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Resource Conservation and Recovery

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LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY GUIDES

Resource Conservation and Recovery

A Guide to Developing and Implementing Greenhouse Gas Reduction Programs

Solid Waste and Materials Management

U.S. ENVIRONMENTAL PROTECTION AGENCY
2012

EPA's Local Government Climate and Energy Strategy Series

The *Local Government Climate and Energy Strategy Series* provides a comprehensive, straightforward overview of greenhouse gas (GHG) emissions reduction strategies for local governments. Topics include energy efficiency, transportation, community planning and design, solid waste and materials management, and renewable energy. City, county, territorial, tribal, and regional government staff, and elected officials can use these guides to plan, implement, and evaluate their climate change mitigation and energy projects.

Each guide provides an overview of project benefits, policy mechanisms, investments, key stakeholders, and other implementation considerations. Examples and case studies highlighting achievable results from programs implemented in communities across the United States are incorporated throughout the guides.

While each guide stands on its own, the entire series contains many interrelated strategies that can be combined to create comprehensive, cost-effective programs that generate multiple benefits. For example, efforts to improve energy efficiency can be combined with transportation and community planning programs to reduce GHG emissions, decrease energy and transportation costs, improve air quality and public health, and enhance quality of life.

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- Resource Conservation and Recovery

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- Green Power Procurement
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- Landfill Gas Energy

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EXECUTIVE SUMMARY

Developing and Implementing Solid Waste and Materials Management Programs

Local governments have a significant opportunity to reduce waste management costs, air pollution, GHG emissions, and energy consumption through resource conservation and recovery. They are typically responsible for managing the waste generated within their municipalities and can implement strategies to help lower the costs to their communities. Solid waste management uses energy and generates GHG emissions, air pollutants, and air toxics. The impacts are even greater when products are viewed from a life-cycle perspective: the extraction, production, use, and disposal of goods and materials are responsible for an estimated 42 percent of U.S. GHG emissions (U.S. EPA, 2009a).

Local governments can reduce these costs and emissions by encouraging source reduction and the reuse of products and materials, as well as composting and recycling wastes generated by their communities. These strategies are collectively known as resource conservation and recovery. This guide describes the process of developing and implementing resource conservation and recovery measures, using real-world examples.

Resource Conservation and Recovery

This guide describes how local governments can work with residents, private companies, and other groups to decrease waste generation and divert more waste from landfills and combustion. It is designed to be used by local government agencies, mayors, city or county councils, and local and regional waste managers. This guide is intended to provide readers with an understanding of principles, technical strategies, and potential funding opportunities for resource conservation and recovery.

The guide describes the benefits of resource conservation and recovery (Section 2); technologies and practices for resource conservation and recovery (Section 3); key participants and their roles (Section 4);

RELATED STRATEGIES IN THIS SERIES

- **Urban Planning and Design: *Smart Growth***

  Smart growth involves development that benefits the economy, the community, the environment, and public health. By reducing sprawl and developing along corridors, communities can reduce the energy, and thus the GHG emissions, associated with collecting and transporting waste.

- **Renewable Energy: *Landfill Gas Energy***

  Landfill gas energy technologies capture methane from landfills to prevent it from being emitted to the atmosphere, reducing landfill methane emissions by 60-90%. Landfill gas energy projects can complement efforts to reduce the quantity of landfilled waste, as part of a comprehensive approach to reduce GHG emissions.

- **Energy Efficiency: *Energy Efficiency in K-12 Schools***

  Like any other institution, schools consume large quantities of materials and generate significant waste (including food waste) every day. Through source reduction, green purchasing, recycling, and composting, schools can further reduce their costs and environmental impacts, complementing efforts to improve energy efficiency.

- **Energy Efficiency: *Energy-Efficient Product Procurement***

  Many local governments are saving energy by requiring that the energy-using products they purchase meet energy efficiency criteria. Local governments can complement this strategy and further decrease their environmental impact by incorporating resource conservation and recovery criteria into purchasing, such as minimum recycled content in products.

- **Energy Efficiency: *Energy Efficiency in Local Government Operations***

  Local governments can implement energy-saving measures in existing local government facilities, new and green buildings, and day-to-day operations. They can combine efforts to reduce energy use through resource conservation and recovery with other energy-saving measures to create a comprehensive municipal energy efficiency strategy.

policies and other initiatives for launching resource conservation and recovery programs (Section 5); implementation strategies for effective programs (Section 6); costs and funding opportunities (Section 7); federal, state, and other programs that could help local governments with information or financial and technical assistance (Section 8); and finally, two case studies of local governments that have successfully implemented resource conservation and recovery programs in their communities (Section 9). Additional examples of successful implementation are provided throughout the guide.

Relationships to Other Guides in the Series

Local governments can use other guides in this series to develop robust climate and energy programs that incorporate complementary strategies. For example, local governments can further reduce GHG emissions associated with the waste generated in their municipality by incorporating waste collection and transportation in **smart growth** planning and by capturing and using **landfill gas energy**. Local governments can also introduce resource conservation recovery strategies as part of a broad effort to decrease energy use and GHG emissions from local government operations that also includes **energy efficiency in K-12 schools**, **energy-efficient product procurement**, and **energy efficiency in local government operations**. See the box on page v for more information. Additional connections to related strategies are highlighted in the guide.

Resource Conservation and Recovery

1. OVERVIEW

Resource conservation and recovery offers significant opportunities for local governments to reduce GHG emissions while saving money. Local governments are typically responsible for managing the waste generated within their municipalities. The cost of managing municipal solid waste depends in large part on its volume, which has increased by 184 percent in the United States over the past half-century—from 88 million tons in 1960 to 250 million tons in 2010 (U.S. EPA, 2011e). Additionally, the extraction, production, use, and disposal of goods and materials are responsible for an estimated 42 percent of U.S. GHG emissions (U.S. EPA, 2009a). Every stage of a product's life-cycle (illustrated in Figure 1 at right) contributes to climate change due to the emission of GHGs during the use of natural resources, the consumption of fossil fuels for energy, and the decomposition of organic waste.

Local governments can reduce these emissions by implementing resource conservation and recovery practices, which involve avoiding, delaying, or decreasing the raw materials required to produce new products. As described in Section 3, *Resource Conservation and Recovery Practices and Technologies*, the greatest emission reductions and cost savings come from avoiding waste in the first place through source reduction and reuse. For materials that reach the end-of-life disposal stage, recycling and composting are the most environmentally preferable options, while waste treatment with energy recovery and landfilling are the least environmentally preferable options.

Local governments are making good progress in reducing the amount of waste generated per capita (see Figure 2 on page 2) and increasing recycling. The national average recycling rate grew from 6 percent in 1960 to 34 percent in 2010 (U.S. EPA, 2011e). However, many cost-effective opportunities still remain untapped.

EPA's Sustainable Materials Management approach (see *http://www.epa.gov/osw/conserve/smm/*) focuses on reducing materials use and associated environmental impacts over the entire product life-cycle. Sustainable Materials Management encourages activities such as substituting services for products, increasing material efficiency in the supply chain, redesigning products and packaging, and a range of other actions. Local governments benefit from these activities by reducing the amount of waste they need to manage and making better use of those materials they do receive for disposal.

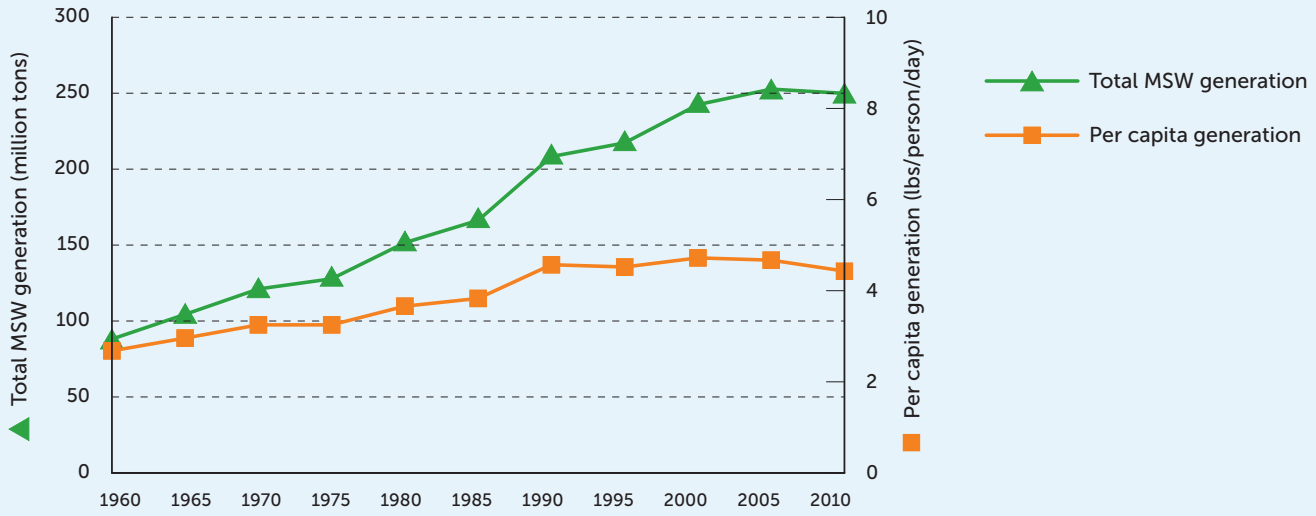
This guide describes how local governments have planned and implemented resource conservation and recovery initiatives, addressing upstream (e.g., source reduction) as well as downstream (e.g., recycling and composting) aspects of the product life-cycle. It includes an overview of the benefits and costs of resource conservation and recovery, sources of funding, and case studies. Links to sources for more information are provided in Section 10, *Additional Examples and Information Resources*. The text box on page 3 defines key terms related to resource conservation and recovery used in this guide.

While much of the information in this guide focuses on reducing GHG emissions through waste management, it also provides information on practices and strategies to reduce emissions from earlier stages of product life-cycles. This information is highlighted with the "upstream" icon shown here.

FIGURE 1. THE MATERIALS LIFE-CYCLE

Source: EPA 2009d.

FIGURE 2. MUNICIPAL SOLID WASTE GENERATION IN THE UNITED STATES, 1960-2010



Source: EPA 2011e.

2. BENEFITS OF RESOURCE CONSERVATION AND RECOVERY

Resource conservation and recovery strategies can produce significant environmental, economic, and quality of life benefits by helping local governments to do the following:

- **Reduce GHG emissions and other pollutants.** Preventing the generation of future waste, along with recycling and composting existing waste, reduces GHG emissions. These strategies decrease the consumption of fossil fuels used to manufacture, transport, and dispose of goods, and in turn, reduce the emission of GHGs, such as carbon dioxide (CO_2), methane, and nitrous oxide, as well as criteria air pollutants such as sulfur dioxide (SO_2) and nitrogen oxides (NO_X). Resource conservation and recovery strategies also help reduce the amount of waste that is ultimately landfilled or combusted, which lowers methane emissions from landfills and other air pollution from MSW incinerators.

