The Waste-to-Energy Sector and the Mitigation of Greenhouse Gas Emissions

Stephen C. Fotis
Van Ness Feldman
1050 Thomas Jefferson Street, N.W.
Washington, DC 20007

David Sussman
Poubelle Associates
704 6th Street, S.W.
Washington, DC 20024

INTRODUCTION

The waste-to-energy sector provides one important avenue for the United States to reduce greenhouse gas (GHG) emissions. The purpose of this paper is to highlight the significant GHG reductions capable of being achieved by the waste-to-energy (WTE) sector through avoided fossil generation and reduced municipal landfills. The paper begins with a review of the current voluntary reporting mechanism for "registering" GHG reduction credits under section 1605(b) of the Energy Policy Act of 1992. The paper then provides an overview of possible emerging international and domestic trends that could ultimately lead to mandatory targets and timetables for GHG mitigation in the United States and other countries. The paper ends with an analysis of the GHG benefits achievable by the WTE sector, based on the section 1605(b) report filed by the Integrated Waste Services Association (IWSA) on the GHG emissions avoided for year 1995.

MECHANISM FOR REPORTING GREENHOUSE GAS EMISSIONS REDUCTIONS

On October 19, 1994, the Department of Energy (DOE) released final guidelines for reporting GHG emissions as required by section 1605(b) of the Energy Policy Act of 1992. These guidelines include six technical support documents for accounting and reporting GHG reductions from each of the following sectors: electricity supply, residential and commercial buildings, transportation, forestry, and agriculture. Entities may wish to report GHG emissions in order to gain recognition, to establish a public record for emissions and reductions for future reference, and to demonstrate support for voluntary approaches to achieving environmental policy goals. Participation in the voluntary reporting program could help to document the significant contribution that the waste-to-energy sector makes to meeting the United States' commitment to reducing GHG emissions.

Although DOE has created an extremely flexible program with many options for the voluntary reporting of GHG emissions and reductions, the agency also encourages the submission of as comprehensive a report as possible. A comprehensive report would include information about: the entire organization and all its GHG activities, historic baseline emissions data for 1987 through 1990, annual emissions, emissions reductions and carbon sequestration projects, other participants in the project, emissions factors used to determine reductions, data on secondary and indirect impacts of the mitigation project, assumptions about the project, and data sources.

DOE pressure for comprehensive reporting poses some risks for section 1605(b) participants. The failure to submit a comprehensive report could undermine the creditability of the underlying mitigation activity. Specifically, it is possible that participants will not receive the full credit and recognition for GHG reductions achieved if they submit only the minimum data required under the section 1605(b) program.

EPAct Section 1605(b) Reporting

Overview of Guidelines.
The guidelines are mandated under section 1605(b) of the Energy Policy Act of 1992, which requires DOE to provide guidance for the voluntary reporting of GHG emissions, their reduction, and carbon fixation achieved through any measure. The guidelines provide information on who may report, what

information may be reported, and how projects should be analyzed for reporting. As a general matter, the guidelines are extremely flexible and are structured in such a way as to promote broad participation. This flexibility should enable utilities to receive credit for GHG reductions achieved through a wide range of measures for mitigating GHG emissions.

Forms for reporting have been designed to suit the guidelines' flexibility. Form EIA-1605 allows individuals to give a detailed account of GHG emissions, reductions, and carbon sequestrations for the entire entity (e.g., corporation, facility) or for specific GHG mitigation projects (e.g., GHG reductions achieved through supply-side efficiency improvements). To accommodate those entities wishing to minimize the reporting burdens, DOE has developed Form EIA-1605EZ, a simplified form that only requires a brief synopsis of the GHG emissions reductions achieved by a specific project in the most recent calendar year. Completed forms are submitted to DOE's Energy Information Agency (EIA), which is charged with the responsibility of administrating the section 1605(b) reporting program and maintaining the GHG registry (e.g., database).

As indicated above, the guidelines are separated into eight sections: a general guidelines section and six technical support documents dedicated to issues particular to a specific sector or activity area. The discussion below provides a brief summary analysis of the general guidelines and the technical support documents related to the electric supply sector.

