

**Appendix C**

**Potential Credits for Early Compliance:  
Assessment of Emissions Reported to EIA's Voluntary  
Reporting of Greenhouse Gases Program**



## Introduction

The purpose of this appendix is to identify some of the difficulties associated with measuring historical greenhouse gas emission reductions and to provide a rough level of the magnitude of the reductions that might be claimed according to the specifications of Section 203 of S.139. Section 203 states that an entity may register greenhouse gas emission reductions achieved after 1990 but before 2010 if it has established a historical baseline. Reductions are to be calculated as changes in direct greenhouse gas emissions relative to historical emission levels after accounting for increases in indirect emissions and/or increases in net carbon sequestration. It is difficult to estimate the amount of potential credits that might be claimed under Section 203, in part because specific rules remain to be developed, and also because it will be difficult to apply and verify the rules retroactively. Careful consideration of greenhouse gas accounting issues will be required, including the operational definition of an entity, greenhouse gas estimation techniques, double reporting of emissions, emissions verification, and the establishment of emissions baselines.

This appendix examines greenhouse gas accounting issues in the context of one potential source of emission reduction credits—the Energy Information Administration (EIA) Voluntary Reporting of Greenhouse Gas Program. The analysis of potential credits for early compliance in this appendix is not part of the analytical efforts reported in the main body of this report and is presented here as a supplement to that modeling effort. EIA’s 1605(b) Voluntary Reporting Program would not be the only source of potential credits under S.139. A number of other Government-sponsored voluntary programs and public/private partnerships also promote emission reductions that could qualify for early compliance credits, depending on the availability of data to verify the reductions claimed by program participants.

According to EIA’s 1605(b) database, 43 of the 97 entities that have reported entity-level emissions to the program have claimed net reductions in emissions relative to their base years. The 43 reporters that showed net reductions would have generated a total of 868 million metric tons carbon dioxide equivalent in reductions over the period 1991 through 2001. This total includes annual reductions that ranged from a low of 41 million metric tons carbon dioxide equivalent in 1991 to a high of 181 million metric tons in 2001. The analysis described here assumed that emission reductions are cumulative relative to a set base year, normally 1990, so that a reduction relative to the base year that was maintained in future years would continue to be counted each and every year it is maintained (e.g., a 5 ton reduction relative to the base year maintained over 10 years would equal a 50 ton reduction). Emission reductions estimates would be reduced if implementation required emission reductions to be calculated on a year-to-year basis (i.e., total emissions relative to the previous year’s emissions). Also, reductions qualifying for early compliance credits could be less than those shown here if reporters were required to establish that the reductions were beyond or “additional to” business-as-usual activities.

### **Voluntary Reporting of Greenhouse Gases Program: Background and Accounting Issues**

Title XVI, Section 1605(b) of the Energy Policy Act of 1992 (EPACT) directed EIA to establish a mechanism for “the voluntary collection and reporting of information on . . . annual reductions of greenhouse gas emissions and carbon fixation achieved through any measures, including fuel switching, forest management practices, tree planting, use of renewable energy, manufacture or use of vehicles with reduced greenhouse gas emissions, appliance efficiency, methane recovery, cogeneration, chlorofluorocarbon capture and replacement, and power plant heat rate improvement . . . .” The legislation further instructed EIA to create forms for the reporting of greenhouse gas emissions and reductions, and to establish a database of the information voluntarily reported under this subsection of EPACT. The reporting Forms EIA-1605 and EIA-1605EZ, “Voluntary Reporting of Greenhouse Gases,”

### Key Definitions from S.139 Affecting Potential Credits for Early Compliance

**Baseline:** The historic greenhouse gas emission level of an entity, as adjusted upward to reflect actual reductions that are verified.

**Covered Entity:** An entity that owns or controls a source of greenhouse gas emissions in the electric power, industrial, or commercial sector of the U.S. economy that emits over 10,000 metric tons of greenhouse gases per year.

**Direct Emissions:** Greenhouse gas emissions by an entity from a facility that is owned or controlled by that entity.

**Indirect Emissions:** Greenhouse gas emissions that are the result of the activities of an entity but are emitted from a facility owned or controlled by another entity and not reported as direct emissions by the entity from which they were emitted.

**Sequestration:** The capture, long-term separation, isolation, or removal of greenhouse gases from the atmosphere.

were first made available to the public in July 1995, providing a vehicle for voluntary reporting on activities that occurred before and during 1994.

EIA's Voluntary Reporting of Greenhouse Gases Program affords an opportunity for any company, organization, or individual to establish a public record of greenhouse gas emissions, reductions, or sequestration activities in a national database. In the most recent reporting cycle, a total of 228 U.S. companies and other organizations reported to the 1605(b) program that, during 2001, they had undertaken 1,705 projects to reduce or sequester greenhouse gases. Emission reductions reported for 2001 on the long form (Form EIA-1605) included 222 million metric tons carbon dioxide equivalent<sup>221</sup> in direct reductions, 71 million metric tons carbon dioxide equivalent in indirect reductions, and 8 million metric tons carbon dioxide equivalent in reductions from carbon sequestration activities. In addition, 15 million metric tons carbon dioxide equivalent of reductions were reported on the short form (Form EIA-1605EZ), which does not specify whether the reported reductions were direct or indirect. Since 1994, the number of entities reporting to the program has grown by 111 percent, and the number of projects reported has grown by 169 percent. Table C.1 summarizes a number of program reporting indicators over the period from 1994 to 2001.

In accordance with the guidelines developed by the U.S. Department of Energy (DOE) in 1994, the Voluntary Reporting Program allows reporters considerable flexibility in the scope and content of their reports. As a result, companies can report their emissions and reductions in several different ways. This flexibility was built into the guidelines to promote increased participation in voluntary reporting. It can be viewed as a useful attribute in evaluating the design and consequences of any proposed program of credits for early action. The 1605(b) database of real-world emission reduction actions and actors can be used to gain insight into the incentive effects and beneficiaries of various credit for early action and related proposals.

In evaluating any credit for early action approach, a number of pertinent greenhouse gas accounting issues need to be addressed, including the following: (1) what is the appropriate reporting level (entity-level reporting versus project-level reporting); (2) how should ownership issues be handled for direct versus

<sup>221</sup> Greenhouse gas emissions and reductions are reported to the Voluntary Reporting Program in terms of carbon dioxide equivalent rather than carbon equivalent units, which are used in the other portions of this report. See footnote 38 in Chapter 1.

**Table C.1. Reporting Indicators for the Voluntary Reporting of Greenhouse Gases Program, 1994-2001**

Indicator	1994	1995	1996	1997	1998	1999	2000	2001
<b>Entities and Projects Reported</b>								
Number of Entities Reporting	108	142	150	162	207	207	236	228
Number of Projects Reported	634	960	1,040	1,288	1,549	1,721	2,089	1,705
Number of Entity-Level Reports Received (Organization- Wide)	40	51	56	60	76	83	109	109
<b>Project-Level Reductions Reported (Million Metric Tons of Carbon Dioxide Equivalent)</b>								
Direct <sup>a</sup>	63	88	90	95	148	155	211	222
Indirect <sup>b</sup>	5	52	53	38	43	57	62	71
Sequestration <sup>c</sup>	1	1	9	10	12	10	9	8
Unspecified <sup>d</sup>	4	6	6	9	19	13	12	15

<sup>a</sup> "Direct" emission reductions are reductions in releases of greenhouse gases "on site." For the purpose of completing Form EIA-1605, "on site" is defined as any source owned (wholly or in part) or leased by the reporting entity.

<sup>b</sup> "Indirect" emission reductions are reductions in emissions from sources not owned or leased by the reporting entity but that occur, wholly or in part, as a result of the entity's activities (for example, an automobile manufacturer's investment in increased automotive fuel economy can result in decreased emissions from vehicles owned by individuals or managed fleets).

<sup>c</sup> "Sequestration" is the fixation of atmospheric carbon dioxide in a carbon sink through biological or physical processes, such as photosynthesis.

<sup>d</sup> "Unspecified" emission reductions represent quantities reported on Form EIA-1605EZ for which the reporting entity did not specify whether the emission reduction was direct or indirect.

Notes: 2000 data have been revised upward to include 2000 reports that were submitted after the filing deadline. It is expected that the 2001 data will also be revised upward in next year's report with the inclusion of late 2001 reports. Totals for direct and indirect reductions may not equal sum of components due to independent rounding. Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

indirect emissions; (3) against what baseline (historical, business-as-usual, unit of production, etc.) should reductions be calculated; and (4) how should emissions and emission reductions be verified?

S.139 specifies in its provisions on credit for early action that credits would be based on the difference between direct entity-level emissions and a historical emissions baseline, reduced by increases in indirect emissions from the entity's baseline indirect emissions and increased by carbon sequestration activities. Because almost one-half (109) of the reporters to the Voluntary Reporting Program submit entity-wide reports, including data on indirect emissions and carbon sequestration, the 1605(b) database represents an available resource to evaluate the credit for early action provisions of S.139.