The complex nature of the economy and product life-cycles means that some of the emissions benefits of resource conservation and recovery may accrue outside of the municipalities implementing these practices. These "displaced benefits" arise for two basic reasons. First, since many municipalities send their waste to landfills located outside their boundaries, the emissions benefits from avoided disposal in landfills will also occur outside their jurisdictions. Second, increasing their recycling rate will reduce the upstream manufacturing energy and GHG emissions required to make new materials from virgin inputs. Those emissions reductions and other benefits are also likely to occur outside of their jurisdictional boundaries, and may not even occur in the same year as the increase in recycling. For more information, see the text box "Lifecycle Accounting Versus GHG Emissions Inventories" on page 13.

Howard County, a community of 270,000 residents in the heart of central Maryland, recycled 12,520 tons of glass, plastic, and metals in 2003. The county estimates that its recycling efforts prevented the release of more than 15,600 metric tons of carbon equivalent, approximately equal to the electricity use of more than 7,300 American households in one year (U.S. EPA, 2010a).

RESOURCE CONSERVATION AND RECOVERY TERMS

Anaerobic Digestion
a process that uses bacteria to break down organic wastes in an oxygen-free environment. The process produces biogas, which can be used to generate energy.

Combustion
a controlled burning process of municipal solid waste to reduce waste volume. Also known as incineration. Combustors, when properly equipped, can recover energy from waste to convert water into steam for fueling heating systems or generating electricity.

Composting
collecting organic waste (e.g., food scraps and yard trimmings) and storing it under conditions designed to help it break down naturally so that the resulting compost can be used to enrich soil.

Downstream
the life-cycle stages that a product goes through after it leaves a manufacturing plant, such as use, reuse, recycling, or disposal.

Energy Recovery from Waste
the conversion of non-recyclable waste materials into usable heat, electricity, or fuel. Also known as waste-to-energy. Processes for recovering energy from waste include combustion, anaerobic digestion, and landfill gas recovery.

Landfills
engineered areas where waste is placed into the land. Landfills usually have liner systems and other safeguards to avoid polluting the groundwater. As organic waste degrades in landfills it produces methane, a potent greenhouse gas.

Landfill Gas Recovery
the act of capturing landfill gas (which includes methane, a potent greenhouse gas) and using it to generate energy.

Life-cycle
a term for the collective stages a product goes through before, during, and after its intended use. While the specific stages of a product's life-cycle will vary, most product life-cycles include raw materials acquisition, transport, manufacturing, use, and end-of-life management.

Municipal Solid Waste (MSW)
everyday items people use and then throw away, such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries. MSW is generated in homes, schools, hospitals, and businesses. MSW is commonly known as trash or garbage.

Pay-As-You-Throw (PAYT)
a way of paying for solid waste services based upon the amount of trash discarded rather than through the tax base. PAYT provides an economic incentive to help motivate residents to change their behavior and conserve natural resources.

Recycling
the recovery of useful materials, such as paper, glass, plastic, and metals, from trash to make new products, reducing the amount of new raw materials needed.

Resource Conservation and Recovery
avoiding, delaying, or decreasing the raw materials required for the production of new products through source reduction, reuse, recycling, composting, or energy recovery.

Reuse
preventing or delaying a material's entry in the waste collection and disposal system.

Solid Waste Management
permanently handling MSW (e.g., recycling, composting, landfilling, combustion). Also known as end-of-life (EOL) management or disposal.

Source Reduction
making product purchase decisions and designing products to reduce the amount of waste that will later need to be thrown away. Also known as waste prevention.

Tipping Fee
the charges assessed for dumping MSW at a disposal facility. They range from about $20-$150/ton with a national average of $44/ton.

Upstream
the stages of a product's life-cycle that take place before manufacturing, such as materials extraction and processing.

- **Reduce dependence on virgin materials.** By reusing and recycling materials local governments can reduce the need for manufacturers to extract virgin natural resources. Reducing reliance on virgin resources can also provide other benefits. For example, avoiding the need to cut down trees for paper and other products can increase carbon sequestration, which is the uptake and long-term storage of atmospheric carbon.[1]

- **Support economic growth through job creation and market development.** Local governments that invest in resource conservation and recovery can stimulate the local economy, encourage development of recycling and composting markets and businesses, and create jobs. According to the Tellus Institute, increasing the national average recycling rate in the United States (currently about 34 percent) to 75 percent by 2030 could create more than 2.3 million jobs, approximately 2.7 times the number of jobs in this sector in 2008 (Tellus Institute, 2011). Local governments can encourage economic development in their communities by establishing or expanding reuse centers and recycling collection, and by hosting recycling or composting processing facilities.

  If communities in Oregon, California, and Washington recycled or composted half of the core recyclables and food scraps currently in their waste streams, they could generate nearly $1.6 billion in additional salaries and wages, more than $800 million in additional goods and services produced, and more than $300 million in additional sales of recycled goods across the West Coast (U.S. EPA, 2011k).

- **Reduce waste collection and landfilling costs.** When local governments encourage residents to divert waste from landfills, they save money by spending less on collecting waste, transporting it to landfills, and paying a fee to landfill each ton. In 2008, the average U.S. tipping fee (a fee for landfilling waste) was approximately $44 per ton, and Americans generated an average of 1.28 tons of waste per person (van Haaren et al., 2010). Assuming these national average values, annual tipping fees alone for the waste generated by a town of 50,000 residents would cost more than $2.8 million. If that town were to initiate a recycling program with a diversion rate of 50 percent, it would avoid $1.4 million in tipping fees. Not all of these savings would be realized, however, due to a parallel increase in costs associated with diversion of waste for recycling and composting.

  With a low average recycling rate of approximately 22 percent, South Carolina spent approximately $15 million in fiscal year 2009 to landfill recyclables. If local governments in the state had recycled those materials instead, they could have earned $52 million in potential revenue (SCDHEC, 2009; U.S. EPA, 2010f).

- **Demonstrate leadership.** Local governments can demonstrate environmental, fiscal, and societal leadership by adopting resource conservation and recovery policies in their own operations. Policies that mandate specific waste reduction goals, promote recycling and composting, or set minimum recycled content requirements for product purchasing can reduce waste collection and disposal and encourage the growth of local recycling and composting businesses. These policies can reduce environmental and health impacts, save money, stimulate economic development, and encourage residents and the private sector to adopt resource conservation and recovery practices.

  Climate Showcase Communities
  Local Climate and Energy Program

  Honolulu, the capital and largest city in Hawaii, adopted a "lead by example" law in 1990 to mandate recycling by the city government (City of Honolulu, 1990). City employees have recycled more than 250,000 pounds of paper annually since the beginning of the city's office paper recycling program. Honolulu mulches or composts all yard trimmings and grass from city parks and grounds, and the Honolulu Zoo has become a showcase for recycled products such as benches, sculptures, and pavement. The city is also paving some of its streets with glasphalt, an asphalt mixture containing crushed glass collected from residential and commercial recycling programs. Honolulu's total landfill diversion rate was over 66 percent in 2011, placing it among the top cities in the United States for waste diversion (City of Honolulu, 2012).[2]

[1] *Trees sequester carbon by converting CO_2 in the atmosphere to carbon in their biomass.*

[2] *To learn about other efforts by Honolulu to reduce GHG emissions, visit its Climate Showcase Communities profile at http://www.epa.gov/statelocalclimate/local/showcase/marginalized-communities.html. The Climate Showcase Communities Program is an initiative of EPA's Local Climate and Energy Program.*

- **Improve public health.** Resource conservation and recovery reduces air and water pollution, providing significant human health benefits. By reducing waste, resource conservation and recovery also reduces the amount of landfill capacity needed, allowing local governments to close existing landfills earlier and convert them into beneficial public spaces.

With financial support from EPA's Tribal Program and technical support from EPA's Responsible Appliance Disposal (RAD) Program, the Yakama Nation in south-central Washington collected 192 old refrigerators and stand-alone freezers from residents during a two-month period in 2010. Some of the units were more than 40 years old. The tribe worked with an appliance recycler to recover 80 pounds of ozone-depleting refrigerants and more than 160 pounds of ozone-depleting foam-blowing agents for safe destruction. Depletion of the Earth's ozone layer is linked to an increased risk of skin cancer, cataracts, and immune suppression in humans. The recovery effort also prevented the environmental release of toxic and hazardous substances, including used oil and polychlorinated biphenyls (PCBs),[3] and avoided the emission of more than 700 metric tons of CO_2 equivalent,[4] comparable to the annual emissions of more than 130 passenger cars (U.S. EPA, 2011l).

For more information on EPA's RAD Program, see page 19.

[3] *If released into the environment, used oil can leak into groundwater and major waterways and pollute drinking water sources. PCBs are regulated by EPA as toxic substances; they may cause cancer and liver damage and can have negative impacts on the neurological development of children, the human reproductive system, the immune system, and the endocrine system.*

[4] *Carbon dioxide equivalent is a measure used to compare the emissions from different GHGs based on their respective global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as metric tons of carbon dioxide equivalent ($MTCO_2e$). The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. In other words, $MTCO_2e$ = (metric tons of a gas) * (GWP of the gas).*

3. RESOURCE CONSERVATION AND RECOVERY PRACTICES AND TECHNOLOGIES

Resource conservation and recovery involves two complementary approaches:

1. Reduce the quantity of waste generated through practices such as source reduction and reuse.

2. Manage waste effectively through practices such as recycling and composting to recover materials and minimize environmental impacts.

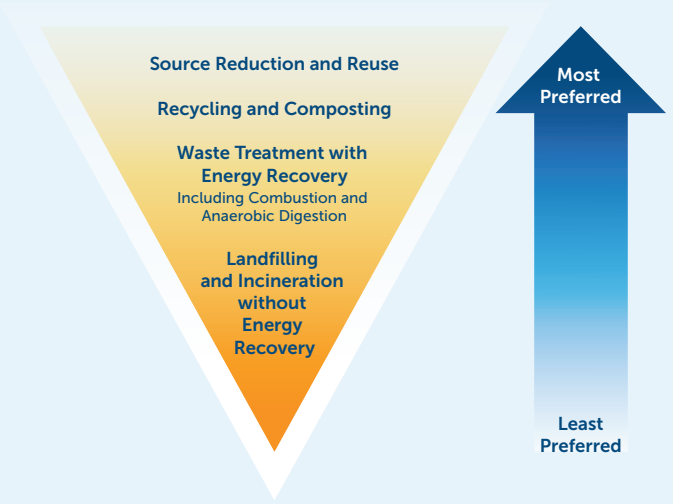
EPA's Solid Waste Management Hierarchy prioritizes the individual practices that local governments can use to implement these two approaches.