Method of Reporting.

Who May Report. The guidelines provide that the following groups or individuals may report: any U.S. citizen or resident alien; any company, organization, or incorporated group; and any federal, state, or local governmental entity. These entities may report their reductions or sequestration efforts as long as they can "define a project and report physical data in enough detail to quantify results of the activity." No minimum reporting threshold is established in order to encourage broad participation and participation by small-scale initiatives.

The DOE rule permits the reporting of activities undertaken in association with others, such as efforts by a utility to implement demand-side efficiency improvements at industrial or commercial facilities (e.g., installation of high-efficiency electric motors or green lighting). In order to avoid double counting, reporters must identify other parties participating in the activity. The rule also allows the reporting by a third party or trade association. As will be discussed below, IWSA has submitted a section 1605(b) report for the entire WTE sector.

What Information May Be Reported. Gases covered in the DOE reporting program include carbon dioxide (CO_2), nitrous oxide, methane, and halogenated carbon substances (e.g., CFCs, HCFCs, PFCs). DOE will count both direct and indirect emissions reduction and sequestration activities related to these four gases. DOE decided against limiting the program solely to direct emissions (which arguably would be more manageable and transparent) in favor of the flexible approach reflected in the guidelines. Direct emissions are those which result from fuel combustion or other processes that release greenhouse gases on-site. Indirect emissions are those which occur off-site from the party whose activities caused the emissions to be generated elsewhere. For example, a manufacturer would report as indirect the emissions associated with the electricity purchased from a utility used to light its assembly plant, since

the production of that electricity had caused emissions elsewhere. In the case of the WTE industry, the principal indirect GHG effect is the avoidance of CO_2 and methane from landfills.

International activities are included in the types of activities that may be reported. The same criteria will be applied to international activities as domestic activities. Difficulties may arise in analyzing the international activity, such as determining the reference case or obtaining credible data, so special attention should be given to direct and indirect effects of these activities.

How to analyze projects for reporting. The project may consist of all emission-producing activities of an organization, several activities, or only one activity. Every report must: (1) define the reference case to use as a basis for comparison with the project, utilizing historic data and/or use projected or modeled data; (2) identify the project's major or minor primary and secondary effects; (3) choose an estimation method using default data or measured/estimated data for the reference case and the project; and (4) report reductions. The general guidelines illustrate the project analysis process in three case studies: an industrial cogeneration project, an energy-efficient project in a large office building complex, and the purchase of new solar-powered electricity generating equipment. These case studies illustrate the varying levels of detail and analysis that can be included in the reports.

Baseline or Reference Case. In order to define the reference case (e.g., the emissions level against which to measure the effects of the project), DOE suggests using either historical data or projected data. Historical data would involve averaging emissions for some previous year(s). An average could be taken from the 1987 to 1990 period, or from some year(s) more accurately reflecting normal operations. Projected data would involve extrapolating the reference case from past trends and external data to determine what emissions would have been in the year in which the project's effects are being measured. This process may involve modeling and adjusting for growth over time. DOE also suggests estimating the emissions per unit of production using historic or current-year data and adjusting for future growth by multiplying this emission rate by the rate of production in the reporting year.

Estimation Methods. DOE provides guidance for choosing the method for estimating emissions levels for both the reference case and the project case to determine emissions reductions. The guidelines and supporting documents recognize three categories of data: physical data, default data, and reporter-generated data. Physical data describes the activities involved in the project. Default data includes emissions factors and stipulated factors. Stipulated factors allow the conversion of physical data about the project into estimates of changes in energy use, GHG emissions, or carbon sequestration. Emissions factors are provided in the specific sector supporting documents, described below.