In using the 1605(b) database, two caveats in the areas of "reporting entity" and "verification" should be mentioned. In terms of "reporting entity," Section 1605(b) mentions only "entities" and "persons" as prospective reporters. Several of the entity-level 1605(b) reports examined for this analysis involved facilities or groups of facilities within a corporation, which might not be considered entities under S.139. In terms of verification, DOE decided not to require verification by an independent third party after considering this issue during the development of the guidelines for the Voluntary Reporting Program. Rather, reporters are required to "self-certify" the accuracy of their reports. EIA reviews each report received for comprehensiveness, arithmetic accuracy, internal consistency, and plausibility and makes suggestions for improving the accuracy and clarity of reports; however, the reporter is ultimately responsible for the accuracy of any report submitted. Meaningful verification of submitted data would require putting in place common baselines and accounting standards that dictate what information should be included in reports and how estimates of greenhouse gas emissions and reductions and carbon sequestration should be calculated. A number of these accounting issues are being addressed under the

President's Climate Change Initiative, which among other things directs DOE to improve the measurement accuracy, data quality, and verifiability of data reported to the Voluntary Reporting Program, with the intent to grant transferable credits for real reductions.

### **The U.S. Climate Change Initiative and Enhanced Voluntary Reporting of Greenhouse Gases Program**

On February 14, 2002, President George W. Bush announced the Administration's Global Climate Change Initiative, which includes new emission intensity reduction goals, incentives for clean technology development, added support for scientific research, expanded collaboration on climate change with foreign governments, and the development of a framework for the enhancement of the Voluntary Reporting of Greenhouse Gases program. Pursuant to the last objective, the Department of Energy is working to improve and expand the 1605(b) Voluntary Reporting of Greenhouse Gases Program. The primary goal is to create a credible and transparent program to report real reductions that support the national greenhouse gas intensity goal of an 18 percent improvement by 2012. In addition, the enhanced 1605(b) Program will allow businesses and individuals to record their reductions and ensure that those reporters are not penalized under a future climate policy. The objective of improving the registry and providing transferable credits for reductions is to help motivate firms to take cost-effective, voluntary actions to reduce greenhouse gas emissions.

On July 8, 2002, the Secretary of Energy, joined by the Secretary of Commerce, the Secretary of Agriculture, and the Administrator of the Environmental Protection Agency, submitted recommendations to the White House that will guide the process over the coming months to improve and expand the Voluntary Reporting Program. Specifically, the Secretaries and Administrator recommended the following improvements to the 1605(b) program:

- Develop fair, objective, and practical methods for reporting baselines, reporting boundaries, calculating real results, and awarding transferable credits for actions that lead to real reductions.
- Standardize widely accepted, transparent accounting methods.
- Support independent verification of registry reports.
- Encourage reporters to report greenhouse gas intensity (emissions per unit of output) as well as emissions or emissions reductions.
- Encourage corporate or entity-wide reporting.
- Provide credits for actions to remove carbon dioxide from the atmosphere (e.g., sequestration activities) as well as for actions to reduce emissions.
- Develop a process for evaluating the extent to which past reductions may qualify for credits.
- Assure that the Voluntary Reporting Program is an effective tool for reaching the 18 percent goal.
- Factor in international strategies as well as State-level efforts.
- Minimize transaction costs for reporters and administrative costs for the Government, where possible, without compromising the foregoing recommendations.

The recommendations highlight the need to create standardized, widely accepted, transparent accounting methods, support independent verification of registry reports, and ensure that companies that make real reductions are awarded credit under a future climate change policy.

To engage the public on these issues, DOE held four regional workshops during November and December 2002. Each workshop addressed the full range of greenhouse gas accounting issues outlined above and how they would relate to an "enhanced" Voluntary Reporting Program. Following the regional workshops, DOE started a process to develop revised guidelines that will meet the intent of the President's Climate Change Initiative. DOE intends to finalize the revised guidelines by the end of calendar year 2003, so that EIA can collect data under the new guidelines in 2004.

## Accounting Issues for Voluntary Reporting and Beyond

The Voluntary Reporting Program was designed primarily to serve as a mechanism by which entities could report voluntary actions intended to reduce greenhouse gas emissions and sequester carbon.<sup>222</sup> EIA has the responsibility, among other things, for establishing and maintaining a database of reported greenhouse reductions that also serves as a national registry of reported reductions. While the information in the database may be used by the reporting entity to demonstrate achieved reductions of greenhouse gases, the program was not primarily designed to support credit for early reductions or emissions trading programs. The program guidelines did not attempt to resolve the issues that arise in constructing the required reporting rules that would create a set of comparable, verifiable, auditable emission and reduction reports.

The 1605(b) database provides a mechanism for identifying some of the issues that would have to be resolved in developing an accounting system for quantifying emissions, emission reductions, and sequestration. Such an accounting system may have to answer the following questions:

- Who can report?
- What is a reduction?
- Who owns the reduction?
- Would the reduction have happened anyway?
- How does one verify reports?

### A. Who Can Report?

Section 1605(b) of the Energy Policy Act of 1992 mentioned only “entities” and “persons” as prospective reporters. Several overlapping concepts of “who can report” surfaced at the public hearings for the guidelines for the Voluntary Reporting Program, all of which were accommodated. These included:

- **A legal person: i.e., an individual, household, corporation, or trade association.** In this approach, emissions and reductions are calculated and reported for the entire entity.
- **A facility or group of facilities.** Emissions and reductions are calculated as those of a particular facility, defined as a single plant in a specified location, or perhaps even a single stack within a plant. A corporation or legal person acquires responsibility for emissions and reductions through ownership of one or more specified facilities.
- **A “project” or activity.** Reductions are defined by comparing the emissions from some set of sources deemed relevant with an estimate of what emissions would have been if a particular action or bundle of actions had not been undertaken.

### B. What is a Reduction?

Perhaps the most intuitive definition of a reduction is one measured against an historical baseline, which represents the use of a “basic reference case.” In this approach, the reduction is defined as the difference between the emissions of an entity or facility in a prior, baseline year, usually 1990, and in the current year. This approach is best suited to reporters whose activities have not appreciably changed since the baseline year. It presents particular problems for firms that have participated in mergers, acquisitions, or divestitures, or have made significant changes in the composition of their business. Startup companies or new facilities that have no history cannot use historical baselines. The historical baseline approach is also

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<sup>222</sup> This discussion of accounting issues is based on testimony given by Jay Hakes, former EIA Administrator, on March 30, 2000, before the Senate Committee on Energy and Natural Resources on Senate Bills S. 882 and S. 1776 and their potential impacts on EIA’s Programs. The full text of the testimony is available on EIA’s web site at <http://www.eia.doe.gov/neic/speeches/hrtest3-30-00/testimony3.htm>.

not well suited to measuring the reductions achieved by projects, because projects are often entirely new activities with no history.

Alternatively, many reporters define their reductions by comparison with what would have happened in the absence of a specified set of actions. Thus, corporate emissions may have risen, but they are less than they would have been in the absence of corporate action. This approach is called, in the Voluntary Reporting Program, a “modified reference case” or a “hypothetical baseline.” It is important to point out, however, that a hypothetical baseline is a best guess of what would have happened in the absence of a project, and there is no way per se to prove or disprove it. Most of the projects reported to the Voluntary Reporting Program use a hypothetical baseline to calculate emission reductions or sequestration.

The “unit of production” approach is a variant of the fixed historical baseline, where the reporter normalizes baseline emissions to reflect changes in production. If emissions per unit of output have declined, by comparison either with levels in a prior year or with what they would have been in the absence of some actions, then the reporter has a reduction. This approach works reasonably well for organizations that have a well-defined product that is homogeneous across companies and over time: for example, kilowatt-hours generated or sold, tons of steel, or barrels of crude oil. As products increase in complexity, this approach gradually breaks down. Tons of semiconductors, for example, is a meaningless measure of output.

The alternative measures of reductions have their advantages and disadvantages. Basic reference cases are objective and relatively easily verifiable. On the other hand, absolute reductions are often the product of circumstance rather than action, while modified reference cases (which are more difficult to verify) explicitly measure the results of actions. Unit-of-production reference cases are useful only in a limited number of cases, and they can combine some of the disadvantages of both basic and modified reference cases.

### **C. Who Owns the Reduction?**

Two theories of emissions ownership coexist in the Voluntary Reporting Program. The most intuitive, and commonplace, is called “direct emissions” and “direct reductions.” If a reporter owns or uses (e.g., leases) the emission source, that reporter owns the emission as well as any reductions from this source. The advantage of limiting ownership to direct emissions is that it generally prevents multiple ownership of the same emission or reduction. However, this approach excludes many important emission reduction methods, including all activities that tend to reduce electricity consumption, the activities of energy service companies, and the provision of energy-efficient or emission reducing capital goods.

