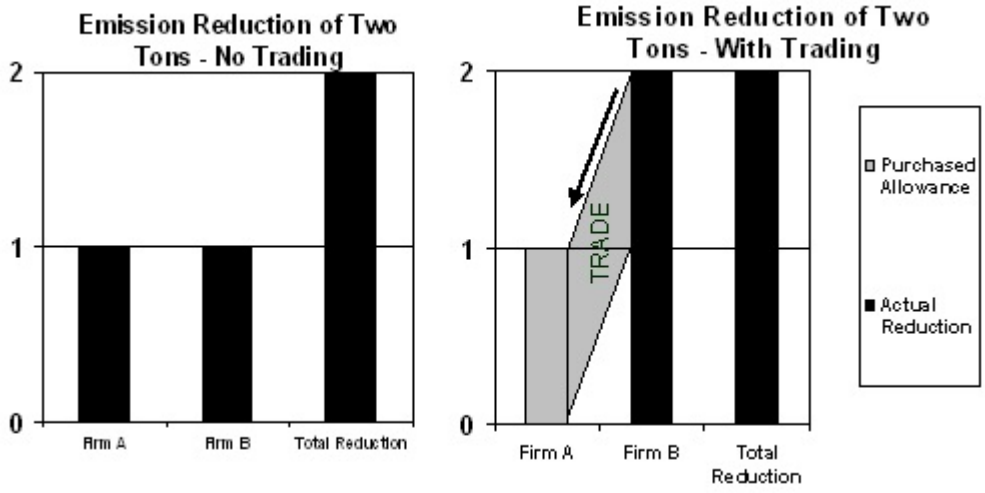
Thank you for inviting us to appear. We will be pleased to address any questions you may have.

Attached:
Appendix: A Trading Example
Common Terms

Appendix: A Trading Example

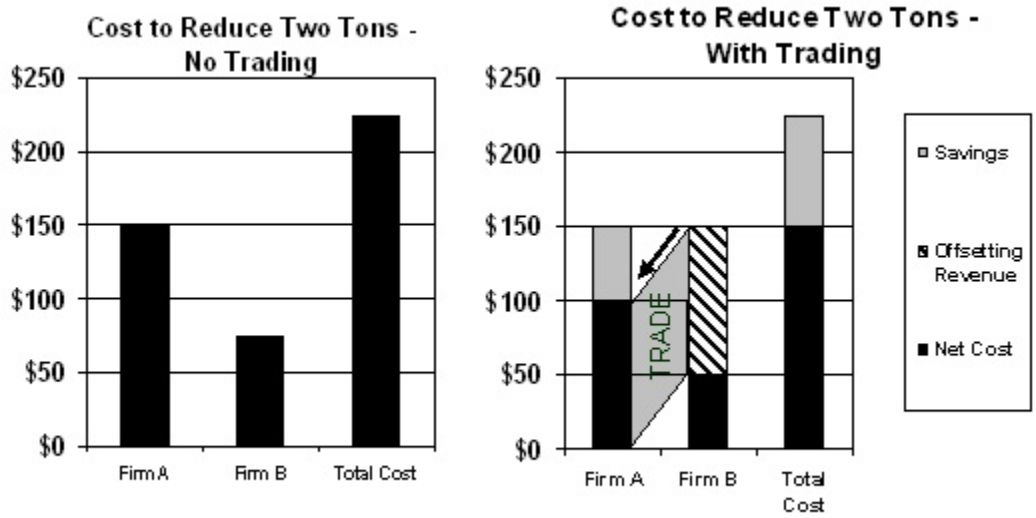
The following is an illustrative example where only two firms exist (see **Figures 1 and 2**). Under an absolute cap with no trading, each firm must reduce emissions by one ton. This costs "Firm A" $150 per ton, while it only costs "Firm B" $75 per ton. The total cost to society to reduce emissions by two tons is $225. Now, taking a case where trading is allowed, Firm A does not reduce, but pays Firm B $100 to reduce emissions by an extra ton. In this case, Firm A's total cost is $100, while Firm B's net cost is $50 (2 x $75, less $100). The total cost to society has been reduced to $150, a savings of $75. In the case of a true reduction program, this sort of trading could happen regionally, nationally, or internationally. It also may be allowed within a sector or among sectors.

Figure 1. A Trading Example - Each Firm Required to Reduce Emissions by One Ton



Source: Prepared by CRS

Figure 2. A Trading Example - Costs to Firms to Reduce Emissions by One Ton Each



Source: Prepared by CRS

Common Terms

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

Auctions. Auctions can be used in market-based pollution control schemes to allocate some, or all of the allowances. Auctions may be used to: 1) ensure the liquidity of the credit trading program; and/or 2) raise (potentially considerable) revenues for various related or unrelated purposes.

Banking. The limited ability to save allowances for the future and shift the reduction requirement across time.

Cap-and-trade program. An emissions reduction program with two key elements: 1) an absolute limit ("cap") on the emissions allowed by covered entities; and 2) the ability to buy and sell ("trade") those allowances among covered and non-covered entities.

Coverage. Coverage is the breadth of economic sectors covered by a particular greenhouse gas reduction program, as well as the breadth of entities within sectors.

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

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

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

Revenue recycling. How a program distributes revenues from auctions, penalties, and/or taxes. Revenue recycling can have a significant effect on the overall cost of the program to the economy.

Point of Regulation. Regulatory approaches to limiting emissions can choose different points and participants along the production process to assign compliance responsibility. **Upstream** allocation schemes establish emission caps at a production, importation, or distribution point of products that will eventually produce greenhouse emissions further down the production process. In contrast, **downstream** allocation schemes establish emission caps and assign allowances at the point in the process where the emissions are emitted.

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