Projected Mitigation Future Years. In certain cases, the mitigation activity may result in greater GHG reductions in future years than in the current reporting year. One obvious example is a forestry project that will sequester carbon dioxide over a thirty-year period. Although some carbon sequestration may be achieved during the initial year, most of the sequestration will accrue over the life of the forestry project. This is also the case for most WTE projects. As explained in the last section of this paper, the combustion of municipal solid waste provides the greatest GHG benefit by avoiding landfill methane and CO_2 over a 20-to-30 year period. In the final guidance, DOE recognized the problems that could ensue from a purely retrospective GHG reporting system (e.g., reporting only GHG emissions actually

reduced, avoided, or sequestered during the current reporting year). As a result, the final guidelines allow for the reporting of the GHG emissions mitigated for future years as well as the current reporting year.

Electricity Supply Sector. Utilities have the flexibility of reporting for their entire system, one specific project, or at some level in between. The "supply sector" technical document is intended to assist utilities in determining an appropriate scope for the reporting of their projects.

The DOE identifies the following types of emissions reduction measures that will be creditable under the section 1605(b) program:

- fuel substitution;
- direct carbon removal by "cleaning" the fuel prior to combustion or by "scrubbing" the emission stream following combustion;
- energy efficiency improvements in electricity generation, conversion, and transfer; and
- energy efficiency improvements in the end-use equipment (e.g., reducing energy demand).

The guidelines presents a standard methodology for estimating reductions from such projects, activities, and measures. The method is applicable to both carbon dioxide and non-carbon dioxide greenhouse gases and can be used to compute emissions from carbon content or from various technologies employed in the electricity supply sector.

FUTURE TRENDS

International

The Framework Convention on Climate Change is an international agreement that was signed by the U.S. and more than 150 nations at the Earth Summit in Rio de Janeiro in June 1992. The agreement committed signatory nations to take non-binding actions to reduce GHG emissions to 1990 levels by 2000. Emission levels for post-2000 were to be determined through subsequent negotiations following the Rio Convention.

The first of these negotiations -- the First Conference of the Parties of the Framework Convention on Climate Change -- occurred in Berlin in April 1995. At this conference, the parties agreed to launch a two year process to define actions and advance commitments to reduce GHG emissions in the post-2000 time frame. This agreement later became known as the "Berlin Mandate." The Second Conference of the Parties was held in Geneva from July 8-19, 1996. The Third Conference of the Parties is scheduled for December 1997 in Kyoto, Japan.

Geneva Conference. At the Geneva Conference, U.S. officials announced that for the first time the U.S. will seek to set verifiable and binding targets to reduce GHG emissions through an international agreement. On July 17, in a speech at the Second Conference of the Parties of the Framework

Convention on Climate Change in Geneva, Tim Wirth, Under Secretary of State for Global Affairs, stated that the U.S. is committed to reducing greenhouse gases, and that only through the setting of binding targets can progress toward emissions reductions be assured. Further, the setting of targets to reduce greenhouse gases must be achieved through maximum flexibility of implementation, which may include joint implementation and trading mechanisms. However, the U.S. proposal does not outline specific targets or goals for emission reductions -- specific numbers are to be decided through international negotiations at a later date.

In his speech, Wirth outlined the goals of the U.S. policy in seeking a binding agreement:

- the U.S. will focus on outcomes that are "real and achievable" and that will seek measured adjustments so that all nations may reduce emissions in an "economically sensible manner";
- the U.S. will seek market-based solutions that are flexible and fair and will not accept proposals that seek to gain an economic competitive advantage;
- the U.S. will seek a proposal that will require the participation of all nations, developing and developed, to take steps to limit emissions (the U.S. will continue to provide technical assistance to nations to help them reduce greenhouse emissions); and,
- the U.S. will seek to set verifiable and binding medium-term targets to reduce greenhouse gases.

In addition to outlining the guidelines for the U.S. proposal, Wirth criticized other proposals that have been submitted as being neither "realistic nor achievable." Further, Wirth underscored the importance of flexibility in the implementation of global emission reductions and that governments should be able to decide how they will achieve the reductions.

International Panel on Climate Change Report. Also presented in Geneva was a report by the Intergovernmental Panel on Climate Change (IPCC) on the environmental and socioeconomic impacts of climate change. Released in 1995, the IPCC report concluded that human activities have an adverse affect on climate change. These findings were officially accepted and supported by the Clinton Administration during the Geneva Conference.