The alternative theory of ownership is based on causation: if an organization causes an emission or reduction, it is responsible for that emission, even if it does not own the emission source. Emissions or reductions from sources not owned by the reporter are referred to as “indirect.” The most important example of an indirect emission is one produced through the consumption of electricity. If entities reduce their consumption of electricity, they cause their electricity supplier to reduce its emissions. This approach permits reporting of any action that has an influence on national emissions. However, the concept of “causing an emission” is inherently more ambiguous than “owning the smoke stack,” and in many cases more than one firm may credibly claim to have helped cause an emission reduction.

EIA requires that reporters using Form EIA-1605 explicitly identify all emissions and reductions as either direct or indirect so that potentially double-counted reductions can be identified.



#### **D. Would the Reduction Have Happened Anyway?**

This issue is often discussed in other contexts under the term “additionality.” It has been suggested that many emission reduction projects do not represent “real” reductions because they would have been undertaken “anyway” in the normal course of business. However, creating an operational definition of additionality is difficult, because the “normal course of business” is a hypothetical concept. For the purposes of voluntary reporting—which include publicizing the types of actions that limit national greenhouse gas emissions and providing recognition for the companies that undertake those actions voluntarily—determining the additionality of projects is unnecessary. For the purposes of a credit for early reduction program, however, additionality is an issue that needs to be considered.

#### **E. How Does One Verify Reports?**

In general, reports submitted to EIA are judged to be factually accurate. Meaningful verification of the accuracy of 1605(b) reporting would require putting in place common baselines and accounting standards that dictate what information should be included in 1605(b) reports and how estimates of greenhouse gas emissions and reductions and carbon sequestration should be calculated. For example, if the accounting treatment for indirect emissions from electricity purchases is undefined, then a particular set of facts about a reporter could result in two different estimates of emissions: one including electricity purchases and one excluding electricity purchases. A third-party verifier can verify the facts about the reporter but cannot determine whether or not indirect emissions from electricity purchases ought to be included and, consequently, cannot determine whether the total emissions reported are correct or not.

### **Other Potential Sources of Credits Under S.139**

Currently, a broad array of efforts are underway to build corporate awareness about greenhouse gas mitigation and develop comprehensive methods for tracking and reporting corporate greenhouse gas inventories. Included among them are the Pew Center’s Business Environmental Leadership Council, Climate VISION, Climate Leaders, the Environmental Resources Trust (ERT) GHG Registry, the Chicago Climate Exchange, Natural Gas STAR, the Landfill Methane Outreach Program, the Coalbed Methane Outreach Program, the Voluntary Aluminum Industrial Partnership, and the Sulfur Hexafluoride (SF<sub>6</sub>) Emissions Reduction Partnership for Electrical Systems. Further, carbon dioxide emissions are reported to the U.S. Environmental Protection Agency (EPA) by utilities required to implement Continuous Emissions Monitoring under the Clean Air Act. Finally, many firms have undertaken emission reduction targets and have achieved emission reductions on a private basis. Some of these initiatives are described below.

- **Climate VISION**, a new voluntary partnership to reduce greenhouse gas emissions launched by DOE on behalf of the Bush Administration, is a public-private partnership to pursue cost-effective initiatives that will reduce the projected growth in U.S. greenhouse gas emissions. The “VISION” in the title stands for “Voluntary Innovative Sector Initiatives: Opportunities Now.” It is administered through DOE’s Office of Policy and International Affairs. A summary of initial industry sector commitments can be found at <http://www.energy.gov/HQPress/releases03/febpr/ClimateFactSheet.pdf>.
- **Climate Leaders** is a voluntary EPA industry-government partnership that encourages companies to develop long-term comprehensive climate change strategies. Climate Leaders gives companies the opportunity to set corporate-wide greenhouse gas reduction goals and inventory their emissions to measure progress. By reporting inventory data to EPA, partners create a lasting record of their accomplishments. Partners also identify themselves as corporate environmental

leaders and strategically position themselves as climate change policy continues to unfold. A listing of the emission reduction goals adopted by 10 Climate Leaders partners can be found at <http://www.epa.gov/climateleaders/goals.html>

- The **Pew Center's Business Environmental Leadership Council (BELC)** includes 38 major companies, most in the Fortune 500, that are working together through the Center to educate the public on climate change risks, challenges, and solutions. In addition to agreeing to a Joint Statement of Principles, the corporate members of the BELC serve in an advisory role, offering suggestions and input regarding the Center's activities. The Pew Center provides a searchable database containing case studies of State and local greenhouse gas reduction initiatives at [www.pewclimate.org/states/index.cfm](http://www.pewclimate.org/states/index.cfm).
- The **ERT GHG Registry** and its associated services provide support for the key infrastructure requirements needed for a robust greenhouse gas emissions reductions trading market: defining the commodity that will be exchanged (emissions units), establishing the accounting language and protocols by which market participants will measure and verify their emissions performance, and providing early actors with third-party validation of their emissions performance, including individually serialized records to provide evidence of their accomplishments. As a nonprofit organization, ERT is committed to promoting an emissions trading market that can drive ambitious greenhouse gas reductions at low cost. Summary data on emissions performance of ERT GHG Registry members is available to the public at <http://www.ecoregistry.org/>. Company-specific data are available only to individual members of the Registry or others they have authorized to view their data.
- The **Chicago Climate Exchange (CCX)** is a voluntary cap and trade program for reducing and trading greenhouse gas emissions. CCX will administer this pilot program for emission sources, farm and forest carbon sinks, offset projects, and liquidity providers in North America. To foster international emissions trading, offset providers in Brazil can also participate. CCX does not provide publicly accessible data on the emissions of its participants.
- The **Natural Gas STAR Program** is a voluntary partnership that encourages companies across the natural gas industry to adopt cost-effective technologies and practices that improve operational efficiency and reduce emissions of methane. Methane, the primary component of natural gas, is a potent greenhouse gas. Natural Gas STAR has three component programs, each of which works with a different sector of the industry: the transmission and distribution program; the producers program; and the gathering and processing program. According to the program's web site, Natural Gas STAR partners have eliminated more than 176 billion cubic feet of methane emissions since 1993. Because the program views the reductions reported as proprietary data, no public database is available.
- The **Landfill Methane Outreach Program (LMOP)** is a voluntary assistance and partnership program that promotes the use of landfill gas as a renewable energy source. By preventing emissions of methane through the development of landfill gas energy projects, LMOP strives to help businesses, States, and communities protect the environment and build a sustainable future. LMOP provides a database of operational, under construction, and planned landfill gas utilization projects at <http://www.epa.gov/lmop/projects/lmopdata.xls>.
- **\$ The Coalbed Methane Outreach Program (CMOP)** is a voluntary program whose goal is to reduce methane emissions from coal mining activities. Its mission is to promote the profitable recovery and use of coal mine methane. By working cooperatively with coal companies and related industries, CMOP helps to identify and implement methods to use coal mine methane productively. In turn, these actions mitigate climate change, improve mine safety and

productivity, and result in financial profits. Since CMOP's inception in 1994, U.S. coal mines have recovered 292 billion cubic feet of gas. The CMOP web site contains summary data on coal mine methane emissions and recovery at <http://www.epa.gov/cmop/images/newchart3.gif>. CMOP also maintains mine-by-mine data that are not publicly available; however, a large portion of the data (methane emissions from ventilation systems) can be obtained from the Mine Safety and Health Administration.

- \$ The **Voluntary Aluminum Industrial Partnership** (VAIP) is an innovative prevention program developed jointly by the EPA and the primary aluminum industry. Participating companies work with EPA to improve aluminum production efficiency while reducing emissions of perfluorocarbons, which are potent greenhouse gases that may remain in the atmosphere for thousands of years. According to EPA, between 1990 and 1998, VAIP partners representing 94 percent of U.S. aluminum production capacity reduced perfluorocarbon emissions by 44 percent. There is no readily apparent public database of the partners' emissions improvements.
- \$ The **SF<sub>6</sub> Emissions Reduction Partnership for Electric Power Systems** works with the electric power industry to pursue technically and economically feasible actions aimed at minimizing SF<sub>6</sub> emissions and reducing the threat of global climate change. SF<sub>6</sub> is a gaseous dielectric used by the electric power industry in circuit breakers, gas-insulated substations, and switchgear. It is a highly potent greenhouse gas. Over a 100-year period, SF<sub>6</sub> is 23,900 times more effective at trapping infrared radiation than an equivalent amount of carbon dioxide. SF<sub>6</sub> is also a very stable chemical, with an atmospheric lifetime of 3,200 years. Thus, a relatively small amount can have an important impact on global climate change. Estimated emission reductions associated with this program can be found in its annual report at [http://www.epa.gov/highgwp1/sf6/pdf/eps\\_program\\_report\\_2002.pdf](http://www.epa.gov/highgwp1/sf6/pdf/eps_program_report_2002.pdf).