Solid Waste Management Hierarchy

EPA created the Solid Waste Management Hierarchy to provide guidance to local governments on how and where they can most sustainably allocate their waste management resources. The hierarchy, shown in Figure 3, presents the most common solid waste management practices and technologies in priority order to maximize resource efficiency and sustainability. Reducing the quantity of waste generated via source reduction and reuse is the most preferred method for managing waste, since it helps to prevent waste in the first place. The remaining options involve the effective management of waste materials, starting with recycling and composting, followed by waste treatment with energy recovery. The least-preferred methods are landfilling and incineration without energy recovery.

Communities will likely need to use a combination of the practices and technologies shown in the Solid Waste Management Hierarchy. They can achieve the greatest environmental and financial benefits by prioritizing their actions according to the hierarchy.

FIGURE 3. SOLID WASTE MANAGEMENT HIERARCHY



Source: U.S. EPA, 2010j.

SOURCE REDUCTION AND REUSE

Upstream

Of all the practices and technologies in the Solid Waste Management Hierarchy, source reduction and reuse have the greatest potential for reducing GHG emissions and saving money. By reducing waste at the source, local governments can avoid life-cycle GHG emissions from the extraction, processing, manufacturing, transport, use, and disposal or recovery of materials and products. If the United States were to cut back its waste generation to 1990 levels—a 17 percent reduction from the level in 2010—it could eliminate 41 million tons of waste and 48 million metric tons of carbon dioxide equivalent ($MMTCO_2e$) annually. That reduction would be equivalent to the annual emissions from nearly 9.5 million cars (U.S. EPA, 2011e).

Preventing food waste, unsolicited mail, beverage packaging, metals, and other materials conserve more natural resources and reduce more GHG emissions than any other MSW practice, by avoiding the production and resource extraction impacts described above. Minimizing food waste has the highest environmental impact savings due to avoided upstream production emissions and the methane emissions generated when food decomposes in a landfill (Gentil, 2011).

Reusing materials to make new products significantly reduces the energy requirements for manufacturing and production. For example, reusing aluminum sheets and glass jars requires only 5 percent and 65 percent, respectively, of the energy needed to make these products from virgin materials (Morris, 2005). Source reduction and reuse also avoid the costs and emissions associated with transporting goods from manufacturer to market, and to waste disposal sites at the end of their useful life.

Communities can also achieve significant economic savings and reduce impacts in the area of Construction and Demolition (C&D) materials (e.g., bulky debris, concrete, wood, metals, glass, etc.) generated during the construction, renovation, and demolition of buildings, roads, and bridges. Reducing and reusing C&D materials lessens the environmental impact of producing new materials, creates jobs, conserves landfill space, and can reduce overall building project expenses through avoided purchase and disposal costs (U.S. EPA, 2012b).

Local governments have many opportunities to decrease waste generation by implementing source reduction and reuse. For example, municipal government offices, schools, and fire and police services can modify their purchasing practices to adopt economic incentives and support extended producer responsibility initiatives that encourage source reduction and reuse.

To decrease waste generation and encourage recycling, Shrewsbury, Massachusetts, adopted a PAYT program, which charges residents a fee for each container of waste they set out for landfilling. In the first year of the program, the town generated 25 percent less overall material (waste and recycling combined). The town's recycling rate increased to 34 percent, and the amount of waste hauled for incineration decreased by more than 40 percent, leading to $260,000 in avoided disposal fees (U.S. EPA, 2010f).

ENVIRONMENTAL BENEFITS OF BUILDING REUSE

A recent report from the National Trust for Historic Preservation (NTHP) describes the environmental benefits of reusing buildings instead of demolishing them and constructing new ones. The report concludes that reuse yields savings of between 4 and 46 percent across a variety of environmental impacts—including GHG emissions, resources use, human health, and ecosystem quality—compared with new construction. In most cases, the GHG emissions associated with building demolition and reconstruction even outweigh the emissions avoided by replacing old buildings with new ones that are more energy efficient. The study found that it can take 10 to 80 years for a new building to offset the emissions from demolition and construction, assuming an improved building efficiency of 30 percent.

For example, the city of Portland, Oregon, could save roughly 230,000 $MTCO_2e$ by retrofitting and reusing the commercial offices and residential homes otherwise slated for demolition over the next 10 years. These savings would achieve 15 percent of the CO_2 emissions reduction goal established by the City of Portland and Multnomah County. It would take roughly 42 years for an efficient, new commercial building in Portland to overcome the climate change impacts from demolition and construction, whereas reuse would offer nearly immediate GHG savings. Other types of reuse (such as converting a warehouse to an office building or multifamily residence) would achieve smaller savings, suggesting that the best candidates for reuse are buildings that require minimal material inputs during the renovation process.

Source: NTHP, 2012.

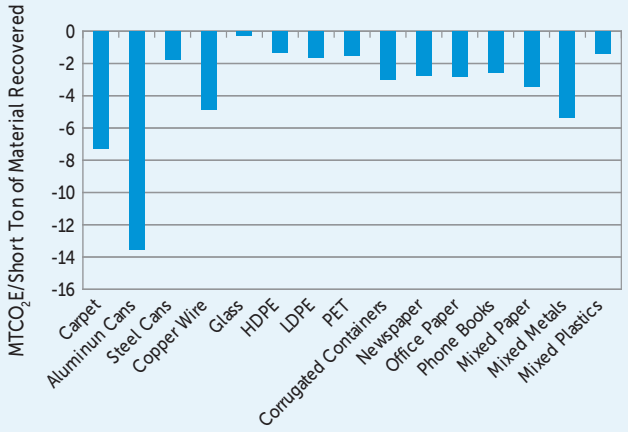
RECYCLING

Recycling is the second-most-preferred solid waste management method. As defined by EPA, recycling involves recovering and reprocessing usable materials that might otherwise become waste and transforming them into other products. When a material is recycled, it can be used in place of virgin resources in the manufacturing. Recycling therefore reduces energy and GHG emissions across multiple phases of product life-cycles:

- Recycling avoids *upstream* GHG emissions from the extraction, harvesting, and manufacturing stages of virgin resources.
- Recycling avoids *downstream* GHG emissions from waste disposal in landfills and combustion facilities.

Figure 4 illustrates how recycling can reduce GHG emissions compared with landfilling materials.

FIGURE 4. REDUCTION IN GHG EMISSIONS FROM RECYCLING VS. LANDFILLING



Source: U.S. EPA, 2010m.

Many communities have developed successful recycling programs to reduce the costs and environmental impacts of traditional disposal methods such as landfilling and waste combustion. Local governments can achieve additional energy savings, GHG emissions reductions, and other benefits by expanding existing recycling programs and sharing their knowledge and experience with other communities that do not currently recycle.

In June 2004, the City Council of Falls Church, Virginia, adopted a 20-year initiative with a goal to raise the city's recycling rate to 65 percent. To reach that goal, the city contracted with a hauler to collect curbside recyclables in a single stream (i.e., all recyclable materials mixed together) once per week. As of November 2010, the city had the highest recycling rate in Virginia, with residents recycling nearly 58 percent of their waste compared with the state average of nearly 39 percent. The city reports that recycling saves more than $100,000 in disposal costs per year (Falls Church Office of Communications, 2010; City of Falls Church, 2011a). In 2011, Falls Church also adopted a PAYT program requiring residents to purchase $1 "excess trash" tags for any bags beyond their allotment of city-supplied trash bags or for bags that do not fit within their assigned carts (City of Falls Church, 2011b).

COMPOSTING

Composting, sometimes referred to as the "recycling" of organic waste, stands with recycling as the second-most preferred solid waste management method after source reduction. Composting involves collecting organic waste, such as food scraps and yard trimmings, and actively managing it under conditions that help it break down naturally. The resulting compost can be used in landscaping and gardening, and as a soil amendment for horticultural and agricultural applications. Composting diverts organic wastes from landfills, reducing the methane released when these materials decompose. It also diverts some materials from incinerators and thus reduces GHG emissions from waste combustion. When used as a natural soil amendment, compost can help avoid the GHG emissions and groundwater pollution associated with synthetic fertilizers.

In 2010, compostable organic materials were the largest component of MSW in the United States, with paper and paperboard accounting for 29 percent, and food scraps and yard trimmings accounting for 27 percent (U.S. EPA, 2011e). Local governments have an opportunity to divert a large portion of these organic wastes toward composting. Organics diversion programs can take several forms, including curbside collection of household organic waste and curbside collection or drop-off of yard trimmings.

In 2006, Tompkins County, New York[5], partnered with Cayuga Compost on a six-month pilot food waste collection program. This program provided county businesses with 55-gallon bins for organic waste, collected weekly and transported to a composting facility. Cayuga Compost composted food scraps along with yard waste collected by the county, diverting roughly 200 tons of food waste from disposal during the six-month program. The program avoided roughly 176 $MTCO_2e$, comparable to the annual emissions of 127 passenger vehicles. Following the success of the pilot program, Tomkins County expanded the food compost program in 2007, which now includes waste collection from additional businesses, institutional settings, and public events (Tompkins County, Undated).

[5] *To learn about other efforts by Tompkins County to reduce GHG emissions, visit its Climate Showcase Communities profile at http://www.epa.gov/statelocalclimate/local/showcase/tompkins.html. The Climate Showcase Communities Program is an initiative of EPA's Local Climate and Energy Program.*

WASTE TREATMENT WITH ENERGY RECOVERY

The next solid waste management practice in the hierarchy is waste treatment with energy recovery. Technologies include waste combustion with energy recovery and landfilling with energy recovery. Energy recovery avoids some of the GHG emissions associated with waste incineration and the anaerobic decay of organics in landfills, as well as the use of fossil fuels associated with electricity and heat generation.

Waste-to-energy combustion facilities process MSW and burn it in a combustion chamber. They use the heat released from combusting the MSW to produce steam, which turns a steam turbine to generate electricity. At a few facilities in the United States, the steam is used directly for heating (EPA 2010d).

Landfilling with energy recovery extracts methane-rich landfill gas generated from organic waste decay using a series of wells and a blower/flare (or vacuum) system. The collected gas is then directed to a central point where it is processed and treated. Landfill gas energy facilities can combust the gas to generate electricity for internal use or to sell to the grid; combust the gas to generate process heat to be used in industrial and manufacturing operations; or upgrade it to pipeline-quality gas, which may be used on-site or distributed for any number of applications, including use as an alternative vehicle fuel (EPA 2011d). For more information on landfilling with energy recovery, please see EPA's *Landfill Gas Energy* guide in the *Local Government Climate and Energy Strategy Series*.