Ministerial Declaration and Future Climate Change Activities. On the last day of the Geneva Convention, a ministerial declaration was adopted that calls for, or encourages, the development and establishment of legally binding post-2000 limits on GHG emissions. Provisions within this agreement, the "Geneva Declaration," encourage the development of legally binding emissions targets for developed countries and emissions reduction commitments from developing countries; endorse the conclusions of the IPCC report; support a U.S. recommendation that legally binding medium-term emission targets be pursued; and, urge expedited development, application, diffusion and transfer of climate friendly technology.

In December 1996, the Ad Hoc Group on the Berlin Mandate (AGBM) met to begin negotiations for emission reduction targets suggested in the Declaration. At that meeting, Parties to the Convention were asked to submit draft proposals for the climate change agreement for review at the next round of negotiations.

Move Towards Post 2000 Targets. The next negotiation session on the U.N. Framework on Climate Change was again held under the auspices of the AGBM in Bonn, Germany from February 25 to March 7. At that time, all draft proposals for a protocol, or other legally binding instrument, were reviewed. The 150 nations participating in the meeting failed to outline the bases for a Protocol to the U.N. Framework on Climate Change. There was no agreement on a timetable for reduction of GHG emissions, a CO_2 reduction target, or on whether reductions should be achieved through coordinated international policies or through policies determined by the individual countries. In the next step, the proposals will be combined into one document which will be distributed by June 1 and reviewed at the next AGBM meeting, scheduled to be held on July 28 - August 7 in Bonn, Germany.

Several different proposals were submitted for treaty negotiations. In January, the United States unveiled its proposal for tradeable emissions budgets to reduce the level of GHG emissions (see discussion below). In a move which surprised observers, the European Union (EU) agreed to call on industrial nations to cut GHG emissions by 15% by 2010. However, member countries were able to agree on country-by-country targets for only a 10% reduction. The remaining 5% reduction would be negotiated later. Other countries, notably the Pacific island states under threat from a rising sea level caused by global warming, are demanding a 20% reduction by 2005.

All of these proposals were criticized. The United States' proposal to create a system of tradeable GHG emission credits received a cool response from delegates and was attacked by environmental groups as "unintelligible, unpopular and extremely complicated." The United States and Japan claimed that the EU's proposal was not a firm commitment, but was simply an international negotiating position. In addition, the proposal was criticized because the proposed 15% reduction would be met by the EU as a whole, allowing some member countries to actually increase their emission levels. Industrialized nations reject the possibility of a 20% reduction on GHG emissions. Some industrialized nations continue to oppose the imposition of binding targets only on developed nations, claiming such a regime would allow developing countries an unfair trade imbalance because of the additional cost of goods produced under an emissions cap.

After the Bonn meeting, the United States proposed that Japan and the United States form a bilateral joint initiative to lead the world community in solving the global warming problem. Specific details of such a proposal have not been released, but Vice President Al Gore has stated that the proposal could be the basis for climate change negotiations later this year.

One final negotiating session is scheduled for October 20-21 before the Third Conference of the Parties to the UN Framework Convention on Climate Change meeting scheduled for December 1-12, 1997 in Kyoto, Japan. At the Third Conference of the Parties, the Parties will decide on what provisions will be included in a final agreement on climate change. The United Nations has insisted that the final agreement must include binding commitments to limit greenhouse gases.

National

U.S. Draft Climate Change Proposal. On January 17, the U.S. submitted its draft protocol to the United Nations for consideration in the climate change negotiations. The U.S. draft document proposes a number of provisions that the U.S. would like included in the final climate change agreement, including the strengthening of commitments by developing countries and the creation of emission trading provisions for developed countries.

The U.S. draft proposal includes a "trigger mechanism" that calls for the creation of a negotiation process that would include binding provisions for developing countries to reduce emissions to be completed by the year 2005. This negotiation process would take place through a separate round of negotiations after the Third Conference of the Parties is complete. The current climate change proposal under consideration by the Parties requires developed nations to take mandatory steps to reduce emissions, while developing countries are encouraged on a voluntary basis.