## Approach and General Trends

In order to produce an estimate of potential credits for early compliance under S.139, EIA examined the emissions and sequestration data reported on Form EIA-1605<sup>223</sup> in light of the requirements contained in S.139 for calculating emission reductions. Section 203 of the bill explicitly focuses on entity-wide reductions and states that the reductions must be calculated by comparing annual emission levels to a historical emission level. Thus, EIA reviewed emissions data reported on an entity-wide basis back to 1990.<sup>224</sup> Because the 1605(b) database is not economy-wide it does not include all the firms that would be eligible for early compliance credits (see box below).

During the 2001 1605(b) reporting cycle, 97 entities reported direct emissions, indirect emissions, and/or achieved carbon sequestration at the entity level (41 electric power producers and 56 entities representing other sectors).<sup>225</sup> Forty-five of the 97 entities reported data for 1990 and were, for the purpose of this analysis, assigned 1990 as the baseline year for comparing annual emission levels (Table C.2). The remaining 52 firms that reported initial data for a year subsequent to 1990 were assigned their first year's emissions levels as a baseline.<sup>226</sup> This appears consistent with Section 203(C)(2)(B)(ii) of S.139, which

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<sup>223</sup> For a detailed description of reported reductions, see Energy Information Administration, *Voluntary Reporting of Greenhouse Gases 2001*, DOE/EIA-0608(2001) (Washington, DC, February 2003), web site [www.eia.doe.gov/oiaf/1605/vrrpt/index.html](http://www.eia.doe.gov/oiaf/1605/vrrpt/index.html).

<sup>224</sup> Because 1990 was a recession year, it may not be indicative of the success or failure of a reporting firm's action.

<sup>225</sup> Only data submitted during the most recent reporting cycle (2001) were examined. In most cases, reporters submit data on all previous years during each subsequent reporting cycle. As a result, earlier estimates of emissions are often superseded by an entity's most recent report. However, because some entities did not report during the 2001 reporting cycle after having reported during earlier cycles, their emissions and reductions were not captured in this analysis.

<sup>226</sup> Two firms that reported emissions data only for 2001 were excluded from this analysis, because no changes from a previous year's baseline could be ascertained.

seems to apply to entity-wide reductions achieved relative to the year preceding the first year data are submitted.

Emission levels for the 45 entities assigned a 1990 baseline rose by an aggregate 242 million metric tons carbon dioxide equivalent between 1991 and 2001. However, the results show a discernible trend over time. Until 1996, emissions were nearly unchanged or below 1990 levels. For example, 1992 emission levels were 39 million metric tons carbon dioxide equivalent lower than 1990 levels. Emissions then increased to levels well above 1990 levels, peaking at 96 million metric tons carbon dioxide equivalent above 1990 levels in 1998. In 2001, emissions were once again 26 million metric tons carbon dioxide equivalent below 1990 levels. This trend correlates with economic growth trends and general national emission trends. Emissions growth was centered in the electric power sector. The 14 firms that reported 1990 data and were not electric power producers showed an aggregate decline of 224 million metric tons carbon dioxide equivalent from 1990 levels and were below 1990 emission levels for all years from 1991 through 2001.

**Table C.2. Entities Reporting to the Voluntary Reporting Program, 2001**

Entity-Type	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
<b>Total Number of Entities Reporting Changes in Entity-Level Emissions in 2001</b>											
<b>Against 1990 Baseline</b>											
Electric Power	27	27	28	29	30	31	32	31	32	31	31
Other Sectors	9	10	11	11	11	11	12	13	14	14	14
<i>Subtotal</i>	36	37	39	40	41	42	44	44	46	45	45
<b>Against Post-1990 Baseline</b>											
Electric Power	0	5	6	6	7	7	8	8	7	9	10
Other Sectors	0	7	7	7	8	12	15	18	22	29	42
<i>Subtotal</i>	0	12	13	13	15	19	23	26	29	38	52
<b>Total</b>	<b>38</b>	<b>49</b>	<b>52</b>	<b>53</b>	<b>56</b>	<b>61</b>	<b>67</b>	<b>70</b>	<b>75</b>	<b>83</b>	<b>97</b>
<b>Number of Entities Showing Increases in Net Emissions</b>											
<b>Against 1990 Baseline</b>											
Electric Power	8	11	16	19	19	18	20	20	23	22	22
Other Sectors	2	3	6	4	3	4	4	4	4	4	4
<i>Subtotal</i>	10	14	22	23	22	22	24	24	27	26	26
<b>Against Post-1990 Baseline</b>											
Electric Power	0	1	1	3	3	3	3	3	4	6	4
Other Sectors	0	5	5	4	6	9	13	10	14	19	24
<i>Subtotal</i>	0	6	6	7	9	12	16	13	18	25	28
<b>Total</b>	<b>10</b>	<b>20</b>	<b>28</b>	<b>30</b>	<b>31</b>	<b>34</b>	<b>40</b>	<b>37</b>	<b>45</b>	<b>51</b>	<b>54</b>
<b>Number of Entities Showing Decreases in Net Emissions</b>											
<b>Against 1990 Baseline</b>											
Electric Power	19	16	12	10	11	13	12	11	9	9	9
Other Sectors	7	7	5	7	8	7	8	9	10	10	10
<i>Subtotal</i>	26	23	17	17	19	20	20	20	19	19	19
<b>Against Post-1990 Baseline</b>											
Electric Power	2	4	5	3	4	4	5	5	3	3	6
Other Sectors	0	2	2	3	2	3	2	8	8	10	18
<i>Subtotal</i>	2	6	7	6	6	7	7	13	11	13	24
<b>Total</b>	<b>28</b>	<b>29</b>	<b>24</b>	<b>23</b>	<b>25</b>	<b>27</b>	<b>27</b>	<b>33</b>	<b>30</b>	<b>32</b>	<b>43</b>

Source: Energy Information Administration, Voluntary Reporting of Greenhouse Gases Public Use Database (May 2003), Form EIA-1605.

The 52 firms that reported initial data for a year subsequent to 1990 showed similar results against their assigned baselines. The 10 electric power producers showed an aggregate increase of 51 million metric tons carbon dioxide equivalent against their baseline emission levels between 1992 and 2001, and other entities showed an aggregate decrease of 15 million metric tons carbon dioxide equivalent against their baseline emission levels between 1992 and 2001.

### Entities Potentially Eligible for Early Compliance Credits Under S.139

Entities covered under S.139 include those that own or control a source of greenhouse gas emissions in the electric power, industrial, or commercial sectors that emits over 10,000 metric tons carbon dioxide equivalent per year. Additionally, an entity that imports or produces petroleum products for use in transportation that will emit more than 10,000 metric tons carbon dioxide equivalent is also covered. Determining the number of entities that would be eligible for early credits under S.139 is not a straightforward matter. An earlier analysis has estimated the number of facilities that produce more than 10,000 metric tons of greenhouse gases per year,<sup>227</sup> but it was conducted on a facility level. Allocating facilities to corporate entities is not a simple undertaking. Further, only those entities achieving reductions in direct emissions or increases in sequestration relative to a historical level after accounting for increases in indirect emissions would be eligible. Absent a comprehensive national reporting system, it is impossible to determine the full inventory of entities that have achieved or will be able to achieve such reductions against their baselines.

Based on existing data some broad suppositions can be made about potential entities covered under the early credit provisions of S.139 on a sector-by-sector basis, as follows:

- *Electric Power.* There are approximately 3,100 electric utilities and 2,100 nonutility power producers in the United States. The 100 largest owners of electricity generation capacity in the United States collectively own more than 1,900 power plants, which produce about 90 percent of carbon dioxide emissions in the power generation sector.<sup>228</sup> A total of 4,636 facilities report carbon dioxide emissions under the Clean Air Act Amendments of 1990. Of that total, 1,633 report more than 10,000 metric tons of annual emissions. In the aggregate, those 1,633 facilities represent 99.9 percent of all carbon dioxide emissions from power plants.<sup>229</sup> Thus, it can be assumed that nearly all entities from the electric power sector covered by S.139 would be among the 100 largest owners.
- *Petroleum Refining.* Petroleum refiners produce petroleum products for use in transportation that will emit more than 10,000 metric tons of greenhouse gases when combusted. There are 153 petroleum refineries in the United States, of which 144 are operating. There are 44 entities that own more than 10,000 barrels of daily capacity within these refineries.<sup>230</sup> This would imply that up to 44 entities would be covered by the reporting requirements of S.139 and potentially eligible for credit for early compliance. Output at U.S. refineries has increased steadily over the last 15 years, despite a 25 percent decline in the total number of refineries. Early reductions would be difficult to achieve if that trend continues. Further, nearly all the large refiners are part of large integrated oil companies that maintain a much broader emissions portfolio.

<sup>227</sup> Tristram O. West and Naomi Pena, "Determining Thresholds for Mandatory Reporting of Greenhouse Gas Emissions," *Environmental Science and Technology*, Vol. 37, No. 6 (2003), pp. 1057-1060.

<sup>228</sup> Natural Resources Defense Council, *Benchmarking Air Emissions of the 100 Largest Electric Generation Owners in the U.S.* (2000).

