Climate Change and Waste
Reducing Waste Can Make a Difference

Climate Change and Municipal Solid Waste: Environmental Issues With an Important Underlying Link

Rising levels of gases in the Earth's atmosphere have the potential to cause changes in our climate. Some of these emission increases can be traced directly to solid waste. The manufacture, distribution, and use of products—as well as management of the resulting waste—all result in emissions of greenhouse gases that affect the Earth's climate. Waste prevention and recycling are real ways to help address climate change.

What Is the Greenhouse Effect?

The atmosphere that surrounds the Earth contains many types of gases, including those known as "greenhouse gases." Greenhouse gases (GHG) absorb and retain heat from the sun. They regulate the Earth's climate by holding warmth in an atmospheric blanket around the planet's surface. Scientists call this phenomenon the "greenhouse effect."

Without greenhouse gases, the average temperature on Earth would be -2 degrees Fahrenheit instead of the current 57 degrees Fahrenheit. Excess greenhouse gases in the atmosphere, however, can raise global temperatures. In the past 100 years, scientists have detected an increase of 1 degree Fahrenheit in the Earth's average surface temperature.

What Are the Effects of Climate Change?

Why try to reduce greenhouse gas emissions? Increased concentrations of greenhouse gases in the atmosphere threaten to disrupt the diversity of habitats and the life dependent on them. In particular, our health, agriculture, water resources, forests, wildlife, and coastal areas are vulnerable to the changes that global warming may bring. A rise of only a few degrees in the Earth's average temperature could result in:

- More frequent and intense storms
- Flooding of beaches, bay marshes, and other low-lying coastal areas
- More precipitation in some areas and not enough in others
- Wider distribution of certain infectious diseases

Such significant changes could damage communities and national economies as well as alter the natural world. Of course, many uncertainties remain. No one can predict the precise timing, magnitude, and regional patterns of climate change. Nor can anyone foretell the ability of mankind and nature to adapt to such changes.

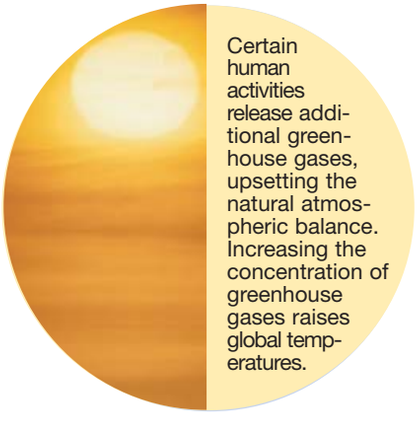
It is clear, however, that climate change will not be easily reversed. Because greenhouse gases remain in the atmosphere for a long time, turning back climate change may take decades or even centuries.

What Is the Link Between Waste and Climate Change?

Waste prevention and recycling-jointly referred to as waste reduction-help us better manage the solid waste we generate. But preventing waste and recycling also are potent strategies for reducing greenhouse gases. Together, waste prevention and recycling:

- **Reduce emissions from energy consumption.** Recycling saves energy. Manufacturing goods from recycled materials typically requires less energy than producing goods from virgin materials. Waste prevention is even more effective. When people reuse things or when products are made with less material, less energy is needed to extract, transport, and process raw materials and to manufacture products. The payoff? When energy demand decreases, fewer fossil fuels are burned and less carbon dioxide is emitted to the atmosphere.
- **Reduce emissions from incinerators.** Recycling and waste prevention allow some materials to be diverted from incinerators and thus reduce greenhouse gas emissions from the combustion of waste.
- **Reduce methane emissions from landfills.** Waste prevention and recycling (including composting) divert organic wastes from landfills, reducing the methane released when these materials decompose.
- **Increase storage of carbon in trees.** Trees absorb carbon dioxide from the atmosphere and store it in wood, in a process called "carbon sequestration." Waste prevention and recycling of paper products allow more trees to remain standing in the forest, where they can continue to remove carbon dioxide from the atmosphere.

The Earth's atmosphere contains greenhouse gases that hold the sun's warmth. In this way, greenhouse gases help control global temperatures.