Further, the U.S. draft proposal would require developing countries to undertake the following:

- prepare annual reports on emissions inventories and report on steps to reduce emissions; and,
- identify and implement measures, not yet specified, to mitigate emissions.

For developed nations, the draft protocol proposes:

- to establish an "emission budget" for each country. The emission budget would encompass a multiple year period (or "budget period") in which a country would be allowed to "bank" emissions credits not used during the current period for future use, to "borrow" emissions credits (with a penalty) from a subsequent budget period, or trade emissions. The draft does not specify the size of the emission budgets (i.e. emissions allowances) or the duration of the budget periods (yet to be determined). The U.S. is currently considering budget periods between 3-10 years. In addition, the U.S. draft proposal states that after the first budget period and corresponding emission budget allowance, subsequent emission budgets must be less than or equal to the previous emission budget;
- to establish a process for reviewing developing country reports and improve emission reduction strategies;
- to allow emissions trading between countries with emissions budgets;
- to permit joint implementation between developed and developing countries, through which developed countries would receive emission credits for transferring energy efficient technology to developing countries; and,
- to create a national system for measuring emissions and reporting annually on measurement, compliance and enforcement practices for the relevant budget period.

Current political climate. In response to the U.S. policy shift toward verifiable and binding targets to reduce GHG emissions, both the Senate and House Commerce Committees held hearings in September on the status of the climate change negotiations.

At the hearings, House and Senate Members expressed concern regarding the Administration's position in the climate change negotiations. Several Members criticized the Administration for acting hastily on this issue without sufficient scientific data and for supporting positions that could harm the American economy and cost American jobs. Further, Members of Congress disagreed with any policy that would set binding emissions reduction targets for developed, but not for developing, countries.

The response to the new draft protocol has been lukewarm in the United States. Environmentalists feel that the unanticipated move toward flexibility in reaching emissions targets is a step backward. They also claim that the logistics of implementing an emissions trading plan, and then verifying its success or failure, will prove to be difficult. Industry, on the other hand, urges the administration to analyze the economic impacts of current climate change policy before committing itself to targets and time tables. However, in February more than 2,000 economists, including six Nobel Laureates, signed a statement declaring that preventive, market-based steps are necessary in light of the significant environmental, economic, social and geopolitical risks of global climate change. Such consensus may influence U.S. policy makers.

Committees in the House and Senate have stated that they intend to hold hearings on global climate change during the current Congressional session. Senator John Chafee, Chair of the Environment and Public Works Committee, is calling for nations to met flexible but binding emissions targets for greenhouse gases. While observers question whether a Republican-controlled Congress would ratify a treaty containing legally binding targets, the United States may be under increasing international pressure to make such a commitment in light of the ranking by the World Wildlife Fund of U.S. efforts to reduce CO_2 emissions as the absolute worst of the 20 major industrialized nations.

WASTE-TO-ENERGY IS CAPABLE OF ACHIEVING SUBSTANTIAL GREENHOUSE GAS EMISSIONS REDUCTIONS

There are approximately 135 municipal waste combustion (MWC) facilities currently operating in the United States. Most of the MWC facilities (91) are waste-to-energy plants that generate electricity or steam by feeding mixed municipal waste into large furnaces dedicated solely to burning trash. In a limited number of cases (23), the MWC facility generates electricity or steam by burning a refuse-derived fuel (RDF) that has removed recyclable and unburnable materials and then shredded or processed the remaining trash into a uniform fuel. In addition, there exist 11 RDF processing plants that provide RDF not only for furnaces dedicated to burn RDF, but also boilers that burn fossil fuel or other waste fuels.[1/]

1/ In 21 cases, the MWC facility is an incinerator that combusts trash but does not recover energy from waste.