<sup>229</sup> Tristram O. West and Naomi Pena, "Determining Thresholds for Mandatory Reporting of Greenhouse Gas Emissions," *Environmental Science and Technology*, Vol. 37, No. 6 (2003), pp. 1057-1060.

<sup>230</sup> Energy Information Administration, *Petroleum Supply Annual 2002, Volume 1*, DOE/EIA-0340(02)/1 (Washington, DC, June 2003), Table 40.

### Entities Potentially Eligible for Early Compliance Credits Under S.139 (continued)

- *Manufacturing.* It has been estimated that some 7,777 manufacturing facilities have carbon dioxide equivalent emissions in excess of 10,000 metric tons annually.<sup>231</sup> It is impossible to allocate these emissions to a specific number of entities without data on emissions and facility ownership in the manufacturing sector.
- *Commercial.* It is unlikely that commercial buildings will surpass the 10,000 metric ton threshold limit. Some commercial buildings, however, could be captured in the entity-level inventories of manufacturers, petroleum refiners, or electric power producers that have significant point sources of emissions. It is difficult to determine the level of participation by large-scale commercial entities with many buildings or retail outlets.

## Quantification of Reductions from Early Compliance

Because S.139 specifically offers the opportunity to register emission reductions achieved after 1990, the remainder of this appendix focuses only on those entities showing net emission reductions against their assigned baseline years, in accordance with the guidelines outlined in S.139. After comparing annual reported emissions data to a 1990 baseline, or the first year of data reported by a participant in the 1605(b) program, EIA generated tables of annual changes in greenhouse gas emissions relative to the base year by reporting entity (Tables C.3 and C.4).

For the purposes of S.139, and as outlined in Tables C.3 and C.4, “changes in greenhouse gas emissions” are equal to the sum of: (1) changes in direct emissions; (2) carbon sequestration (recorded as a negative number because sequestration denotes an activity where carbon is taken from the atmosphere and sequestered in a carbon sink); and (3) increases in indirect emissions (set to zero if indirect emissions are not increasing). All the data shown in Tables C.3 and C.4 are evaluated relative to the base year. Positive numbers denote emissions increases, and negative numbers denote emissions reductions.

### Magnitude of Emission Reductions

Forty-three of the 97 entities reporting direct emissions, indirect emissions, or sequestration at the entity level showed net reductions in emissions relative to the base year after adding in increases in carbon sequestration and any increases in indirect emissions. The 43 reporters that showed net reductions of direct emissions after accounting for increases in net sequestration and increases in indirect emissions would have generated a total of 868 million metric tons carbon dioxide equivalent in reductions over the period 1991 through 2001 (Table C.4). This total includes annual reductions that ranged from a low of 41 million metric tons carbon dioxide equivalent in 1991 to a high of 181 million metric tons in 2001.<sup>232</sup> Of the 868 million metric tons carbon dioxide equivalent reduced over the 11-year period, 58 million metric tons (6.7 percent) is attributable to increases in sequestration. Overall reductions in direct emissions

<sup>231</sup> Tristram O. West and Naomi Pena, “Determining Thresholds for Mandatory Reporting of Greenhouse Gas Emissions,” *Environmental Science and Technology*, Vol. 37, No. 6 (2003), pp. 1057-1060.

<sup>232</sup> The large increase in 2001 totals, roughly 90 million metric tons carbon dioxide equivalent higher than the next highest year (1996), is attributable to a large decrease in emissions from Southern Company (explained later in this appendix).

**Table C.3. Reported Changes in Emissions Relative to 1990 Levels (million metric tons carbon dioxide equivalent)**

Reduction Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Totals
<b>Sum (Net) of All Changes in Emissions Reported by 2001 Entity-Level Reporters<sup>a</sup></b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	-29.79	-40.21	-5.06	-3.35	-1.99	2.54	43.68	87.36	82.98	88.01	-25.62	<b>198.57</b>
Sequestration	-0.55	-0.08	-0.31	-0.41	-1.14	-1.15	-1.99	-2.21	-2.23	-1.63	-1.74	<b>-13.44</b>
<i>Subtotal</i>	<b>-30.34</b>	<b>-40.29</b>	<b>-5.36</b>	<b>-3.76</b>	<b>-3.12</b>	<b>1.39</b>	<b>41.69</b>	<b>85.15</b>	<b>80.75</b>	<b>86.38</b>	<b>-27.36</b>	<b>185.13</b>
Increase in Indirect Emissions	4.00	4.39	10.78	12.26	16.28	27.19	57.19	36.44	35.76	40.60	36.02	<b>280.91</b>
<b>Net Total Change—Electric Power Sector</b>	<b>-26.34</b>	<b>-35.90</b>	<b>5.41</b>	<b>8.50</b>	<b>13.15</b>	<b>28.58</b>	<b>98.88</b>	<b>121.59</b>	<b>116.52</b>	<b>126.99</b>	<b>8.66</b>	<b>466.04</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	-3.72	-3.03	-6.98	-20.50	-19.87	-23.21	-24.84	-25.89	-31.63	-32.94	-35.76	<b>-228.36</b>
Sequestration	*	*	*	*	*	*	*	*	*	*	*	<b>-0.02</b>
<i>Subtotal</i>	<b>-3.72</b>	<b>-3.03</b>	<b>-6.98</b>	<b>-20.50</b>	<b>-19.87</b>	<b>-23.21</b>	<b>-24.84</b>	<b>-25.89</b>	<b>-31.63</b>	<b>-32.95</b>	<b>-35.76</b>	<b>-228.38</b>
Increase in Indirect Emissions	0.06	0.04	0.03	2.00	0.09	0.26	0.31	0.15	0.16	0.33	0.72	<b>4.16</b>
<b>Net Total Change—Other Sectors</b>	<b>-3.66</b>	<b>-2.99</b>	<b>-6.95</b>	<b>-18.50</b>	<b>-19.78</b>	<b>-22.95</b>	<b>-24.52</b>	<b>-25.74</b>	<b>-31.47</b>	<b>-32.61</b>	<b>-35.04</b>	<b>-224.22</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	-33.51	-43.24	-12.04	-23.85	-21.86	-20.66	18.85	61.47	51.35	55.07	-61.38	<b>-29.79</b>
Sequestration	-0.55	-0.08	-0.31	-0.41	-1.14	-1.15	-1.99	-2.21	-2.23	-1.63	-1.74	<b>-13.46</b>
<i>Subtotal</i>	<b>-34.06</b>	<b>-43.32</b>	<b>-12.35</b>	<b>-24.26</b>	<b>-22.99</b>	<b>-21.81</b>	<b>16.86</b>	<b>59.26</b>	<b>49.13</b>	<b>53.44</b>	<b>-63.12</b>	<b>-43.25</b>
Increase in Indirect Emissions	4.06	4.42	10.81	14.26	16.37	27.45	57.50	36.58	35.93	40.94	36.74	<b>285.07</b>
<b>Net Total Change—All Sectors</b>	<b>-30.00</b>	<b>-38.90</b>	<b>-1.54</b>	<b>-10.00</b>	<b>-6.62</b>	<b>5.64</b>	<b>74.36</b>	<b>95.85</b>	<b>85.05</b>	<b>94.37</b>	<b>-26.38</b>	<b>241.82</b>
<b>Changes in Emissions Reported by Entities with Increases in Net Emissions Relative to 1990 Levels</b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	7.56	10.87	37.67	45.34	54.19	63.20	94.19	116.38	109.21	127.43	113.18	<b>779.22</b>
Sequestration	*	1.53	-0.01	0.00	-0.55	-0.58	-1.41	-1.52	-1.64	-1.20	-1.15	<b>-6.53</b>
<i>Subtotal</i>	<b>7.56</b>	<b>12.40</b>	<b>37.66</b>	<b>45.34</b>	<b>53.65</b>	<b>62.61</b>	<b>92.78</b>	<b>114.86</b>	<b>107.57</b>	<b>126.22</b>	<b>112.03</b>	<b>772.68</b>
Increase in Indirect Emissions	2.44	1.64	6.86	8.84	11.47	22.21	52.47	36.27	33.26	37.97	32.47	<b>245.89</b>
<b>Net Total Change—Electric Power Sector</b>	<b>10.00</b>	<b>12.44</b>	<b>44.34</b>	<b>54.15</b>	<b>65.08</b>	<b>84.80</b>	<b>145.22</b>	<b>151.10</b>	<b>140.79</b>	<b>164.16</b>	<b>144.50</b>	<b>1,016.58</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	0.82	1.33	1.43	1.21	1.53	1.74	1.63	1.63	2.42	3.33	3.29	<b>20.38</b>
Sequestration	*	*	*	*	*	*	*	*	*	*	*	<b>*</b>
<i>Subtotal</i>	<b>0.82</b>	<b>1.33</b>	<b>1.43</b>	<b>1.21</b>	<b>1.53</b>	<b>1.74</b>	<b>1.63</b>	<b>1.64</b>	<b>2.42</b>	<b>3.33</b>	<b>3.29</b>	<b>20.38</b>
Increase in Indirect Emissions	0.00	0.04	0.01	1.93	0.01	0.01	0.01	0.01	0.01	0.02	0.02	<b>2.06</b>
<b>Net Total Change—Other Sectors</b>	<b>0.82</b>	<b>1.37</b>	<b>1.44</b>	<b>3.15</b>	<b>1.54</b>	<b>1.75</b>	<b>1.64</b>	<b>1.65</b>	<b>2.43</b>	<b>3.35</b>	<b>3.30</b>	<b>22.44</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	8.37	12.20	39.11	46.55	55.72	64.94	95.83	118.01	111.63	130.76	116.46	<b>799.59</b>
Sequestration	*	1.53	-0.01	0.00	-0.55	-0.58	-1.41	-1.52	-1.64	-1.20	-1.15	<b>-6.53</b>
<i>Subtotal</i>	<b>8.37</b>	<b>13.73</b>	<b>39.10</b>	<b>46.55</b>	<b>55.18</b>	<b>64.35</b>	<b>94.42</b>	<b>116.50</b>	<b>109.99</b>	<b>129.56</b>	<b>115.32</b>	<b>793.06</b>
Increase in Indirect Emissions	2.44	1.68	6.86	10.78	11.47	22.22	52.48	36.28	33.27	37.99	32.48	<b>247.95</b>
<b>Net Total Change—All Sectors</b>	<b>10.82</b>	<b>13.81</b>	<b>45.78</b>	<b>57.30</b>	<b>66.63</b>	<b>86.55</b>	<b>146.86</b>	<b>152.74</b>	<b>143.23</b>	<b>167.51</b>	<b>147.80</b>	<b>1,039.02</b>