Certain human activities release additional greenhouse gases, upsetting the natural atmospheric balance. Increasing the concentration of greenhouse gases raises global temperatures.

Measuring the Benefits of Waste Reduction

To help measure the climate change benefits of waste reduction, EPA conducted a comprehensive study of greenhouse gas emissions and waste management. The study estimated the greenhouse gas emissions associated with managing 16 types of waste materials: office paper, newspaper, corrugated cardboard, aluminum cans, steel cans, glass, plastic (HDPE, LDPE, and PET), magazines/third-class mail, phone books, textbooks, dimensional lumber, medium-density Fiberboard, food scraps, and yard trimmings. Management options analyzed in the study included waste prevention, recycling, composting, incineration, and landfilling.

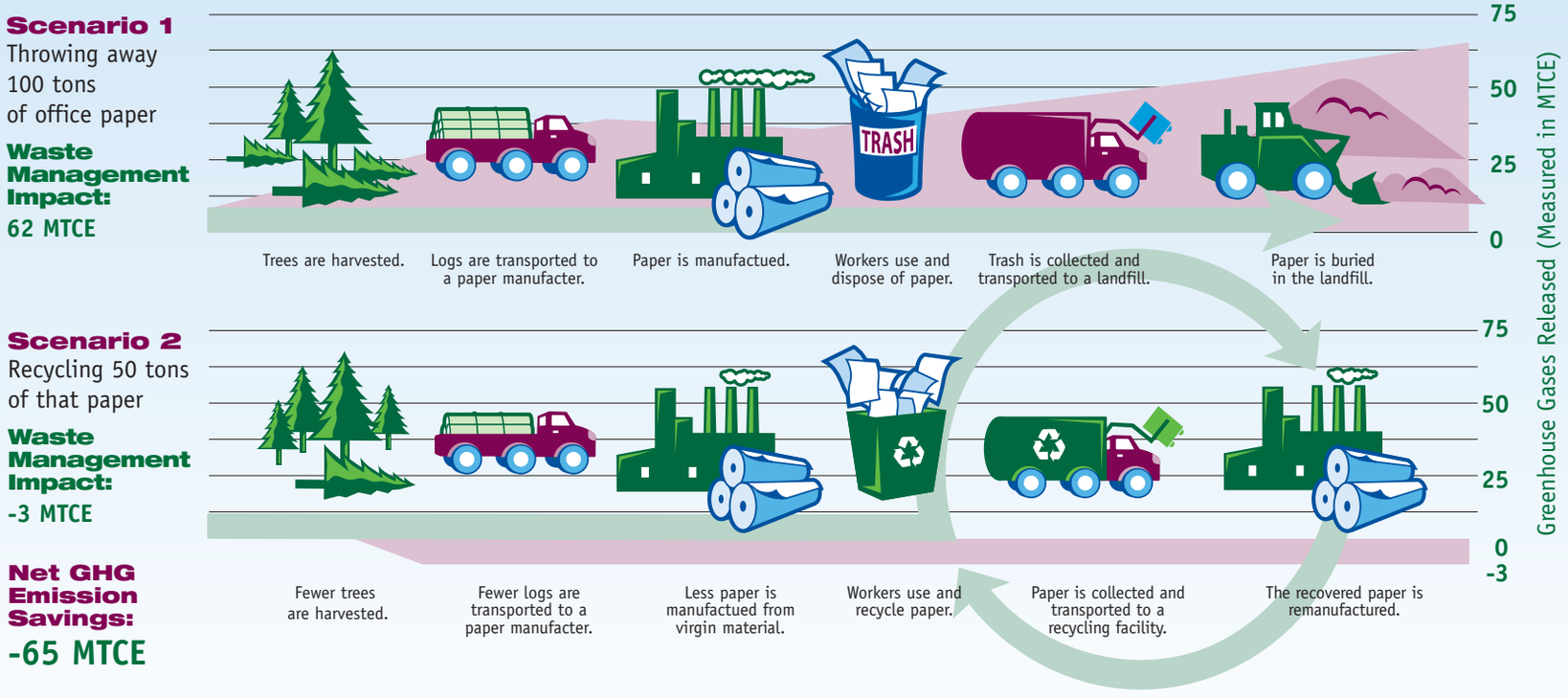
The research indicates that, in terms of climate benefits, waste prevention is generally the best management option. Recycling is the next best approach. The research enables waste managers to analyze their potential to reduce GHG emissions based on the characteristics of their community's waste stream and the management options available to them.