This section discusses several ways in which one might expect waste-to-energy facilities to mitigate GHG emissions. The first is the CO_2 that would have been emitted from the combustion of fossil fuel in order to generate electricity or steam. The second is the avoidance of methane and CO_2 that would have been emitted if the municipal solid waste had been disposed in a landfill instead of burned in MWC facility. As the discussion below indicates, the greatest opportunity for GHG mitigation exists from avoiding landfill gas emissions as well as ash reuse for various commercial purposes. The discussion below is based on IWSA's section 1605(b) report submitted to the EIA on GHG emissions avoided by the WTE industry for the year 1995.[2/]

Avoided Fossil Generation.

One important benefit of waste-to-energy facilities is that they displace the use of fossil fuel for generating electrical power and steam. In 1995, for example, the waste-to-energy sector combusted over 31 million tons of municipal waste. The combustion of this fuel source resulted in the generation of 2650 megawatts of electricity every hour[3/] and the export of nearly 1.4 million pounds of steam every hour. As a point of reference, this energy output is sufficient to meet the power needs of 1.2 million homes and businesses across the country. In addition, the combustion of this municipal waste avoided the use of about 30 million barrels of crude oil or almost 9 million tons of bituminous coal that would be necessary to generate an equivalent energy output.

The avoidance of fossil fuels in such a substantial amount has many clear energy, economic, and environmental benefits for the nation. Unfortunately, a direct net reduction in GHG emissions is not one of them. Using year 1995 as an example, waste-to-energy facilities emitted 31.3 million tons of CO_2 emissions to generate 2650 megawatts per hour. This represents a CO_2 emissions increase of slightly over 9 million tons, when compared against the CO_2 levels that would have been emitted from replacement coal-fired generation.[4/] In assessing the total GHG consequences of WTE facilities, the analysis does not end with a simple comparison of WTE and power plant emissions. As the next subsection indicates, WTE facilities also produce a number of indirect GHG benefits by reducing the amount of MSW deposited in landfills. These benefits more than offset any marginal increase in CO_2 emissions resulting from MSW combustion at WTE facilities.

Avoided Landfill Gases.

CO_2 and methane are two greenhouse gases emitted from landfills as the organic waste decomposes over a 20 to 30 year period. The decomposition begins with aerobic bacteria consuming oxygen while converting organic substances to CO_2, heat and water. This process continues until all available oxygen is depleted. After oxygen depletion, decomposition of organic material continues under anaerobic

---

2/ The authors would like to recognize the efforts of Maria Zannes, President of IWSA, and Greg Gesell, American Ref-Fuel, in preparing the section 1605(b) report submitted on behalf of the WTE sector for year 1995.

3/ Assuming parasitic usage of 20 percent, the net power exported into the grid is estimated to be approximately 2120 megawatts of electricity per hour.

4/ The combustion of 31.3 million tons of waste by WTE facilities results in about 31.3 million tons in CO_2 emissions. In contrast, coal-fired generation of an equivalent energy output results in 21.1 million tons of CO. The reasons for this decrease of slightly over 9 million tons result from more a favorable heating value, heat rate, and CO_2 conversion factor for fossil fuel sources than waste-to-energy facilities.

conditions. In the absence of oxygen, anaerobic bacteria begin digesting the waste and producing methane. Over the life of the landfill, organic materials will be broken down into CO_2 and methane at ratio of approximately 45:55.

The combustion of MSW avoids the release of both CO_2 and methane from landfills. In the case of 33.3 million tons of MSW combusted in 1995, this translates into the avoidance of about 9 million tons of CO_2 over the life of the landfill. Similarly, landfill methane will be reduced by about 4 million tons over the same time frame. It should be noted that methane has substantially higher global warming potential than CO_2. According to latest estimates, methane has a "heat-trapping" capacity that is some 24.5 times greater than that of CO_2. Applying this factor to instant example, the avoidance of 4 million tons of methane is equivalent to a CO_2 emissions reduction of 98 million tons. Table 1 provides a summary of these GHG benefits. It should be noted that some landfills collect and combust a portion of the emitted methane. A few landfills use this methane for the generation of electricity. (See below.)