**Table C.3. Reported Changes in Emissions Relative to 1990 Levels (continued)**

Reduction Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Totals
<b>Changes in Emissions Reported by Entities with Decreases in Net Emissions Relative to 1990 Levels</b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	-37.34	-51.08	-42.73	-48.69	-56.18	-60.65	-50.51	-29.02	-26.23	-39.41	-138.80	-580.65
Sequestration	-0.55	-1.61	-0.30	-0.40	-0.59	-0.57	-0.58	-0.69	-0.59	-0.43	-0.60	-6.90
<i>Subtotal</i>	-37.90	-52.69	-43.03	-49.10	-56.77	-61.22	-51.09	-29.71	-26.82	-39.84	-139.39	-587.55
Increase in Indirect Emissions	1.56	2.75	3.92	3.41	4.81	4.98	4.72	0.17	2.51	2.63	3.56	35.02
<b>Net Total Change—Electric Power Sector</b>	<b>-36.33</b>	<b>-48.34</b>	<b>-38.93</b>	<b>-45.66</b>	<b>-51.93</b>	<b>-56.22</b>	<b>-46.33</b>	<b>-29.51</b>	<b>-24.28</b>	<b>-37.18</b>	<b>-135.84</b>	<b>-550.54</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	-4.54	-4.36	-8.42	-21.71	-21.41	-24.95	-26.47	-27.52	-34.05	-36.28	-39.04	-248.74
Sequestration	*	*	*	*	*	*	*	*	*	*	*	-0.02
<i>Subtotal</i>	-4.54	-4.36	-8.42	-21.71	-21.41	-24.95	-26.47	-27.52	-34.05	-36.28	-39.05	-248.76
Increase in Indirect Emissions	0.06	0.00	0.03	0.07	0.09	0.25	0.30	0.14	0.15	0.32	0.71	2.10
<b>Net Total Change—Other Sectors</b>	<b>-4.48</b>	<b>-4.36</b>	<b>-8.39</b>	<b>-21.64</b>	<b>-21.32</b>	<b>-24.70</b>	<b>-26.17</b>	<b>-27.39</b>	<b>-33.90</b>	<b>-35.96</b>	<b>-38.34</b>	<b>-246.65</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	-41.88	-55.45	-51.15	-70.40	-77.58	-85.60	-76.98	-56.54	-60.27	-75.69	-177.84	-829.39
Sequestration	-0.55	-1.61	-0.30	-0.40	-0.59	-0.57	-0.58	-0.70	-0.59	-0.43	-0.60	-6.92
<i>Subtotal</i>	-42.44	-57.05	-51.45	-70.81	-78.17	-86.17	-77.56	-57.23	-60.87	-76.12	-178.44	-836.31
Increase in Indirect Emissions	1.62	2.75	3.95	3.48	4.90	5.23	5.03	0.31	2.65	2.95	4.26	37.12
<b>Net Total Change—All Sectors</b>	<b>-40.81</b>	<b>-52.71</b>	<b>-47.32</b>	<b>-67.30</b>	<b>-73.25</b>	<b>-80.91</b>	<b>-72.50</b>	<b>-56.90</b>	<b>-58.18</b>	<b>-73.14</b>	<b>-174.18</b>	<b>-797.20</b>

<sup>a</sup> Positive values indicate increases in emission; negative values indicate sequestration or decreases in emissions.

\*Less than 0.005 million metric tons carbon dioxide equivalent.

Source: Energy Information Administration, Voluntary Reporting of Greenhouse Gases Public Use Database (May 2003), Form EIA-1605.



Table C.4. Reported Changes in Emissions Relative to "First Year Reported" Levels (million metric tons carbon dioxide equivalent)

Reduction Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Totals
<b>Sum (Net) of All Changes in Emissions Reported by 2001 Entity-Level Reporters<sup>a</sup></b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	-29.79	-40.76	-3.48	-0.52	4.31	9.91	51.89	106.18	100.31	109.19	-16.98	290.27
Sequestration	-0.55	-1.64	-6.02	-6.12	-6.85	-6.86	-7.70	-7.93	-7.94	-7.34	-7.46	-66.41
Subtotal	-30.34	-42.40	-9.49	-6.63	-2.54	3.05	44.19	98.26	92.37	101.84	-24.43	223.86
Increases in Indirect Emissions	4.00	4.39	11.39	13.07	17.54	28.48	58.53	38.23	37.50	41.99	37.63	292.75
<b>Net Total Change—Electric Power Sector</b>	<b>-26.34</b>	<b>-38.01</b>	<b>1.89</b>	<b>6.44</b>	<b>15.00</b>	<b>31.53</b>	<b>102.71</b>	<b>136.49</b>	<b>129.87</b>	<b>143.83</b>	<b>13.20</b>	<b>516.61</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	-3.72	-2.83	-6.72	-20.95	-19.38	-26.26	-35.73	-35.33	-26.29	-31.72	-37.77	-246.71
Sequestration	*	*	*	*	*	*	*	*	*	*	*	-0.02
Subtotal	-3.72	-2.83	-6.72	-20.95	-19.38	-26.27	-35.73	-35.33	-26.30	-31.72	-37.77	-246.73
Increases in Indirect Emissions	0.06	0.07	0.07	2.04	0.14	0.54	0.62	0.54	0.73	1.08	1.13	7.02
<b>Net Total Change—Other Sectors</b>	<b>-3.66</b>	<b>-2.77</b>	<b>-6.65</b>	<b>-18.91</b>	<b>-19.25</b>	<b>-25.73</b>	<b>-35.11</b>	<b>-34.79</b>	<b>-25.56</b>	<b>-30.64</b>	<b>-36.64</b>	<b>-239.71</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	-33.51	-43.60	-10.19	-21.47	-15.08	-16.35	16.16	70.85	74.01	77.47	-54.74	43.56
Sequestration	-0.55	-1.64	-6.02	-6.12	-6.85	-6.86	-7.70	-7.93	-7.94	-7.34	-7.46	-66.43
Subtotal	-34.06	-45.23	-16.21	-27.59	-21.92	-23.22	8.46	62.93	66.07	70.13	-62.20	-22.87
Increases in Indirect Emissions	4.06	4.45	11.46	15.11	17.68	29.02	59.14	38.78	38.24	43.07	38.76	299.78
<b>Net Total Change—All Sectors</b>	<b>-30.00</b>	<b>-40.78</b>	<b>-4.75</b>	<b>-12.47</b>	<b>-4.25</b>	<b>5.80</b>	<b>67.60</b>	<b>101.70</b>	<b>104.31</b>	<b>113.19</b>	<b>-23.44</b>	<b>276.91</b>
<b>Changes in Emissions Reported by Entities with Increases in Net Emissions Relative to First Year Levels</b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	7.56	10.96	38.25	46.97	59.13	69.57	101.32	133.85	123.75	147.57	120.98	859.90
Sequestration	*	0.00	-0.01	-0.03	-0.58	-0.62	-1.45	-1.55	-1.67	-1.24	-1.15	-8.29
Subtotal	7.56	10.96	38.23	46.94	58.55	68.95	99.88	132.29	122.08	146.34	119.83	851.60
Increases in Indirect Emissions	2.44	1.64	6.86	8.84	11.47	22.22	52.48	36.27	34.69	37.98	32.79	247.68
<b>Net Total Change—Electric Power Sector</b>	<b>10.00</b>	<b>12.53</b>	<b>45.09</b>	<b>55.74</b>	<b>69.99</b>	<b>91.14</b>	<b>152.32</b>	<b>168.54</b>	<b>156.74</b>	<b>184.28</b>	<b>152.62</b>	<b>1,098.99</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	0.82	1.66	2.02	1.91	2.21	3.82	3.60	3.61	8.72	7.80	4.57	40.71
Sequestration	*	*	*	*	*	*	*	*	*	*	*	*
Subtotal	0.82	1.66	2.02	1.91	2.21	3.82	3.60	3.61	8.72	7.78	4.57	40.69
Increases in Indirect Emissions	0.00	0.07	0.04	1.97	0.05	0.27	0.31	0.37	0.56	0.72	0.41	4.77
<b>Net Total Change—Other Sectors</b>	<b>0.82</b>	<b>1.72</b>	<b>2.06</b>	<b>3.88</b>	<b>2.25</b>	<b>4.09</b>	<b>3.91</b>	<b>4.01</b>	<b>9.31</b>	<b>8.54</b>	<b>4.98</b>	<b>45.59</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	8.37	12.62	40.26	48.88	61.33	73.38	104.92	137.45	132.47	155.37	125.54	900.61
Sequestration	*	0.00	-0.01	-0.03	-0.58	-0.62	-1.45	-1.55	-1.67	-1.24	-1.15	-8.29
Subtotal	8.37	12.62	40.25	48.85	60.76	72.77	103.48	135.90	130.80	154.12	124.39	892.29
Increases in Indirect Emissions	2.44	1.71	6.90	10.82	11.51	22.49	52.78	36.64	35.25	38.70	33.20	252.45
<b>Net Total Change—All Sectors</b>	<b>10.82</b>	<b>14.25</b>	<b>47.15</b>	<b>59.63</b>	<b>72.24</b>	<b>95.23</b>	<b>156.24</b>	<b>172.55</b>	<b>166.04</b>	<b>192.82</b>	<b>157.60</b>	<b>1,144.58</b>