LANDFILLING AND INCINERATION WITHOUT ENERGY RECOVERY

The least preferred waste management practice in the hierarchy is waste disposal by landfilling or incineration without energy recovery. Organic waste disposed in landfills decomposes anaerobically and produces methane, a GHG that is 25 times more potent than CO_2, which is released into the atmosphere and contributes to climate change. Methane emissions from landfills in the United States in 2010 contributed roughly 100 $MMTCO_2e$. Waste incineration produces emissions of CO_2 and nitrous oxide, a GHG that is 310 times more potent than CO_2 (IPCC, 2007). Communities may miss an important opportunity to use the inherent energy of waste by landfilling or incinerating it without energy recovery.

4. KEY PARTICIPANTS

Local governments that want to develop resource conservation and recovery initiatives can increase their likelihood of success by involving key stakeholders to help mobilize resources and ensure effective implementation. Important stakeholders may including the following:

- **City or county council.** Resource conservation and recovery activities are often initiated by city, town, and county councils or boards. Securing support from members is important to ensure that initiatives receive the resources necessary to produce results. City or county councils can also set waste reduction or recycling rate goals.

- **Mayor, town manager, or county executive.** The mayor, town manager, or county executive can provide increased visibility for resource conservation and recovery activities. High-level local government officials have been the driving force behind many successful resource conservation and recovery programs.

  In Louisville, Kentucky, Mayor Jerry E. Abramson played a lead role in the city's 2005 Cantucky Derby program, which collected approximately 75 tons of aluminum cans. The program saved more than 15 billion BTU of energy and avoided GHG emissions of more than 1 million $MTCO_2e$. To promote the program, Mayor Abramson held a press conference announcing the project at the Louisville Zoo (the site of a prominent can collection and education center), sent emails to city employees encouraging recycling at city offices, and promoted the program on his five regular weekly call-in radio shows (U.S. Conference of Mayors, 2005).

- **Local waste and public works departments and local-level staff.** Waste management authorities, departments of public works, or other local or regional waste entities are usually responsible for collecting and managing waste. It is important to engage these government bodies and their employees for their perspective and input when seeking changes to MSW operations and during program implementation.

  In 2007, the City of New York implemented a pilot program for recycling paper and commingled metals, glass, and plastic at six New York City parks and two transit hubs. In order to service the recycling bins, the city had to ensure close collaboration and coordination across three municipal departments: sanitation, parks and recreation, and transportation. The three departments held a series of meetings to clarify roles and responsibilities, equipment capacities, and needs. Under the project, the city collected more than 31,000 pounds of recyclables over the 13-week pilot period, avoiding roughly 4.5 $MTCO_2e$—equivalent to the GHG emissions from the electricity use of two homes for an entire year. Based on the successes of the pilot program, the city has expanded public space recycling to 500 bins at 137 locations (DSNY, 2007).

  Climate Showcase Communities
  Local Climate and Energy Program

  With grant support from EPA's Climate Showcase Communities Program, the Gila River Indian Community of Arizona developed a pilot curbside recycling program as part of a range of projects to reduce GHG emissions. To provide staff support, the Gila River Department of Environmental Quality established a Climate Projects Specialist position. One of the Climate Projects Specialist's duties is to coordinate a recycling team to implement a demonstration curbside recycling program. The team promotes the program to community members through presentations and information materials. Between May and December 2011, the community collected 49 tons of recyclable material, and is considering expanding the pilot program to include other residential communities and a commercial pick-up route (U.S. EPA, 2011g). For more information about the Climate Showcase Communities Program, visit: *http://www.epa.gov/climateshowcase*.

- **Private waste collection companies, incinerators, and material recovery facilities.** Private companies contracted by municipalities to collect, sort, landfill, recycle, and incinerate MSW may have valuable experience in resource conservation and recovery that can be used to inform local initiatives.

  The City of Hartford, Connecticut, partnered with a private company that awards residents points for recycling. The points are redeemable for discounts and deals at local and national businesses. Hartford and the company collaborated on a single-stream recycling program that debuted in 2008 as a pilot program and expanded citywide a year later.

- **Private businesses.** Like residences, private businesses generate waste that can be reduced or diverted for recycling or composting. Local governments can educate businesses about resource conservation and recovery options and facilitate the recycling and composting of commercial waste.

Washtenaw County, Michigan's Waste Knot Program provides value-added education, organization-specific technical assistance, and community-wide recognition to more than 200 partner businesses and other organizations that are taking extra steps toward excellence in waste reduction. Partners receive free support, such as waste audits and consulting services, free print media and radio advertising, and eligibility for environmental excellence awards. Washtenaw lists partner businesses in an online directory organized by sector and location, encouraging customers to support sustainable businesses. Individually, partners have saved up to $120,000 a year through their waste reduction programs (Washtenaw County, 2011).

- **General public, community organizations, and non-profit organizations.** The success of resource conservation and recovery programs often depends on the ability of community members to change their waste management habits. It is important to engage them early and often with opportunities to offer ideas and feedback on resource conservation and recovery proposals. Interest groups can also be important partners in gathering support for resource conservation policies: they can reach out to their members and stakeholders to raise awareness about the benefits of resource conservation and recovery.

When starting a citywide recycling challenge, the City of Tulsa, Oklahoma, reached out to neighborhood groups to find out what they needed and what challenges they faced. The first 100 groups that signed up for the challenge received free recycling barrels, which also gave city staff the opportunity to discuss the challenges and the benefits of recycling with the neighborhood groups in more detail (U.S. Conference of Mayors, 2005).

- **Industry and utility companies.** Local governments can partner with private companies, including utilities, to create mutually beneficial projects to finance resource conservation and recovery projects. For example, industries can contribute organic wastes to be combined with municipal organic wastes and processed at composting facilities or anaerobic digesters. Utilities can partner with the communities to buy the energy generated at anaerobic digesters fueled from local organic wastes.

In Columbus, Ohio, Kurtz Bros., Inc., partnered with quasar energy group to create the Organic Waste Recycling and Recovery System plant. The plant, partially funded by a $250,000 Market Development Grant from the Ohio Department of Natural Resources (ODNR) Division of Recycling and Litter Prevention, will process biosolids from the City of Columbus, and food waste, fats, oil, and grease collected from municipalities throughout the region to generate 1 megawatt-hour of electricity each hour. The plant is expected to divert 45,000 wet tons of organic waste annually while generating enough electricity to power 725 Ohio homes each year (ODNR, Undated).

5. FOUNDATIONS FOR PROGRAM DEVELOPMENT

There are many ways to implement resource conservation and recovery measures, including the following:

- **Local government initiatives.** Local government leaders can use their oversight and budget powers to influence government operations, and can promote resource conservation and recovery strategies to city residents. City councils may set goals for recycling rates or waste reduction, which establish quantifiable goals and raise awareness and motivation for implementing sustainable materials management programs.

In June 2009, the City of San Francisco enacted the nation's first mandatory composting law. As a result, restaurants in the city and nearby Contra Costa County partnered with the Oakland, California-based East Bay Municipal Utility District (EBMUD) to process their food waste at anaerobic digesters, generating green renewable electricity and compost. EBMUD's anaerobic digester processes 90 tons per week of food waste from restaurants and food processing facilities, with plans to more than double the amount of food waste processed to its maximum capacity of 200 tons per day. At its current capacity, the facility avoids roughly 4,100 $MTCO_2e$ per year, equivalent to the annual emissions of almost 3,000 passenger vehicles (ENS, 2009).

- **Local government resolutions.** City councils or citizen advisory groups can pass local resolutions that fund or mandate studies or implement resource conservation and recovery strategies. By adopting PAYT programs or by mandating recycling or composting, local government resolutions can make resource conservation and recovery a local policy priority.

  King County, Washington, has established clearing and grading regulations for site development that require permit holders to restore soils to specified standards, preventing costly environmental and landscape impacts. Permit holders can meet these standards by adding compost to existing soil. Compost can improve the health of soil, providing benefits such as better erosion control, reduced need for water and chemicals, less stormwater runoff, and better water quality, as well as more marketable buildings and landscapes. King County's regulations encourage the development of compost markets by creating a demand for compost. In areas without commercial composters, demonstrating a demand for compost is the first step toward establishing a commercial composting operation (King County, 2005).

- **State government programs.** Some municipalities have implemented resource conservation and recovery strategies under broader efforts coordinated by state governments. States can provide funding or other resources that help municipalities to expand their resource conservation and recovery efforts beyond what would be possible on their own. For example, states can facilitate collaboration with other communities or private industry, or encourage local governments to participate in statewide waste reduction or recycling challenges.

  With an investment of $2.2 million in grant funding from its Solid Waste Trust Fund (SWTF), the state of Georgia developed four regional recycling collection hubs to reduce transportation and separation costs faced by low-volume rural recycling programs. These facilities accept truckloads of recyclables from surrounding communities and transfer them to long-haul transport vehicles bound for large, efficient materials recovery facilities. The four hubs have projected an average 185 percent increase in recovered materials in their communities, which translates to roughly $514,500 savings in avoided landfill tip fees at the current statewide average tip fee of $35 per ton. Hub communities and Georgia's strong recycling markets will also benefit from the increase in recovered materials, with projected annual revenues of $370,000. For this project, the estimated return on the SWTF grant is less than three years. The hub concept has proved so popular that private sector partners developed a fifth recycling hub (U.S. EPA, 2010c).

- **Public-private partnerships.** Local government agencies can partner with businesses to expand communications or provide funding to study or implement resource conservation and recovery strategies.

  In April 2009, Philadelphia Mayor Michael Nutter worked with BigBelly Solar, Inc., to replace 700 traditional litter baskets with 500 solar-powered trash compactors and 210 companion single-stream recycling units in public spaces throughout Center City, Philadelphia. The single-stream recycling units allow for collection of clean paper, metal cans, plastic bottles, and glass jars all in one container. The compactors and recycling containers allowed Philadelphia to reduce waste collection trips, leading to $720,000 in annual operating savings (City of Philadelphia, 2009).

- **State and local Pay-As-You-Throw programs.** With PAYT, residents pay directly for the amount of trash they throw out rather than strictly through the tax base or a flat fee. This shift creates a strong financial incentive for residents to prevent waste, reuse and recycle materials, and compost organics. More than 7,000 municipalities in the United States have adopted PAYT programs, leading to the diversion of roughly 6.5 million tons of waste that otherwise would have been landfilled, and avoiding GHG emissions of 8 to 13 $MMTCO_2e$ annually (Skumatz & Freeman, 2006). While PAYT systems are usually adopted at the local level, Wisconsin, Oregon, and Minnesota have laws mandating implementation of PAYT programs in some or all communities.