The Environmental Protection Agency (EPA) has promulgated New Source Performance Standards (NSPS) and Emissions Guidelines (EG) for landfills under Title I of the Clean Air Act.[5/] The requirements of the NSPS and EG are basically the same, with the main difference being the timing of implementation and the lead agency. Specifically, EPA administers the NSPS which takes place immediately for affected new landfills, while states implement the EG for affecting existing landfills once States have completed and received EPA approval of their implementation plans. As a general matter, the NSPS and EG standards require the collection and destruction of landfill gases at those facilities with a design capacity of 2.5 million metric tons and with annual non-methane organic compound emissions of at least 50 megagrams per year. Once fully implemented, affected landfills will consist of approximately two thirds of the nation's total landfill capacity. Although some landfills may install an energy recovery system, most facilities are expected to install a flare system that will burn off the collected methane. Although such flaring systems will reduce the amount of methane released into the atmosphere from regulated landfills, the methane combusted by flaring will result in a CO_2 emissions increase of 24.1 million tons. Table 2 provides a summary of these GHG benefits assuming all (e.g., affected and nonaffected) landfills comply with EPA's NSPS and EG requirements.

Ash Reuse.

In recent years, the use of MSW combustion ash has begun to increase for the WTE sector. Fifteen facilities currently are using a portion of their ash either as landfill cover, road building material or artificial reefs. Ash reuse is underway in projects from Florida to Maryland, Minnesota, Pennsylvania, Massachusetts, Tennessee and New York. There exist many additional safe applications of MSW combustion ash, which could provide a useful solid by-product and result in avoidance of GHG emissions. One example is use of WTE ash by-products in many cement and concrete applications as a substitute for portland cement and natural aggregates. The manufacture of portland cement and the mining of natural aggregates require considerable amounts of fossil energy and produce CO_2 emissions. Replacing portland cement or natural aggregates with WTE ash will offset the amount of fossil energy consumed and associated GHG emissions.

5/ See 61 Fed. Reg. 49,9905 (March 12, 1996).

Although not included in IWSA's section 1605(b) report, the use of MSW combustion ash represents another important GHG mitigation benefit resulting from WTE facilities. This mitigation opportunity, however, will only taken on greater importance as potential barriers to ash reuse are removed.[6/]

CONCLUSION

WTE facilities have the capability of achieving substantial GHG benefits for the environment. This becomes especially evident when avoided landfill gases are factored into the GHG mitigation analysis. Using 1995 as an example, WTE facilities are capable of achieving what is equivalent to a net CO_2 reduction of up to 98 million tons. If the amount of MSW combusted annually were to triple over the near term, the amount of CO_2-equivalent emissions avoided could increase up to almost 300 million tons per year. Such reductions would substantially contribute to the Clinton Administration's efforts to meet current and future GHG mitigation obligations being negotiated by international treaty.

6/ Many of these barriers are related to safety concerns about the MSW combustion ash. These concerns, however, are largely unfounded. Specifically, the WTE sector has been testing for the safe management of MSW combustion ash for over a decade. These studies consistently show that leachate from ash landfills is similar to salty ocean water, with metals content at about the same level as the standards set for safe drinking water. MSW combustion ash tested under federal guidelines has consistently shown to be non-hazardous.

Table 1. NET GHG Benefit for 1995.

Greenhouse Gas	Emissions in Equivalent CO_2
Avoided Emissions Resulting from WTE Sector	
Fossil Generation CO_2	22 million tons
Landfill Methane	98 million tons
Landfill CO_2	9 million tons
Total	129 million tons
Emissions from WTE Sector	
Fossil Generation CO_2	31 million tons
Net CO_2 Benefit	98 million tons

Table 2. NET GHG Benefit for 1995 (assuming all landfills comply with EPA's NSPS and EG requirements).

Greenhouse Gas	Emissions in Equivalent CO_2
Avoided Emissions Resulting from WTE Sector	
Fossil Generation CO_2	22 million tons
Landfill CO_2	24 million tons
Total	46 million tons
Emissions from WTE Sector	
Fossil Generation CO_2	31 million tons
Net CO_2 Benefit	15 million tons