**Table C.4. Reported Changes in Emissions Relative to "First Year Reported" Levels (continued)**

Reduction Category	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Totals
<b>Changes in Emissions Reported by Entities with Decreases in Net Emissions Relative to First Year Levels</b>												
<b>Electric Power Providers</b>												
Change in Direct Emissions	-37.34	-51.72	-41.72	-47.49	-54.82	-59.66	-49.43	-27.66	-23.44	-38.38	-137.95	<b>-569.63</b>
Sequestration	-0.55	-1.63	-6.01	-6.08	-6.27	-6.25	-6.26	-6.37	-6.27	-6.11	-6.31	<b>-58.11</b>
<i>Subtotal</i>	<b>-37.90</b>	<b>-53.36</b>	<b>-47.73</b>	<b>-53.57</b>	<b>-61.09</b>	<b>-65.90</b>	<b>-55.69</b>	<b>-34.04</b>	<b>-29.71</b>	<b>-44.49</b>	<b>-144.26</b>	<b>-627.74</b>
Increase in Indirect Emissions	1.56	2.75	4.53	4.23	6.07	6.26	6.05	1.96	2.81	4.01	4.84	<b>45.08</b>
<b>Net Total Change—Electric Power Sector</b>	<b>-36.34</b>	<b>-50.54</b>	<b>-43.20</b>	<b>-49.31</b>	<b>-54.99</b>	<b>-59.61</b>	<b>-49.61</b>	<b>-32.05</b>	<b>-26.87</b>	<b>-40.45</b>	<b>-139.42</b>	<b>-582.38</b>
<b>Reporters from Other Sectors</b>												
Change in Direct Emissions	-4.54	-4.49	-8.73	-22.86	-21.59	-30.08	-39.33	-38.94	-35.01	-39.51	-42.33	<b>-287.42</b>
Sequestration	*	*	*	*	*	*	*	*	*	*	*	<b>-0.02</b>
<i>Subtotal</i>	<b>-4.54</b>	<b>-4.49</b>	<b>-8.73</b>	<b>-22.86</b>	<b>-21.59</b>	<b>-30.08</b>	<b>-39.33</b>	<b>-38.94</b>	<b>-35.02</b>	<b>-39.51</b>	<b>-42.34</b>	<b>-287.42</b>
Increase in Indirect Emissions	0.06	0.00	0.03	0.07	0.09	0.27	0.31	0.17	0.18	0.36	0.72	<b>2.26</b>
<b>Net Total Change—Other Sectors</b>	<b>-4.48</b>	<b>-4.49</b>	<b>-8.71</b>	<b>-22.80</b>	<b>-21.50</b>	<b>-29.82</b>	<b>-39.02</b>	<b>-38.80</b>	<b>-34.87</b>	<b>-39.18</b>	<b>-41.62</b>	<b>-285.29</b>
<b>Reporters from All Sectors</b>												
Change in Direct Emissions	-41.88	-56.21	-50.46	-70.35	-76.41	-89.74	-88.76	-66.60	-58.46	-77.90	-180.29	<b>-857.05</b>
Sequestration	-0.55	-1.63	-6.01	-6.08	-6.27	-6.25	-6.26	-6.38	-6.27	-6.11	-6.31	<b>-58.13</b>
<i>Subtotal</i>	<b>-42.44</b>	<b>-57.85</b>	<b>-56.46</b>	<b>-76.43</b>	<b>-82.68</b>	<b>-95.99</b>	<b>-95.02</b>	<b>-72.97</b>	<b>-64.73</b>	<b>-83.99</b>	<b>-186.59</b>	<b>-915.16</b>
Increase in Indirect Emissions	1.62	2.75	4.56	4.30	6.16	6.53	6.36	2.13	2.99	4.38	5.56	<b>47.33</b>
<b>Net Total Change—All Sectors</b>	<b>-40.81</b>	<b>-55.03</b>	<b>-51.90</b>	<b>-72.10</b>	<b>-76.49</b>	<b>-89.43</b>	<b>-88.64</b>	<b>-70.85</b>	<b>-61.74</b>	<b>-79.63</b>	<b>-181.04</b>	<b>-867.67</b>

<sup>a</sup> Positive values indicate increases in emission; negative values indicate sequestration or decreases in emissions.

<sup>b</sup> First Year Reported is defined as 1990 or the first post-1990 year for which emissions data were reported.

\*Less than 0.005 million metric tons carbon dioxide equivalent.

Source: Energy Information Administration, Voluntary Reporting of Greenhouse Gases Public Use Database (May 2003), Form EIA-1605.

would have been 44 million metric tons carbon dioxide equivalent (5.3 percent) higher if they had not been offset by increases in indirect emissions.

Of the 43 reporters showing net emission reductions in one or more years between 1991 and 2001, 19 showed emissions data for a 1990 base year and 24 used a subsequent year as their initial base year. Nine of the 15 electric power producers showing net decreases in emissions provided data for a 1990 base year (Table C.2). A preponderance of reductions (797 million metric tons carbon dioxide equivalent or 91.9 percent) was generated against a 1990 base year, with 70 million metric tons carbon dioxide equivalent (8.1 percent) generated against a subsequent baseline year (Tables C.3 and C.4). Of that 70 million metric tons carbon dioxide equivalent, 39 million metric tons was attributable to 18 entities from industries other than electric power production.

### Distribution of Emission Reductions

Electric power producers represented 67 percent of the 868 million metric tons carbon dioxide equivalent in reductions generated from 1991 through 2001. This share did not remain consistent over time however. In 1994, 1995, and 1996, electric power producers showed 68, 72, and 67 percent of all reductions, respectively, as compared with only 45, 44, and 51 percent of reductions in 1998, 1999, and 2000.<sup>233</sup> While reductions from other sectors grew between 1996 and 2000, reductions from the electricity sector declined (Table C.4). This was partially a reporting-related phenomenon, in that 17 of 28 reporters showing reductions outside the electric power sector had a base year of 1996 or later, while all but 6 electric power producers used a 1990 baseline.

Together, 7 entities generated 74 percent of all emission reductions from 1991 through 2001. The largest was FirstEnergy Corporation of Akron, Ohio, with 187 million metric tons carbon dioxide equivalent in reductions, or 21.6 percent of all reductions generated between 1991 and 2001. FirstEnergy's share of overall reductions ranged from 10.3 percent in 1998 to 51.1 percent in 1991.<sup>234</sup> Next, Consol Coal Company showed 121 million metric tons carbon dioxide equivalent in reductions, or 14.0 percent of the overall total. Consol's share of overall reductions ranged from a high of 27.9 percent in 1999 to a low of 10.4 percent in 2001. Consol did not report emissions for 1991 through 1993. Together, 5 other entities—Southern Company (12.3), Jim Walters Resources (8.6 percent), Niagara Mohawk (6.7 percent), KeySpan (5.6 percent), and the AES companies (5.2 percent)—were responsible for an additional 38.2 percent of total reductions.