In 2009, the City of Concord, New Hampshire, implemented a PAYT program as a way to reduce the impact of rising disposal fees. Concord's contract with a nearby waste-to-energy facility had expired, and the city's tipping fees per truckload were scheduled to increase by 35 percent. The city council created a solid waste advisory committee, composed of a mix of city officials, city staff, and local residents, to determine the best way to cover the rising fees. The committee recommended a PAYT program, finding that it would be cost-effective and equitable and would change residents' waste disposal practices over the long term. Concord implemented the program, which reduced the city's annual waste collection from 15,000 tons to 8,500 tons of MSW and increased its annual recycling from 2,700 tons to 4,200 tons (U.S. EPA, 2010f).

- **Neighborhood, interest, or citizen group efforts.** Non-government groups can help build momentum for resource conservation and recovery by developing program plans and committing themselves to implementation. They can also propose resource conservation and recovery strategies to local governments and encourage their approval.

In March 2008, Anne Arundel County, Maryland, initiated its 50/50 Recycling Challenge, an effort to increase the county's curbside recycling rate to 50 percent. To get the county's citizens involved in the program, the county appointed a residential recycling advisory committee. The committee, made up of 20 citizens, met monthly and presented a final report to the County Department of Public Works at the end of their term. Among other suggestions, the committee strongly recommended that the county decrease trash collection from twice a week to once a week as soon as possible, and to collect trash and recycling on the same day each week (Anne Arundel County, 2010).

6. STRATEGIES FOR EFFECTIVE PROGRAM IMPLEMENTATION

This section discusses strategies for implementing resource conservation and recovery initiatives based on case studies and successful approaches to overcoming barriers.

Developing Goals and Tracking Results

- **Create a baseline.** By estimating their baseline waste-related emissions, local governments can compare the GHG impacts of the waste they generate with those of other emissions sources. Estimating baseline emissions also helps communities measure emissions reductions from resource conservation and recovery strategies. Local governments can compare waste-related GHG emissions in future years to the baseline to determine emissions avoided through resource conservation and recovery efforts.

- **Incorporate resource conservation and recovery into climate action and sustainability plans.** Many cities and counties have adopted climate change action plans to implement a range of policies that reduce GHG emissions and track progress toward their goals. Local governments can achieve significant tangible and quantifiable GHG reductions by integrating resource conservation and recovery sections strategies into these plans.

Broward County, Florida, developed a climate change action plan that includes reducing landfill disposal by 75 percent by 2020 by increasing the recycling rate by 50 percent and converting 25 percent of waste to energy using renewable energy technology. The combined impact of these two goals would reduce the county's GHG emissions by an estimated 480,000 $MTCO_2e$ per year. The county plans to implement single-stream recycling in all of its municipalities and is considering a variety of methods to increase the recycling of residential, organic, business and institutional, and construction and demolition waste. The county also plans to adopt environmentally preferable purchasing policies that use the collective buying power of local governments to purchase products made with recycled materials and reduce packaging and toxicity (Broward County, 2010).

LIFE-CYCLE ACCOUNTING VERSUS GHG EMISSIONS INVENTORIES

Life-cycle GHG accounting evaluates and reports the full life-cycle GHG emissions associated with raw materials extraction, manufacturing or processing, transportation, use, and end-of-life management of a good or service. A life-cycle perspective accounts for all emissions connected to the good or service, regardless of which industrial or economic activities or sectors produce these emissions (e.g., energy, mining, manufacturing, or waste sectors), and regardless of when or where these emissions occur over time.

This perspective is fundamentally different from that of sector GHG inventories, which identify and quantify human-caused sources and sinks of GHGs in order to develop an accounting of overall GHG emissions for a specific entity (such as a local government) over a specified period of time. Local governments use GHG inventories to establish baselines, track GHG emissions, and measure reductions over time.

In its climate action plan, the City of Austin, Texas, set a goal to make all city operations carbon neutral by 2020. Among the initiatives contributing to that goal are a PAYT program that has led to a 120-pound decrease in the city's annual per capita waste disposal rate and a single-stream recycling program that has resulted in higher diversion rates using fewer city recycling trucks in less time. The city is developing a plan for zero waste by 2040 through a Zero Waste Challenge for individuals, businesses, and organizations. Participants can enter and track their waste reduction efforts online. Judges rate entries based on creativity and ingenuity, as well as on the impact on waste output (U.S. EPA, 2008d).

- **Track program results and emissions reductions.** By tracking data and comparing them to baseline levels, local governments can quantify resource conservation and recovery program results, estimate how changes in waste management are affecting GHG emissions, and identify where improvements can be made. They can also use these data for GHG inventories and life-cycle accounting frameworks. The text box on page 14 describes a number of online tools and related resources that local governments can use to help them track waste generation and reduction, estimate GHG emissions reductions, and quantify other benefits of resource conservation and recovery practices.

In 2009, Lincoln County, Washington's Solid Waste Department worked with Reardan-Edwall Middle School, to conduct a school-wide waste audit. The school used EPA's Waste Reduction Model (WARM) to quantify its baseline materials management emissions and the benefits of recycling 5,460 pounds of cardboard, paper, aluminum, and plastic. The school estimated that its recycling efforts avoided 8 $MTCO_2e$ in GHG emissions, roughly equivalent to the annual emissions of six passenger vehicles (Washington Green Schools, 2011).

Managing Logistics

- **Consider multiple funding options.** While many local governments may already have funding for resource conservation and recovery initiatives in their operating budgets, they may require additional sources of funding for specific projects. Partnerships with private companies can provide funding for projects that benefit both entities. Local governments can also pursue state, federal, and non-governmental grants for further funding. For more information, see Section 7, *Costs and Funding Opportunities*.

- **Conduct communications and outreach.** The success of resource conservation and recovery policies depends largely on effectively communicating expectations and benefits to the community. Many of the resource conservation and recovery projects with the largest environmental and financial benefits require members of the community to reduce their waste generation, recycle more of their waste, set aside their organic wastes for composting, or change their behavior in other ways. Local governments can help ensure the success of new programs by reaching out to residents using traditional methods such as community meetings, local newspapers, bulletins, and mailers, as well as by distributing information through email, local government websites, and other digital means.

TOOLS AND RESOURCES FOR ESTIMATING ENVIRONMENTAL BENEFITS OF SUSTAINABLE MATERIALS MANAGEMENT

- **Materials Management Climate Action Plan (MMCAP) Toolkit**

  The MMCAP Toolkit is designed to help communities understand the implications of managing resources as they flow through the economy from raw materials extraction to end of life. The toolkit provides information on the background and motivation for using a life-cycle approach to materials management, developing a GHG inventory as a first step, developing climate action plans, setting GHG reduction targets, and measuring results.

  Website: ***http://www.captoolkit.wikispaces.com***

- **Cool Climate Calculators for Local Governments**

  The California Air Resources Board created this compendium of resources with links to tools that can help cities and counties conduct GHG emissions inventories for government operations, waste, energy use, and transportation; quantify GHG reductions associated with materials management activities; and model the potential reductions from waste reduction and other climate action planning scenarios.

  Website: ***http://coolcalifornia.org/article/climate-calculators***

- **WARM (Waste Reduction Model)**

  EPA created WARM to help solid waste planners and organizations track and voluntarily report GHG emissions reductions from a variety of materials management practices and material types. WARM is available both as a Web-based calculator and as a Microsoft Excel™ spreadsheet. Local governments can use WARM to compare their baseline waste management with alternative waste management strategies to determine the most effective ways to reduce GHG emissions.

  Website: ***http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html***

- **ReTRAC**

  EPA's ReTRAC is a sophisticated data management and reporting system that helps track an organization's waste generation and reduction activities. This web-based tool is freely available to participants in EPA's WasteWise program (a voluntary program that helps organizations eliminate MSW and selected industrial wastes; see full description in Section 8, *Federal, State, and Other Program Resources*), and allows local governments to quantify the environmental benefits of materials management-related activities, including programs for waste prevention, recycling, composting, and procurement of recycled content. It also allows users to generate reports on program performance and trends, GHG emissions reductions, equivalencies, and an EPA Climate Profile report.

  Website: ***http://www.epa.gov/osw/partnerships/wastewise/retrac.htm***

- **ReCon (Recycled Content Tool)**

  EPA's ReCon is designed to help assess the life-cycle GHG emissions and energy impacts from purchasing or manufacturing materials with post-consumer recycled content. Local governments can use ReCon to determine the environmental benefits of procurement activities and quantify the impacts of strategies to increase procurement of recycled-content materials that meet standards in EPA's Comprehensive Procurement Guidelines Program.

  Website: ***http://www.epa.gov/climatechange/wycd/waste/calculators/ReCon_home.html***

- **SMART BET (Saving Money and Reducing Trash Benefit Evaluation Tool)**

  EPA's SMART BET is a decision-making tool to help community waste managers determine whether PAYT or unit-based pricing for solid waste management is the right model for their town. The tool allows users to input annual levels of landfilled and recycled waste as well as population statistics and landfill tipping fees. It combines this information with nationwide average waste disposal data, typical PAYT results, and GHG emission factors to estimate the GHG and cost savings that a community could see after implementation.

  Website: ***http://www.epa.gov/osw/conserve/tools/payt/tools/smart-bet***

Local governments often must address two groups when conducting recycling outreach: those who recycle and non-recyclers. When communicating with current recyclers, local governments can focus on where, when, and what to recycle—with less emphasis on promotion and more on instruction. Appealing to non-recyclers requires different promotional methods that encourage them to begin recycling, emphasizing the ease of recycling and the benefits it brings. With either group, it is most effective to avoid heavy-handed environmental messages and guilt-based approaches (U.S. EPA, 2011c).

In 2004, The City of Charlotte, North Carolina, launched "Meta Un Gool Reciclando" (Score a Goal Recycling), a three-month grassroots public relations recycling campaign aimed at increasing recycling in Charlotte's Hispanic/Latino community. City officials partnered with Latin American groups to gather feedback about the best ways to communicate with the Hispanic population. The initial pilot outreach campaign in 2004 resulted in a 12 percent increase in recycling rates in just three months. City officials looked at ways to incorporate what they learned to launch a new, year-long campaign during fiscal year 2007. The campaign continues to focus on recycling messaging and themes identified as top priorities to the Hispanic community, including a clean environment, clean space for gathering and meeting, sanitation, and healthcare. (U.S. EPA, 2011c).

Encouraging Source Reduction and Reuse

Upstream

- **Promote initiatives that encourage reuse and waste reduction.** Local governments can encourage reuse of existing products in order to avoid the need for local residents to purchase new products. For example, some cities offer centralized locations where residents can drop off extra paint and household products, which other residents can then pick up for free. Local governments can also encourage residents to reduce the amount of junk mail being disposed by removing themselves from the mailing lists of direct marketers and by contacting catalog companies to ask to be removed from their mailing lists (NJDEP, 2011). Local governments can encourage municipal organizations, private businesses, and local citizens to participate in programs that encourage waste reduction, such as EPA's WasteWise and Plug-In To eCycling programs, among others. More information on these and other programs that encourage reuse and waste reduction is included in Section 8, *Federal, State, and Other Program Resources*, and Section 10, *Additional Examples and Information Resources*.

