

Source Reduction and Recycling: A Role in Preventing Global Climate Change

The production, transport, and disposal of Municipal Solid Waste leads to greenhouse gas (GHG) emissions. GHG emissions trap heat in the Earth's atmosphere and the release of these gases occurs at every stage of a product's life-cycle, contributing to climate change. However, certain measures can be taken to reduce the potentially negative effects on human health and the environment due to changes in the Earth's atmosphere.

The U.S. Environmental Protection Agency estimates that cutting back waste generation to 1990 levels could reduce GHG emissions by 11.6 million metric tons of carbon equivalent (MMTCE). Increasing our national recycling rate from its current level of 28 percent to 35 percent would reduce GHG emissions by 9.8 MMTCE, compared to landfilling the same material. Together, these levels of waste prevention and recycling would slash emissions by more than 21.4 million MMTCE – an amount equal to the average annual emissions from the electricity consumption of roughly 11 million households.

Carbon Equivalents:

GHG emissions in the U.S. are most commonly expressed as "million metric tons of carbon equivalents" (MMTCE). Global warming potentials are used to convert GHG to carbon dioxide equivalents. Carbon dioxide equivalents can then be converted to carbon equivalents by multiplying the carbon dioxide equivalents by 12/44 (the ratio of the molecular weight of carbon to carbon dioxide).

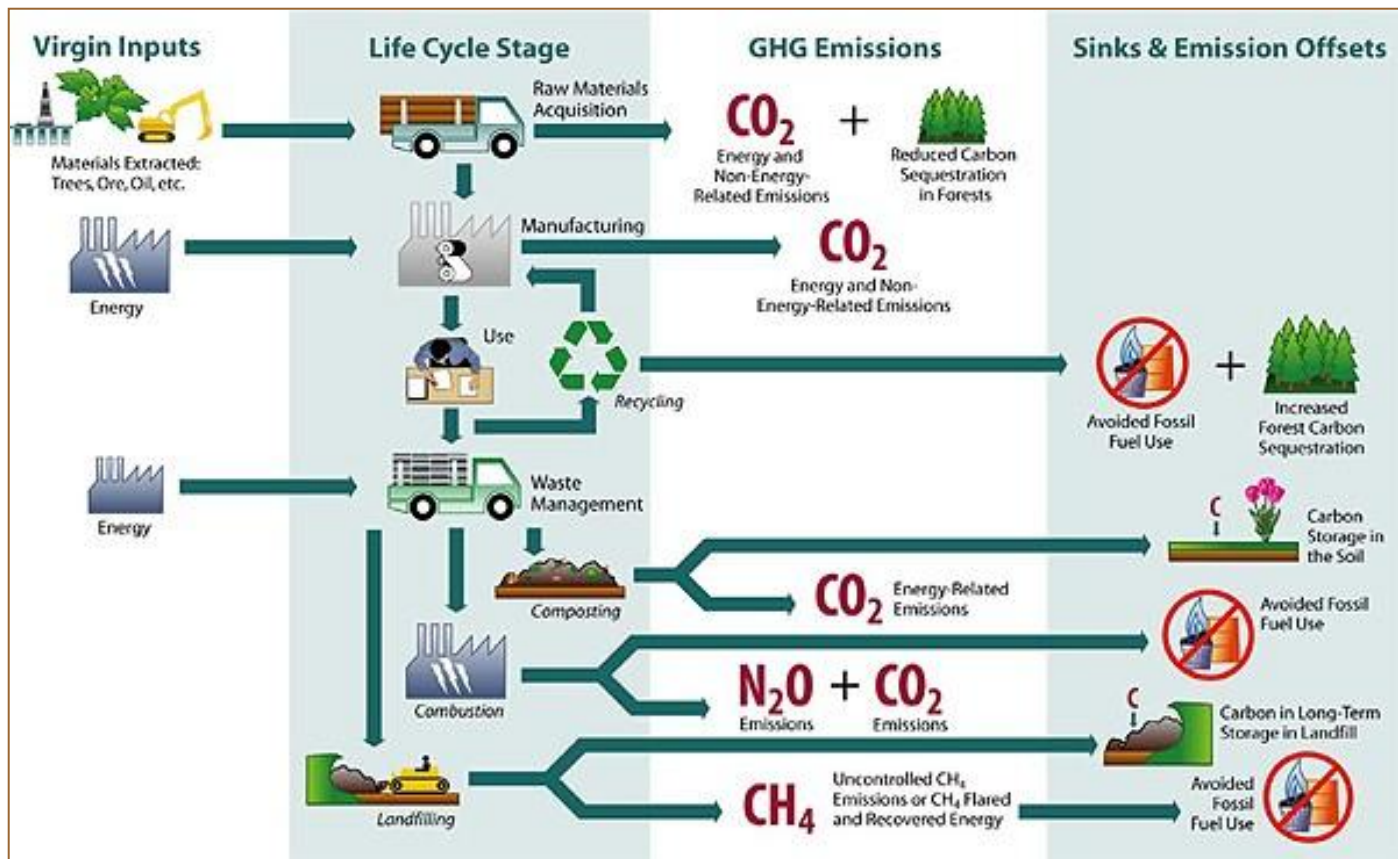
The Link Between Solid Waste and GHG Emissions