### Characterization of Emission Reductions

Because a small group of entities represents a large share of total emission reductions that could be registered under S.139, the nature of those entities and their emission reductions are described below. The discussion below also highlights a number of accounting issues germane to greenhouse gas accounting in a flexible system such as the Voluntary Reporting Program.

**FirstEnergy.** The seven electric utility operating companies held by FirstEnergy<sup>235</sup> have a combined generating capacity of 13,000 megawatts and serve 4.3 million customers across Ohio, Pennsylvania, and New Jersey. FirstEnergy also holds interest in 7,700 oil and gas wells and owns some 5,000 miles of gas pipeline. FirstEnergy reported direct emissions from eight power plants owned by Ohio Edison and its

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<sup>233</sup> This share jumps to 77 percent in 2001 if the very large reductions accruing to Southern Company in that year are included.

<sup>234</sup> FirstEnergy's share of total annual reductions was 7.9 percent in 2001, due in part to the very large reductions accruing to Southern Company.

<sup>235</sup> Ohio Edison, Cleveland Electric Illuminating Company, Toledo Edison, Pennsylvania Power, Pennsylvania Electric, Metropolitan Edison, and Jersey Central Power & Light.

subsidiary Penn Power, as well as fossil plants owned by the Cleveland Electric Illuminating Company and Toledo Edison. FirstEnergy's direct stationary combustion emissions peaked at 51.2 million metric tons carbon dioxide equivalent in 1990 and have been lower in every subsequent year by as much as 22.2 million metric tons carbon dioxide equivalent, or 43.4 percent (reported for 1995). FirstEnergy has embarked on a comprehensive emissions mitigation program that has included heat rate improvements, fuel switching, transmission and distribution improvements, and a host of demand-side management measures. Capacity improvements at three nuclear generating facilities (Perry, Davis-Besse, and Beaver Valley) are likely to have had the biggest effects on overall emission levels. Other large emission changes may be attributable to the evolving nature of the holding company's assets, which cannot be traced using the existing data.

**CONSOL Coal Group.** CONSOL Coal Group has 22 coal mining complexes in the United States, 20 of which are underground mines. CONSOL reports direct emissions of methane associated with mine ventilation systems, degasification wells, inactive mines, and post-mining sources. CONSOL reduced its emissions significantly through alterations in mining techniques, the capture and sale of methane from degasification wells, and the internal use of coalbed methane as a fuel. Post-1993 emissions data are increased for the acquisition of Island Creek Coal Company in 1993, Rochester and Pittsburgh Coal in 1998, and AEP's mining operations in mid-2001. If the baseline were restated, emission reductions would increase accordingly. Because the emissions reduced are methane, the benefit in carbon dioxide equivalent is 23 times that of carbon dioxide reductions (due to the greater heat trapping capacity of methane).

**Southern Company.** As the owner of five electric utilities in the Southeast, Southern Company operates over 36,000 megawatts of capacity. It has more than 26,000 employees and generated \$1.3 billion in net income for 2002. Ninety-one percent (97 million metric tons carbon dioxide equivalent) of Southern Company's reductions from its 1990 baseline accrued in 2001. This large single-year change in emission rates does not appear to represent an "actual" change in emissions as envisaged under S.139 but rather the exclusion of a large portion of the company's coal-fired fleet from emissions reported for 2001. Southern Company chose to discontinue reporting on these emission sources, because it had removed emission reduction projects at the plants from the scope of its voluntary report.<sup>236</sup>

**Jim Walters Resources.** As the owner-operator of three underground coal mines in Tuscaloosa County, Alabama, Jim Walters has a productive capacity of approximately 7 million short tons of coal annually. Jim Walters reported direct methane emissions from ventilation systems at these coal mines. Emissions peaked in 1990 at 662,119 metric tons methane and have declined steadily to 238,821 metric tons methane in 2001. About half of this decrease can be traced to the application of improved methane control techniques, including horizontal drilling, gobwell,<sup>237</sup> and standard well degasification systems. The source of the remainder is undetermined. Because the emissions reduced are methane, the benefit in carbon dioxide equivalent is 23 times that of carbon dioxide reductions.

**Niagara Mohawk.** A subsidiary of National Grid USA, Niagara Mohawk provides electric service to approximately 1.5 million customers in upstate New York. Niagara Mohawk's direct emissions from stationary combustion peaked at 15.2 million metric tons carbon dioxide equivalent in 1990. This number declined rapidly and steadily to 0.1 million metric tons carbon dioxide equivalent in 2001. The reductions were partially offset by increased indirect emissions from power purchases, which grew from 3.6 million metric tons carbon dioxide equivalent in 1990 to 7.2 million metric tons in 2001. Nearly all the remaining

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<sup>236</sup> Although "entity-level" reporting normally denotes reporting emissions for an entire organization, the General Program Guidelines (Section GG-4.3) allow entity-level reporting for individual plants or sets of plants. For purposes of reporting entity-level information for S.139, Southern Company would need to revise its entity-level emissions baseline so that the plants included in the base year matched plants included in subsequent years.

<sup>237</sup> A gob is a zone of rubble created when the roof of a coal mine collapses behind the mining operations.

reductions prior to 1999 can be attributed to increased generation at the Nine Mile Point nuclear generation plant. The remaining reductions after 1998 are attributable to Niagara Mohawk's divestiture of fossil-fueled generating facilities.

**AES.** AES owns and operates 158 power generation facilities in the United States and worldwide, with 55,000 megawatts of electric generation capacity. AES does not report emissions for all of its U.S. plants but rather for a set of four, each presented as an individual entity. Nearly all of AES's reductions are the result of increases in sequestration activities undertaken overseas to offset emissions from each of the plants.<sup>238</sup>

**KeySpan.** KeySpan was formed in 1998 as the result of the merger of KeySpan Energy, the parent company of Brooklyn Union Gas, and portions of Long Island Lighting Company (LILCO), including LILCO generating assets. KeySpan is the largest distributor of natural gas in the Northeast and the largest investor-owned utility in New York State. KeySpan's total electric power system requirements increased somewhat from its 1990 levels. However, the company was able to reduce its direct emission levels by moving away from oil- and gas-fired generation at LILCO plants to generation from the Nine Mile Point nuclear power plant and, to a greater extent, outside power purchases. It appears possible that KeySpan does not capture all the carbon dioxide emissions associated with outside power purchases in its voluntary report. If it did report all its indirect emissions, KeySpan's overall reductions between 1990 and 2001 could be smaller.

## Summary of Findings

In aggregate, total net greenhouse gas emissions reported by the 97 entities that reported direct emissions, indirect emissions, or sequestration at the entity level to the Voluntary Reporting Program increased by 241.8 to 276.9 million metric tons carbon dioxide equivalent between 1990 and 2001.<sup>239</sup> The net increase includes a total increase of 1,039.0 to 1,144.6 million metric tons carbon dioxide equivalent for the 54 companies reporting increased entity-level emissions and a total decrease of 797.2 to 867.7 million metric tons carbon dioxide equivalent for 43 companies reporting decreased entity-level emissions. The dichotomy between companies reporting increases and those reporting decreases illustrates how it is possible for entities to qualify for credits for early action in the face of increases in total emissions. To put these reductions in perspective, total reported reductions by only 97 entities out of thousands of possible emitting entities represent from 1.1 to 1.2 percent of total U.S. greenhouse gas emissions (72,568 million metric tons carbon dioxide equivalent) during the 1991 to 2001 time period.<sup>240</sup>

The characterization of emission reductions above also serves to highlight some of the important greenhouse gas accounting issues that must be considered in implementing a program of credits for early compliance. The operational definition of an entity would have important ramifications for early action credits. How aggregated or subaggregated an entity could become could be the difference between qualifying for credits and not pursuing such action. Additionally, how a firm's actual emissions and reductions are calculated would also come in to play, particularly where activities and emissions sources do not always have a straightforward or certain calculation methodology (unlike fossil fuel combustion, for example). The issue of direct and indirect emissions would also have to be addressed. The bill requires

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<sup>238</sup> As mentioned above, the General Program Guidelines (Section GG-4.3) allow entity-level reporting for individual plants or sets of plants. Thus, AES, would, for the purposes of reporting entity-level information for S.139, need to revise its entity-level emissions baseline so that the plants included in the base year matched plants included in subsequent years.

<sup>239</sup> The lower bound number in all the ranges in this section is the total for all Voluntary Reporting Program entity-level reporters for which a 1990 base year could be used. The upper bound number is the total for all Voluntary Reporting Program entity-level reporters whose base year was between 1990 and 2000.

<sup>240</sup> Reporters to the Voluntary Reporting Program self-certify their reports. EIA does not certify the correctness of this information.

that indirect emissions must come into consideration if they are not reported by another entity. Safeguards would need to be put in place to ensure that all indirect emissions were properly reported. Implementation of the credit for early compliance would also require consideration of the issue of verification. Namely, how can it be determined that past and current emission levels reported by individual firms are accurate?