- **Promote programs that provide financial incentives for waste reduction.** Beverage container deposit laws, or bottle bills, which offer deposits on recyclables, are well-known approaches used by municipalities to encourage recycling. However, other programs that promote recycling and waste reduction through financial incentives have gained prominence in recent years. Examples include volume-based fee programs (i.e., PAYT) and companies that partner with communities to offer coupons and discounts to residents for recycling.

- **Promote product stewardship.** Product stewardship is a broad policy principle stipulating that whoever designs, produces, sells, or uses a product takes responsibility for minimizing the product's environmental impact throughout all stages of its life-cycle. Governments can implement a product stewardship framework through policy instruments such as Extended Producer Responsibility (EPR), which extends a producer's responsibility to include the discards management of its products. EPR typically includes features such as take-back programs, which are effective at increasing the recovery of products and materials, increasing the safe handling of hazardous materials, and shifting waste management costs from local municipalities to producers.

  Local governments, often in partnership with the private sector and state and federal agencies, can foster product stewardship, source reduction, and reuse through a variety of policy instruments that place the responsibility of the life-cycle environmental impacts of products on producers. Examples of relevant policy instruments include:

  - ***Product Standards and Labeling.*** Private entities, public agencies, or stakeholders and experts from the public and private sectors can develop product standards, including standards for recycled content. Eco-labels are used to indicate to consumers that products meet certain standards. For more information, visit ***http://www.epa.gov/ooaujeag/standards/index.html***.

- ***Government Purchasing Rules.*** Procurement guidelines that require or encourage source reduction and the purchase of recycled-content products can help drive markets and reduce waste. For more information, visit *http://www.epa.gov/epawaste/conserve/tools/cpg* and *http://www.epa.gov/greensuppliers/*.

- ***Carbon Footprinting.*** Local Governments can follow carbon footprinting standards (e.g. ISO 14064 or EPA's Center for Corporate Leadership guidance) to quantify and report their GHG emissions and reductions, including those from materials management and source reduction. For more information, visit *http://www.epa.gov/climateleadership/reporting*.

- ***Green Servicizing.*** Servicizing involves shifting from a product-oriented business model to a service-oriented model. An example would be a car-share service that provides organizations and households with an alternative to purchasing their own vehicles. Green servicizing emphasizes services that provide environmental benefits compared with "business as usual" and can lead to reductions in materials use and waste. For more information, visit *http://www.epa.gov/osw/conserve/tools/stewardship/green-service.htm*.

7. COSTS AND FUNDING OPPORTUNITIES

This section provides information on resource conservation and recovery strategy costs, including their magnitude and potential payback. It also identifies financing opportunities that can help municipalities manage the costs of these strategies.

Costs

- **Overall project costs and expected payback period.** The expected costs for resource conservation and recovery programs can vary widely and depend on the size, location, scope, and technologies used for each program. It can be difficult to develop reliable estimates of expected costs for broad resource conservation and recovery technologies and strategies. Similarly, payback periods for projects will depend on the regional market for recyclables or compost or, in the case of source reduction, the local government's current waste management costs.

To help quantify cost savings associated with waste management programs, local governments can use existing tools such as EPA's Saving Money and Reducing Trash Benefit Evaluation Tool (SMART BET). This tool is designed to help city waste managers decide whether PAYT programs are appropriate for their communities. SMART BET and related tools are described in the text box on page 14.

- **Research and planning.** Many communities will require input from outside firms on the most effective methods for adopting resource conservation and recovery strategies. While investing in consulting advice from a private company is not always necessary, communities with more ambitious goals or those with a small in-house staff may benefit from seeking outside help. Municipalities can avoid spending money in the wrong places and identify potential cost savings by contacting outside experts or other cities with experience.

- **Private contracting.** Many communities contract with private firms to carry out their resource conservation and recovery strategies. Private contractors can use their experience in the resource conservation and recovery industry to save money for municipalities. With the right amount of research beforehand, local governments can negotiate a contract that allows the community to meet its goals effectively and efficiently.

The City of Decatur, Georgia, improved its recycling program by creating a hauler agreement that best suits the needs of its citizens. Decatur opted for city-operated hauling of recyclables until August of 1997 when it privatized collection of recycling. According to the city's calculations, the introduction of privatized recycling coincided with a 14 percent reduction in per-capita landfill deposits. Decatur emphasizes hauler contracts that encourage outreach to citizens and provide incentives for the hauler. For example, in 2002, Decatur switched from a contract requiring payment for recycling pick-up services based on a fixed fee per household to a contract that pays the contractor based on tonnage hauled. This arrangement gives the hauler an immediate stake in a successful recycling program and a direct economic incentive to recover as many recyclable materials as possible. By ensuring that its contract is incentive-based and allows for flexibility, the City of Decatur is proactively improving its recycling program and maximizing the potential for future success (U.S. EPA, 2011c).

- **Public outreach.** Public outreach to introduce resource conservation and recovery initiatives are an important, and often overlooked, aspect of creating a successful program. Many municipalities choose to handle public outreach themselves, dedicating a portion of the program budget to raise awareness. Other communities seek assistance from outside consultants due to the complexity of creating and administering a successful outreach program.

- **Economic incentives.** Communities often offer financial incentives to encourage businesses and citizens to adopt resource conservation and recovery strategies, as well as to influence consumer behavior and preferences. Many sustainability strategies put a price on the amount of materials collected and disposed in order to encourage source reduction, recycling, and composting.

Fayetteville, Arkansas, has collected residential trash under a PAYT program since 2003, charging residents based on the amount of trash that they throw away. Through this incentive, Fayetteville residents have achieved a recycling rate of 51 percent, annually recycling more than 13,000 tons of waste. Residential curbside recycling includes mixed paper, newspaper, paperboard and cardboard, plastics, aluminum, steel, and glass, in recycling bins made of 50 percent post-consumer recycled plastic. The city collects bagged yard waste, turns it into mulch and compost, and then sells it back to the community. Residents can drop off household hazardous waste for free and electronics waste for a small fee. The city also provides recycling services to commercial entities (U.S. EPA, 2008d).

Funding Opportunities

Federal, state, and private funding opportunities are available for many resource conservation and recovery practices, such as recycling, source reduction, and the creation of recycling markets.

FEDERAL FUNDING

Some federal agencies offer grants to help communities initiate resource conservation strategies.

- **EPA Regional Recycling Grants.** A number of EPA Regional offices offer grants for recycling. For example, the Region 8 Solid Waste Program (serving Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming, and 27 tribal nations) provides funding to government agencies and non-profit organizations to promote waste reduction and the safe and effective management of solid waste. EPA solid waste grants generally fund program development or pilot projects that promote waste reduction, recycled-content products, and markets for recycled materials, or assist in the development of solid waste management plans and the cleanup of open dumping (U.S. EPA, 2011h).

  Website: *http://www.epa.gov/region8/recycling/grants.html*

- **EPA Source Reduction Assistance Grant Program.**

Some EPA Regions annually issue Source Reduction Assistance (SRA) awards to support environmental projects that reduce or eliminate pollution at the source. Each EPA Region establishes specific criteria for SRA grants (U.S. EPA, 2011f).

Website: *http://www.epa.gov/p2/pubs/grants/#sra*

STATE FUNDING

Many states offer grants that help communities initiate resource conservation and recovery strategies. Local governments can search their states' environmental department website to see if programs are available. A few examples are listed below:

- **Florida Recycling Grants and Loans.** The Florida Department of Environmental Protection funds several recycling grant and loan programs, including Innovative Recycling/Waste Reduction Grants, Small County Consolidated Grants, and funding Special Projects for local governments (Florida DEP, 2011).

  Website: *http://www.dep.state.fl.us/waste/categories/recycling/pages/grants.htm*

- **Ohio Department of Natural Resources Community Development Grants.** The Community Development Grant program provides financial assistance to local governments in Ohio that propose to design and establish projects involved in the collection and processing of recyclable materials (ODNR, 2011a).

  Website: *http://www.ohiodnr.com/Home/Grants/CommunityDevelopmentGrant/tabid/21188/Default.aspx*

- **Ohio Department of Natural Resources Market Development Grants.** Ohio offers grants for private-public partnerships in Ohio communities to help create the infrastructure necessary for successful markets of recyclable material and related products. Grants can be used for a variety of purposes, such as purchasing equipment, product manufacturing, material processing and recovery, or facility expansion (ODNR, 2011b).

  Website: *http://www.dnr.state.oh.us/Home/Grants/MarketDevelopmentGrant/tabid/21189/Default.aspx*

- **Pennsylvania Recycling Finance Assistance.** Pennsylvania charges a $2-per-ton recycling fee to all resource recovery facilities in the state that process waste or dispose of it in landfills. These fees fund County Planning Grants, Recycling Program Development and Implementation Grants, County Recycling Coordinator Grants, Recycling Performance Grants, and Household Hazardous Waste Collection Grants (Pennsylvania DEQ, 2011).

  Website: *http://www.portal.state.pa.us/portal/server.pt/community/financial_assistance/14065*

- **Texas Regional Solid Waste Grants Program.** The Texas Commission on Environmental Quality (TCEQ) awards grants to regional and local governments for MSW management projects through the state's Regional Solid Waste Grants Program. The state Legislature directs TCEQ to dedicate one-half of the revenue generated by state fees on MSW disposed of at landfills to grants for regional and local MSW projects. Eligible project categories includes source reduction and recycling projects that provide a direct and measurable effect on reducing the amount of MSW going into landfills, by diverting materials from the municipal solid waste stream for reuse or recycling, or by reducing waste generation at the source (TCEQ, 2010).

  Website: *http://www.tceq.texas.gov/permitting/waste_permits/waste_planning/wp_grants.html*

- **Wisconsin Recycling Efficiency Incentive Grants.** The Wisconsin Department of Natural Resources awards Recycling Efficiency Incentive Grants to local governments that have made efforts to improve the efficiency of their recycling programs (Wisconsin DNR, 2010).

  Website: *http://docs.legis.wisconsin.gov/code/admin_code/nr/549.pdf*

NON-GOVERNMENT FUNDING

Non-profit organizations may provide grants and other funding for resource conservation and recovery initiatives, often in partnership with for-profit companies.

- **Coca-Cola/KAB Recycling Bin Grant Program.** Coca-Cola and Keep America Beautiful (KAB) provide beverage container recycling bins for parks, schools, offices, and special events. The Coca-Cola/KAB Recycling Bin Grant Program supports local community recycling programs by providing selected grant recipients with containers for the collection of beverage container recyclables in public settings. Grant recipients receive actual recycling bins instead of funding (Coca-Cola/KAB, 2011).