The disposal of solid waste produces GHG emissions in a number of ways.

- The anaerobic decomposition of waste in landfills produces **methane**, a GHG *21 times more potent* than carbon dioxide. Landfills are the top human-caused source of methane.
- The incineration of waste produces **carbon dioxide** as a by-product. In 2005, EPA's WARM model showed that GHGs equivalent to 99 million metric tons of CO₂ were released as a consequence of discarded packaging alone. It would take almost 83 million acres of pine or fir forest one year to store that much carbon.
- Materials that are disposed of in landfills must be replaced by new products manufactured from raw materials. Extraction of raw materials and manufacturing activities to new products requires **fossil fuel combustion**. According to Oregon's evaluation of GHG emissions from solid waste, landfills and incinerators contribute approximately one percent of Oregon's GHG emissions; however, "upstream" or production-related emissions are approximately 10 times higher, due to transportation of materials and industrial energy use.

Region IV Municipal Government Toolkit

The Municipal Government Toolkit was developed to assist agencies in initiating or improving waste reduction programs. You can find case studies, reports, best management practices, fact sheets, and sample legislation to bolster your community program. For more in-depth resources to help your community maximize its waste prevention potential, visit: <http://www.epa.gov/region4/recycle/govtoolkit.html>



Source: EPA's *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks* (3rd Edition)

Product Life-Cycles Diagram

The diagram above illustrates the four main stages of product life cycles, all of which provide opportunities for GHG emissions and/or offsets. These stages are raw material acquisition, manufacturing, recycling, and waste management.

The Role of Recycling:

How Can My Community Reduce GHG Through Recycling?

When a material is *recycled*, it is used in place of virgin inputs in the manufacturing process, rather than being disposed of and managed as waste. Collecting and processing secondary materials, manufacturing recycled-content products, and then purchasing recycled products creates a loop that ensures the overall success and value of recycling and thus leads to an overall success of reducing GHG emissions. Here are some ways to make a difference in your community through recycling efforts:

- **Collect and Process Recyclables**

Once collected, recyclables are sent to a materials recovery facility to be sorted and prepared into marketable commodities for manufacturing. Recyclables are bought and sold just like any other commodity, and prices for the materials change and fluctuate with the market.



In action: South Carolina has a 35 percent recycling goal. If just one county, such as Anderson County, meets this goal, the County could meet the demands of several recycling markets. Anderson County is conveniently

located on I-85 with easy access to Atlanta-based and Charlotte-based suppliers. Striving to meet recycling goals such as these can have an impact on reducing GHG emissions in any community.

- **Support the Manufacturing of Recyclables**

Contrary to popular belief, there *is* a lucrative market for recycled goods. More and more of today's products are being manufactured with total or partial recycled content. Recycled materials are being used in innovative applications, such as recovered glass in roadway asphalt (glassphalt) or recovered plastic in carpeting, park benches, and pedestrian bridges. In the southeast especially, there is great demand from suppliers for recycled materials. In 2004, Georgians discarded 225.6 tons of office paper that could have been recycled. This number represents 28 percent of the paper needed each year by Georgia-based SP Newsprint Co. to produce recycled newspaper. By developing products with more recycled content, GHG emissions can be further reduced. Simply increasing the recycled content of polyethylene terephthalate (PET) bottles from 10 percent to 50 percent creates more than a 40 percent savings in energy during manufacturing.