Waste prevention can make an important difference in reducing emissions. By cutting the amount of waste we generate back to 1990 levels, we could reduce greenhouse gas emissions by 18 million metric tons of carbon equivalent (MMTCE), the basic unit of measure for greenhouse gases. EPA estimates that increasing our national recycling rate from 30 percent in 2000 to 35 percent would reduce greenhouse gas emissions by another 10 MMTCE, compared to landfilling the same material. Together, these levels of waste prevention and recycling would be comparable to annual emissions from the electricity consumption of nearly 4.9 million households.

Every little bit helps! For example, by recycling all of its office paper waste for one year, an office building of 7,000 workers could reduce greenhouse gas emissions by 570 metric tons of carbon equivalent (MTCE), when compared to landfilling. This is the equivalent to taking about 370 cars off the road that year. If an average family of four were to recycle all of its mixed plastic waste, nearly 340 pounds of carbon equivalent emissions could be reduced each year.

You Can Make a Difference!

By choosing to prevent waste and recycle, you can help curb climate change. Assume your office, for example, throws away 100 tons of white office paper each year. If you recycle just half that amount of paper, look what happens:



What Are Greenhouse Gases?

Some greenhouse gases occur naturally in the atmosphere, while others result from human activities.

Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. Certain human activities, however, add to the levels of most of these naturally occurring gases.

Carbon dioxide is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned.

Methane is emitted during the production and transport of coal, natural gas, and oil; the decomposition of organic wastes in municipal solid waste landfills; and the raising of livestock.

Nitrous oxide is emitted during agricultural and industrial activities, as well as during the combustion of solid waste and fossil fuels.

Several classes of halogenated substances are also greenhouse gases. **Hydrofluorocarbons** (HFCs), **perfluorocarbons** (PFCs), and **sulfur hexafluoride** (SF_6) are potent greenhouse gases that primarily result from industrial activities. Sources of HFC emissions include foams, refrigeration, air-conditioning, solvents, aerosols, and fire extinguishing sectors. PFCs and SF_6 are predominantly emitted from industrial processes, including magnesium casting, aluminum smelting, semiconductor manufacturing, and electric power transmission and distribution systems.

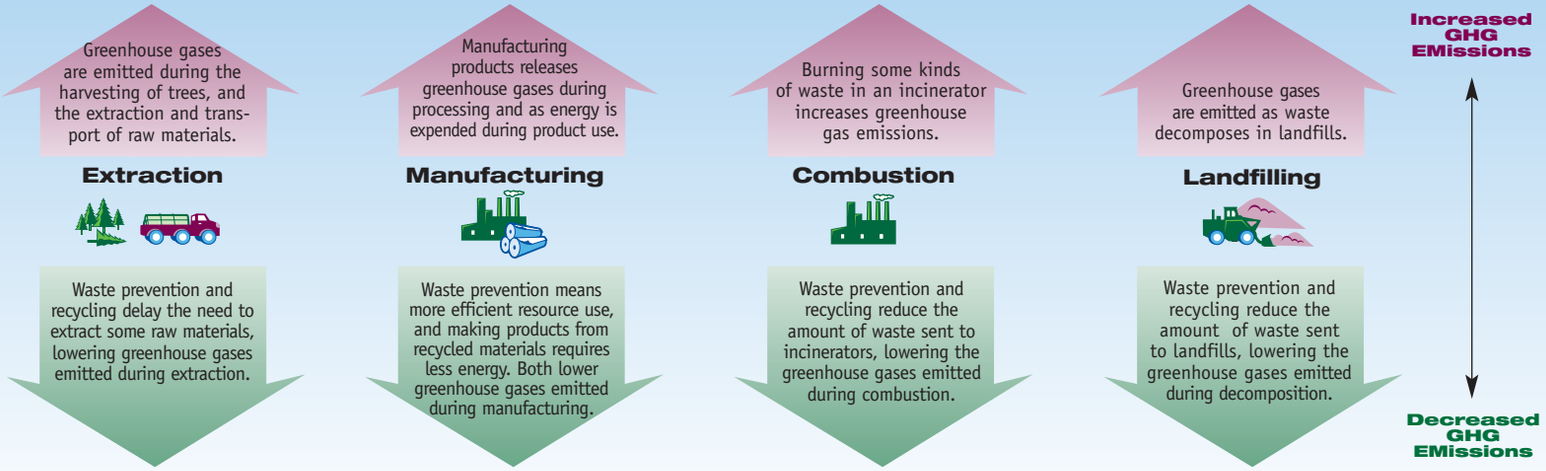
Each greenhouse gas differs in its ability to trap heat in the atmosphere. SF_6 is the most heat absorbent, trapping 23,900 times more heat than carbon dioxide. Methane traps over 21 times more heat than carbon dioxide, and nitrous oxide absorbs 310 times more than carbon dioxide.