  Website: *http://www.bingrant.org*

TAX INCENTIVES

Some local governments offer tax incentives to encourage private firms to operate recycling facilities and other resource conservation and recovery operations in their municipalities.

- **North Carolina Recycling Tax Credits.** The North Carolina Recycling Business Assistance Center offers two recycling tax credits. The N.C. Recycling Property Tax Exemption exempts equipment and facilities used exclusively for recycling and resource recovery from state property taxes. The N.C. Sales Tax Incentive for Manufacturing Equipment applies a one-percent privilege tax rate to recycling equipment purchases, with a maximum tax of $80.00 per article. Local governments can use these incentives to encourage the state's recycling industry(RBAC, 2011).

  Website: *http://www.p2pays.org/rbac/tax_credit.html*

8. FEDERAL, STATE, AND OTHER PROGRAM RESOURCES

Local governments can obtain information and assistance on resource conservation and recovery strategies from federal, state, and other programs, including those listed below.

Federal Programs

- **U.S. EPA Landfill Methane Outreach Program (LMOP).** LMOP is a voluntary assistance and partnership program that promotes the use of landfill gas as a renewable, green energy source. By preventing emissions of methane through the development of landfill gas energy projects, LMOP helps businesses, states, energy providers, and communities protect the environment and build a sustainable future (U.S. EPA, 2011d).

  Website: *http://www.epa.gov/lmop/*

- **U.S. EPA PAYT Program.** EPA provides tools and technical assistance to local governments to implement PAYT, a system in which residents are charged for the collection of household trash based on the amount they throw away instead of through the tax base or a flat fee. This creates a direct economic incentive to recycle more and to generate less waste (U.S. EPA, 2009).

  Website: *http://www.epa.gov/waste/conserve/tools/payt*

- **U.S. EPA Plug-in to eCycling.** Plug-in to eCycling develops partnerships between EPA and leading electronics manufacturers to assist consumers in donating or recycling their used electronic devices (U.S. EPA, 2010g).

  Website: *http://www.epa.gov/epawaste/partnerships/pluginU.S.*

- **EPA Responsible Appliance Disposal Program.** The Responsible Appliance Disposal Program is a partnership program for utilities, retailers, manufacturers, and state and local governments to ensure that ozone-depleting substances and other chemicals from old household appliances are handled properly. By capturing and destroying or reclaiming the chemicals from the appliances and recycling the durable goods, partners also prevent GHG emissions (U.S. EPA, 2011i).

  Website: *http://www.epa.gov/ozone/partnerships/radU.S.*

- **EPA State and Local Climate and Energy Program.** This program assists state, local, and tribal governments in meeting their climate change and clean energy goals by providing technical assistance, analytical tools, and outreach support. It includes two programs:

  - ***The Local Climate and Energy Program*** helps local and tribal governments meet multiple sustainability goals with cost-effective climate change mitigation and clean energy strategies. EPA provides local and tribal governments with peer exchange training opportunities and planning, policy, technical, and analytical information that support reduction of GHG emissions.

  - ***The State Climate and Energy Program*** helps states develop policies and programs to reduce GHG emissions, lower energy costs, improve air quality and public health, and help achieve economic development goals. EPA provides states with and advises them on proven, cost-effective best practices, peer exchange opportunities, and analytical tools.

  Website: *http://www.epa.gov/statelocalclimate/U.S.*

- **EPA WasteWise Program.** WasteWise is a free, voluntary EPA program through which organizations reduce and recycle MSW and selected industrial wastes, benefiting their bottom line and the environment. WasteWise members can join as partners, endorsers, or both. Partners range from small local governments and nonprofit organizations to large, multinational corporations.

  Website: *http://www.epa.gov/epawaste/conserve/smm/wastewise/*

State Programs

- **CalRecycle.** CalRecycle is California's state authority on recycling, waste reduction, and product reuse. CalRecycle's goal is to "play an important role in the stewardship of California's vast resources and promote innovation in technology to encourage economic and environmental sustainability." CalRecycle's extensive website provides resources for California consumers, businesses, recycling and waste-hauling industries, non-profit organizations, educational facilities, and others (CalRecycle, 2011a).

  Website: *http://www.calrecycle.ca.gov/*

- **North Carolina Division of Pollution Prevention and Environmental Assistance (DPPEA).** The North Carolina DPPEA provides resources to help industries, citizens, local government, recycling businesses, and state agencies enact resource conservation and recovery programs. The DPPEA's goal is to "use a systems approach to promote the elimination, reduction, reuse, recycling, and proper management of wastes" (DPPEA, 2011).

  Website: *http://www.p2pays.org/*

Other Programs

- **Institute for Local Self-Reliance (ILSR).** ILSR works with citizens, activists, policymakers, and entrepreneurs to design systems and policies to increase economic effectiveness, reduce wastes, decrease environmental impacts, and provide for local ownership of the infrastructure and resources essential for community well-being. ILSR has issued a number of reports and other publications (ILSR, 2011).

  Website: *http://www.ilsr.org*

- **Keep America Beautiful (KAB).** KAB is a national non-profit organization that focuses on changing behaviors and improving communities through litter prevention, waste reduction and recycling, and beautification and community greening (KAB, 2011).

  Website: *http://www.kab.org*

- **National Recycling Coalition (NRC).** The NRC is a national non-profit advocacy group and a professional membership organization that represents and advocates for every sector of the recycling industry across the United States at the local, state, and federal levels (NRC, 2011).

  Website: *http://www.nrcrecycles.org/*

- **Northeast Recycling Council (NERC).** NERC's mission is to advance an environmentally sustainable economy by promoting source and toxicity reduction, recycling, and the purchasing of environmentally preferable products and services. NRERC works with 10 states—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and Delaware—and holds regular conferences (NERC, 2011).

  Website: *http://www.nerc.org*

- **U.S. Composting Council.** This group's mission is to advance composting and promote compost use to enhance soils and provide economic and environmental benefits for its members and society. The U.S. Composting Council hosts a yearly conference (U.S. Composting Council, 2011).

  Website: *http://compostingcouncil.org/*

9. CASE STUDIES

City of Kansas City, Missouri

Kansas City, Missouri, has one of the most cost-effective trash and recycling collection programs in the nation, currently spending about $7 less per household than the national average (City of Kansas City, 2011). However, as the city's local landfills start to reach capacity, trash collection costs are projected to rise by an estimated 45 to 75 percent as more money is spent on fuel, driver salaries, and truck maintenance to ship trash farther away (SCS Engineers, 2008). When the city began confronting these cost concerns, it was in the process of developing a climate protection plan that called for significant GHG emission reductions through improved waste management. The priorities of cost control and GHG reduction have led to a greater emphasis on recycling and the development of Kansas City's Long-Term Solid Waste Strategic Management Plan, completed in the spring of 2008.

PROGRAM INITIATION

Kansas City's Public Works Department, Solid Waste Division, initiated KC Recycles as a biweekly curbside recycling program in 2004. The city expanded the program to a weekly basis in 2005.

On August 17, 2006, the mayor of Kansas City signed a resolution directing a climate protection planning process for Kansas City. The City Council subsequently approved a goal to reduce GHG emissions from city government operations by 30 percent from year 2000 levels by the year 2020 and to reduce community-wide emissions in Kansas City by 30 percent from year 2000 levels by 2020. The Kansas City Climate Protection Plan includes goals to increase and expand curbside recycling, expand city government recycling and green purchasing, and require construction and demolition recycling in city-supported projects. Together, these goals would reduce GHG emissions by an estimated 116,725 $MTCO_2e$ (City of Kansas City, 2008).

Profile: City of Kansas City, Missouri

Area: 313 square miles

Population: 447,306

Structure: KC Recycles is run by the City of Kansas City's Public Works Department, Solid Waste Division.

Program Scope: KC Recycles is Kansas City's curbside recycling and household waste disposal program. Recycling is voluntary and residents can set their recyclables out every week or on an as-needed basis. The city also provides event recycling and recycling drop-off centers for the region.

Program Creation: Kansas City initiated KC Recycles in 2004 as a biweekly collection in order to reduce the amount of waste going to landfills in the region. The city expanded to weekly collection in 2005 and initiated its event recycling program in 2007. The city's Climate Protection Plan calls for further expansion of recycling for residents, government operations, and city-supported projects.

Program Results: KC Recycles collects approximately 1,500-1,600 tons of recyclable materials per month, and has collected more than 98,000 tons of recyclable materials since its launch in 2004. This amounts to a GHG savings of approximately 281,260 $MTCO_2e$.

PROGRAM FEATURES

Kansas City provides a variety of recycling opportunities for its citizens through curbside recycling, event recycling programs, and recycling drop-off centers. The city provides weekly curbside collection of recyclables from houses and apartments having up to six units. It gives each resident a 22-gallon bin for recyclable materials, which is collected on trash day every week through a private hauler under contract to the city. Materials collected at the curb include aluminum and tin cans, plastic bottles, mixed paper, and cardboard. The recyclables are collected in a "single stream" and taken to a privately owned material recovery facility where they are sorted and sold (City of Kansas City, 2011).

The program is voluntary, but the city encourages participation by limiting the amount of trash that can be picked up. Kansas City uses a hybrid PAYT system: residents are allowed a base amount of trash (80 pounds, two 40-pound bags) for no monthly cost and only purchase tags for bags in excess of that base amount. By limiting the amount of waste that can be picked up at no cost, the city is encouraging residents to recycle materials. There is no limit on recyclable collection: materials that do not fit in the bins can be placed next to them for pickup (City of Kansas City, 2011).

In addition to weekly curbside collection, the city operates three drop-off recycling centers. The centers provide outlets for residents of multi-unit housing that do not have curbside recycling service, and they accept materials not included in the curbside collection program.

Kansas City also encourages recycling in the community through public education. In 2010, KC Recycles distributed approximately 10,000 door hangers and made presentations to neighborhood groups where recycling bins are distributed (Mid-America Regional Council Solid Waste Management District, 2010).

KC Recycles has started expanding its efforts beyond curbside and commercial recycling into food waste collection and composting. The city began collecting food waste in 2008 from several city facilities and works with a private composting firm that collects about 4,000 tons of food waste annually from a range of private and public clients in the area. Despite the fact that about 75 percent of housing units in Kansas City have in-house food disposals, food waste still accounts for about 19 percent of residential waste sent to the city's landfills (SCS Engineers, 2008).

Kansas City launched an event recycling program in 2007 to provide recycling services at special events and festivals. It also launched a recycling for pedestrians program in 2008, providing curbside recycling to pedestrian traffic in several business districts. Food waste collected from these programs is mixed with yard waste collected by the city to create premium market-ready compost.