In Action: In 2005, Mississippi saw 480,000 tons of coal combustion by-products (CCBs) used beneficially in the state in various construction projects as a replacement material for limestone and other similar products. Using CCB's in this manner saved transportation and raw material costs for various industries, local governments, and construction contractors in the state.

- **Purchase Recycled Products**

By "buying recycled," governments play an important role in making the recycling process a success. In January 2007, the President signed Executive Order 13423 requiring federal agencies to use sustainable environmental practices when acquiring goods and services, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products. Although this Order applies to Federal agencies, similar policies can be set on the local level to support efforts to reduce GHGs and encourage broader participation in the recycling market.

In Action: Salisbury, North Carolina is the first city in the country to use locally manufactured 100 percent recycled bricks and brick pavers in citywide improvements. The bricks and pavers, called "Green Leaf Brick," are composed of 100-percent recycled materials, specifically designed, and engineered for the environmental or green-oriented builder.

What about composting? Composting is a management option for food discards and yard trimmings. The net GHG emissions from composting are lower than those for landfilling since composting avoids methane emissions. Instead of being released into the atmosphere, the soil serves as a sink for GHG emissions. In the state of Georgia, yard trimmings are presently banned from being deposited in municipal solid waste landfills. According to the Department of Community Affairs, prior to this ban going into effect in 1996, yard trimmings accounted for 18 percent of the state's municipal solid waste stream. Lifting the ban has the potential for reducing landfill capacity by eight years, not only releasing more GHGs, but also requiring eventual development of more landfills in the State.

The Role of Source Reduction:

How Can My Community Reduce GHGs Through Source Reduction?

Source reduction is the most effective way to prevent waste. When a material is *source reduced*, GHG emissions associated with producing the material and the management of post-consumer waste is avoided. Source reduction can be achieved using various practices, such as:

- Lightweighting (using less material)
- Use of recycled materials in production
- Substituting one material with another more environmentally preferable

Source reduction is possible in several industries. Georgia-based Mohawk Industries uses one-third of all PET plastic, including beverage containers recovered in North America in the production of their carpet.

- material, or
- By-product synergy.

By educating the community about the opportunities for avoiding unnecessary material waste, great energy and environmental benefits can occur. One way to do this is through the development of by-product synergy partnerships. By-product synergy occurs when one entity utilizes certain waste materials in their production practices that another entity typically discards. Therefore, a loop is formed and excess materials are prevented from entering the waste stream.

What Are Other Communities Doing to Curb Their Impact on Climate Change?

State data from **Georgia** shows that during 2004, 526 thousand metric tons of CO₂e were emitted as a consequence of landfilling, while 7.2 million metric tons of CO₂e were prevented from being released due to recycling.

In the state of **Florida** in 2000, two million BTUs of energy were wasted due to discarded packaging. This number is equivalent to over 446 thousand cars on the road for a year.

In **Kentucky**, the first recycling grant was awarded in June 2007 for a total of \$2.3 million. With the influx of the recycling grants, rural areas in Kentucky that do not have recycling opportunities will have the funding to develop a recycling program to educate their citizens on the importance of recycling. Increased participation in recycling will inevitably serve to further reduce GHG emissions.

Effective January 2008, the state of **North Carolina** will ban the disposal of beverage containers by certain permit holders. Due to high demand for products made from recycled glass and ready markets both in the state and nearby, certain restaurant and bar establishments must ensure that valuable containers are not discarded. The ban will benefit glass, aluminum, and plastic suppliers. Not only will energy be saved by avoiding the extraction of raw materials for production, but the reduction of valuable commodities from the waste stream will prevent the release of GHGs into the atmosphere.

In 2005, **Mississippi** recycled over six million waste tires representing approximately 95 percent of the waste tires collected from in state and out-of-state sources. In addition, the national Rubber Manufacturers Association ranked Mississippi as the 5th state nationally in performance of state waste tire management and recycling programs. All 82 counties in Mississippi offer waste tire collection centers for residents. As the No. 1 tire recycler, South Carolina demonstrates, there is always room for even greater GHG reductions.

In 2006, **Americans** recycled 82 million tons of solid waste (32.5 percent of waste generated), providing an annual benefit of 49.7 MMTC of reduced emissions, or the equivalent to taking 39.4 million passenger cars off the road.