Find these materials online at
www.epa.gov/mswclimate

For more information

For an online copy of EPA's report "Solid Waste Management And Greenhouse Gases" (EPA 530-R-02-006) and for additional educational materials on climate change and waste, access www.epa.gov/mswclimate. EPA's Landfill Methane Outreach Program (LMOP) also demonstrates how to put waste to good use. As organic waste in landfills decomposes, it produces methane gas, which contributes to global warming. LMOP works with companies, energy suppliers and users, and communities on how to capture landfill gas and convert it to energy. Access the LMOP Web site at www.epa.gov/outreach/lmop/.

The Link Between Waste Management and Greenhouse Gases



How Are EPA Programs Slowing Climate Change?

The United States is committed to reducing greenhouse gas emissions. In 1992, the United States joined 160 other countries as a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), which calls on countries to reduce their greenhouse gas emissions. Since 1994, the United States has been implementing a series of voluntary initiatives to achieve reductions in greenhouse gas emissions from all sectors of our economy. There are currently more than 50 separate initiatives, including one that aims to reduce greenhouse gas emissions through waste reduction and recycling.

Waste prevention and recycling can make a significant contribution to reducing our nation's greenhouse gas emissions. By 2010, the U.S. expects to reduce greenhouse gas emissions by 5.6 MMTCE through waste prevention and recycling. These reductions are the carbon equivalent to taking more than 4 million cars off the road for one year. To help achieve these reductions, EPA supports a number of programs, including:

- **WasteWise.** WasteWise is a voluntary partnership between EPA and U.S. businesses, Federal, tribal, state and local governments, and institutions to prevent waste, recycle, and buy and manufacture products made with recycled materials. Presently, more than 1,200 organizations are participating in the WasteWise program.
- **Pay-As-You-Throw Programs.** EPA provides technical and outreach assistance to encourage communities to implement pay-as-you-throw systems for managing solid waste. Under pay-as-you-throw, residents are charged based on the amount of trash they discard. This creates an incentive for them to generate less trash and recycle more. Currently, there are over 5,000 pay-as-you-throw communities in the U.S. On average, communities with pay-as-you-throw see waste reductions of 14 to 27 percent.

EPA's voluntary partnership programs for climate protection have already achieved substantial environmental results. In 2000 alone, these programs reduced GHG emissions by 35 MMTCE, the equivalent of eliminating the emissions of approximately 24 million cars. In addition, an increasing number of states have been instituting their own voluntary actions to reduce emissions. Twenty-five states and Puerto Rico have completed or initiated state action plans, which list steps to reduce emissions. At least six of these states have incorporated the reduction of waste into their GHG mitigation strategies.

Taking climate change mitigation efforts one step further, in February 2002 President Bush committed the nation to reduce greenhouse gas intensity by 18 percent over the next decade—equivalent to a 4.5 percent reduction from forecast emissions in 2012. These reductions will be reached through a combination of voluntary, incentive-based, and existing mandatory measures.

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