South Carolina is the No. 1 state for tire recycling in the country. In addition to this accomplishment, the State set up *The Waste Tire Grant Program*. The program is funded by fees placed on new tires. Retailers must include a two dollar fee on every new tire sold in South. Fifty cents of the fee goes to the DHEC (Department of Health, and Environmental Control) and is used for grants for counties or local governments. Waste tire grants are used only for the collection or recycling of waste tires.

How Can State & Local Governments Get Started With Waste Reduction?

States are developing and implementing a range of programs and strategies that are cost-effectively reducing GHG, improving air quality, enhancing economic development, and creating jobs. Local governments across the United States are implementing energy efficiency and renewable energy actions that can have multiple benefits including saving money, creating jobs, promoting sustainable growth and reducing GHGs and air pollution. So, how do you get started?

- **Take an inventory of your waste.** To do this, feel free to reach out to representatives from EPA’s numerous voluntary programs. One program, Waste Wise, 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 Waste Wise program.
- **Identify potential waste prevention opportunities.** EPA and its partners have developed several tools to help individuals and organizations determine the GHG impact of their purchasing, manufacturing, and waste management actions and find opportunities for waste prevention. Several of these tools are based on EPA research on emission factors, as reported in *Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks (3rd Edition)* and associated reports.
 - *The ReCon Tool* calculates GHG emissions and energy consumption related to purchasing and/or manufacturing activities using analyses of baseline and alternative recycled-content scenarios. For example, the tool will allow the user to estimate the GHG emissions and energy benefits of purchasing office paper with 35 percent recycled content instead of 25 percent recycled content. Emissions and energy impacts are calculated using a life-cycle perspective (i.e., what impacts will this purchasing or manufacturing decision have on emissions and energy use associated with the manufacture and disposal of a given material).
 - *The Waste Reduction Model (WARM)* is a user-friendly software tool that enables waste managers to compare GHG emissions from business-as-usual waste management practices with emissions from alternative strategies. WARM covers 17 types of materials and five waste management options: source reduction, recycling, combustion, composting, and landfilling. WARM also accounts for transportation distances to disposal and recycling facilities, carbon sequestration, and utility offsets that result from landfill gas collection and combustion.
 - *The Durable Goods Calculator* estimates GHG emission and energy in order to support voluntary GHG measurement and reporting initiatives, as well as provide information regarding the GHG emission implications of waste management decisions. The Calculator estimates GHG emissions benefits in MTCE and energy savings in MMBtu for recycling, landfilling, and combustion of 14 typical durable goods.
- **Develop an Action Plan and Implement it.** Set goals and determine the top priorities for your community waste reduction program. Focus on communicating your goals and getting legislators on board.
 - *Legislation in Action:* When North Carolina realized the need for recycled plastics and noticed that 96 percent of plastic was recyclable, they passed legislature to ban disposal of beverage containers by several types of businesses. This action will help ensure that usable plastics are put to good economic and environmental use.
 - *Goals in Action:* In 2003, Kentucky recycled approximately 6,000 tons of aluminum. By setting goals to increase aluminum recycling to 10 percent more the following year, a total energy savings

Life Cycle Inventory: A study conducted by Oregon’s DEQ to assess packaging options for shipping soft goods in e-commerce and catalog sales utilized a Life Cycle Inventory Analysis to evaluate natural resource use and environmental burdens from production to disposal for 26 different packaging options for non-breakable items. The study found that minimizing box size and total fiber content has the most result in significant environmental savings.

Every other week collection: Although you may think that every other week collection of recycling saves energy by reducing fossil fuel combustion from trucks by 50 percent, Oregon investigators found that the consequences of this collection method actually outweighs the benefits. Less frequent collection leads to 9 to 20 percent fewer participants, fewer recyclables, and greater time for contamination of recycled materials.

equivalent to removing approximately 1,800 cars from the road could occur. These savings are possible just from increasing aluminum recycling alone.

- *Municipalities in Action*: More than 160 municipalities in the United States have joined the Cities for Climate Protection (CCP) campaign run by Local Governments for Sustainability. CCP members agree to inventory their GHG emissions, set a reduction target, write an action plan to reduce emissions, and implement the plan.

Take Action in Your Community

The Municipal Toolkit was created with local and state governments in mind. For the resources you need to develop the framework for your waste prevention program or case studies to learn about what your peers are doing in their communities, visit:

<http://www.epa.gov/region4/recycle/govtoolkit.html>