The Kansas City Climate Protection Plan, released in 2008, called for the development of a comprehensive solid waste management plan with a goal of diverting up to 80 percent of residential trash from landfill disposal. The city adopted this plan and goal in 2008 (SCS Engineers, 2008). Other goals in the Climate Protection Plan include doubling the amount collected from curbside recycling, from 20,000 tons today to 40,000 tons in four years through marketing and expansion of existing programs, improving the city's own recycling rate (in government operations) from 2 to 22 percent, and making construction and demolition recycling mandatory for city-supported projects (City of Kansas City, 2008).

PROGRAM RESULTS

KC Recycles has collected more than 98,000 tons of recyclable materials since launching in 2004 (U.S. EPA, 2010).

Recycling Results

- In 2009, KC Recycles collected approximately 19,000 tons of material through curbside recycling (City of Kansas City, 2011). Average curbside collection rates are 1,500-1,600 tons per month (City of Kansas City, 2008).

- In 2009, Kansas City provided recycling services at six events, including a major festival where the city recycled more than 46 percent of the trash generated.

- The city's drop-off recycling centers recovered 2,664 tons of materials for recycling in 2008 (City of Kansas City, 2008).

- The city's recycling rate in 2006 was about 26 percent. The city's Long-Term Solid Waste Strategic Management plan lays out the steps the city will need to take to boost its diversion rate to 80 percent, in line with the climate protection plan (SCS Engineers, 2008).

Revenue Generated

- The sale of recycled materials enables Kansas City to generate revenues up to 4 percent of the composite market value of the materials. In 2007, the city received approximately $69,000 for nearly 19,000 tons of recyclables (SCS Engineers, 2008).

Greenhouse Gas Benefits

- Since its inception in 2004, the program has avoided emissions of 281,260 $MTCO_2e$ through recycling, comparable to the annual emissions of more than 55,000 cars (U.S. EPA, 2010).

- In 2009 alone, KC Recycles avoided emissions of 54,530 $MTCO_2e$ (City of Kansas City, 2011).

Kansas City has received several awards and other recognitions for its waste reduction efforts, including the 2005 National Award for Waste Reduction from KAB and an Outstanding Large Municipality Recycling Award in 2010 from the Missouri Recycling Association. (City of Kansas City, 2011)

Website: *http://www.kcmo.org/CKCMO/Depts/PublicWorksKCRecycles-YourCurbsideRecyclingProgram*

Palm Beach County, Florida

The Solid Waste Authority (SWA) of Palm Beach County, Florida, uses a range of innovative approaches to encourage recycling among residents (both single-family and multi-family residences) and businesses. SWA is achieving an annual waste reduction goal of 42 percent, compared with the current statewide recycling rate of 28 percent (SWA, 2010).

PROGRAM INITIATION

The Florida Legislature created SWA in 1974 under the Palm Beach County Solid Waste Act. SWA began residential curbside recycling in 1987, and by 1992 it was available to more than 98 percent of single-family residences and 78 percent of multi-family residences (SWA, 2011a). In 2009, the county built a new 138,000-square-foot facility, the Recovered Materials Processing Facility, the largest such facility in the state, to handle its recycling stream and to expand the range of materials accepted for recycling. SWA continues to explore avenues for expanding waste diversion in the county, including several projects to recover food waste from individual businesses in the county. In one of these projects, food wastes are processed by fly larvae, which are then used as food for farm-raised fish (SWA, 2011b).

Profile: Palm Beach County, Florida

Area: 1,977 square miles

Population: 1.3 million

Structure: The Solid Waste Authority (SWA) is a Dependent Special District governed by the seven elected county commissioners of Palm Beach County.

Program Scope: SWA provides recycling collection from residential (single and multi-family) and commercial areas within the unincorporated county. It collects materials through curbside pick-up and at over 240 drop-off centers. Recyclable materials are then sent to the Recovered Materials Recycling Facility where they are sorted, processed, and prepared for sale.

Program Creation: The Florida State Legislature created SWA in 1974. SWA began curbside recycling in 1987, and it built a new recycling facility in 2009 to collect, sort, and process materials for sale to the market to produce revenue. SWA has an annual goal of 50 percent waste reduction.

Program Results: SWA has exceeded its recycling goal three out of the past nine years. It has collected more than 2 million tons of recyclable material since the recycling program's inception, with an average of 130,000 tons of recyclables collected per year. In 2010, SWA collected more than 94,000 tons from residential recycling, and more than 19,500 tons from commercial recycling. Current recycling activities conducted by SWA are estimated to reduce GHG emissions by nearly 501,300 $MTCO_2e$ annually.

PROGRAM FEATURES

Palm Beach County, Florida, is made up of 37 incorporated cities. These communities organize recycling and solid waste collection for residential and commercial establishments. SWA provides solid waste and recycling processing and disposal services to both incorporated and unincorporated parts of the county.

SWA provides two types of recycling bins to residences for curbside pick-up: yellow bins for paper products, and blue bins for recyclable containers (plastic, glass, aluminum, etc.) (SWA, 2011c). Unlike many communities, SWA provides large versions of these recycling bins to multi-family residences, making it easy for apartment and condo dwellers to participate in the recycling program. SWA determines disposal fees through a disposal assessment to the customer and from tipping fees at transfer stations and processing facilities. All residents are assessed a disposal fee, currently set at $166 per year for single-family households and $94 per year for multi-family households (SWA, 2011a).

To improve efficiency and reduce the costs of waste transportation, SWA operates six transfer stations around Palm Beach County that accept nearly 72 percent of the county's solid waste and recyclables (SWA, 2009a). The remaining materials are delivered directly to the Recovered Materials Processing Facility, the waste-to-energy facility, the composting facility, or landfills, which are all located adjacent to one another and all owned and operated by SWA. Recovered materials are sorted, processed, and prepared for sale to manufacturers that will use the materials to produce new products. The revenue from the sale of these materials is used to offset the costs to operate and maintain SWA's recycling programs. A portion of revenue is also shared with local businesses and municipalities, as described below (SWA, 2009a).

To reduce commercial waste, which accounts for approximately 40 percent of the 1.4 million tons of solid waste generated in the county every year, SWA offers businesses financial incentives, technical support, and free waste audits (SWA, 2011c). Financial incentives are provided through SWA's Commercial Material Purchase Program, which provides a portion of SWA's recycling revenues to businesses and government offices that deliver clean loads of corrugated cardboard and sorted white ledger paper to the processing facility (SWA, 2011c). Waste audits evaluate a company's current waste stream, recommend steps to cut costs, and propose a plan for a recycling program. Audits also involve educational presentations and outreach materials for employees. SWA provides recycling bins for businesses and offers over 240 convenient public recycling sites around the county where businesses can drop off their recyclables.

Because recycling in Palm Beach County is voluntary, SWA provides educational programs and outreach materials to inform the public and businesses about the benefits of recycling and source reduction. SWA educators come to schools to give classroom presentations, and schools can take site tours of SWA's facilities. SWA also provides an extensive set of interactive educational materials for teachers, with nearly 50 classroom activities and 12 lesson plans for different grade levels, all of which can be downloaded from SWA's website: *http://www.swa.org/site/recycling/educational/educational_programs.htm*.

PROGRAM RESULTS

Since the program's inception, SWA has collected more than 2 million tons of material from residential and commercial recycling (SWA, 2011a). Palm Beach County households and businesses recycle more than 130,000 tons of recyclable materials per year (SWA, 2011d).

Recycling Results

- In 2010, SWA received more than 94,000 tons of materials from residential recycling, and more than 19,500 tons from commercial recycling (SWA, undated).

- In 2010, SWA collected curbside recycling from more than 700,000 residences, including both single-family and multi-family units (SWA, 2011a).

Revenue Generated

- In 2010, SWA sold more than 118,000 tons of recyclable materials and generated approximately $11.4 million in recycling revenues (SWA, 2011a; 2011e).

- In 2010, SWA began a revenue-sharing program to encourage cities to participate in SWA's recycling program. This program directs 50 percent of the net revenues to the cities and the SWA collection enterprise, based on the amount of recyclable materials delivered to SWA (SWA, 2011e).

Greenhouse Gas Benefits

- Current recycling activities conducted by SWA reduce GHG emissions by a nearly estimated 501,300 $MTCO_2e$ annually, comparable to the annual emissions of 98,300 cars (SWA, 2009b).

- In addition to providing waste management benefits, SWA's transfer stations provide GHG and air pollution benefits by reducing miles traveled and enhancing transportation efficiency. SWA estimates that these transfer stations save almost 11 million miles and 2.5 million gallons of diesel fuel, reducing CO_2 emissions by 25,400 metric tons annually (SWA, 2011a).

SWA's recycling program has been recognized by a number of organizations, including the Solid Waste Association of North America, American Forest and Paper Association, KAB, and Recycle Florida Today (SWA, 2011a; 2011e).

Websites: *http://www.swa.org/* and *http://www.epa.gov/osw/conserve/tools/localgov/success/palmbeach.htm*

10. ADDITIONAL EXAMPLES AND INFORMATION RESOURCES

Title/Description	Website
Examples of Resource Conservation and Recovery Activities	
The Bottomline on Buying Recycled. This EPA document illustrates how some businesses save money by using recycled materials in the products they purchase and manufacture.	*http://epa.gov/climatechange/wycd/waste/downloads/Bottomline_Buying_Recycled.pdf*
Broward County, FL. Recyclables collected by Broward County residents are processed at a materials recovery facility (MRF) located in Davie, Florida. The MRF is a 40,000-square-foot center that processes more than 450 tons of Broward County's recyclables per day. The MRF's operational costs are covered through a surcharge on the disposal fee at the county's waste-to-energy plants, state grants, and other funds. Revenues raised from the sale of the materials are returned to participating cities based on the tonnage they deliver.	*http://www.epa.gov/region4/rcra/mgtoolkit/*
Clayton, NC. Clayton residents more than tripled the amount of waste they recycle thanks to an expanded collection program the town implemented at the beginning of 2008. The revised recycling program included the replacement of 18-gallon bins with 64-gallon rollcarts, which are easier for residents to use. Several more items were also added to collection, including magazines; catalogs; phone books; cereal boxes; junk mail; office waste paper; and plastic bottles and jugs numbered 3, 4, 5, 6, and 7.	*http://www.epa.gov/region4/rcra/mgtoolkit/*
Climate Showcase Communities. Several of EPA's Climate Showcase Communities (CSC) are testing innovative resource conservation and recovery programs. Quarterly updates on their progress are available online. Communities with waste management elements include: Gila River Indian Community, AZ; Hailey, ID; Alameda County Waste Management Authority, CA; Humboldt Waste Management Authority, CA; Monroe County, NY; and the Mid Ohio Regional Planning Council.	*http://epa.gov/climateshowcase*
Food Recovery Success Stories. Many organizations have successful food recovery programs. EPA has compiled examples of successful programs here.	*http://www.epa.gov/epawaste/conserve/materials/organics/food/success*
Kinston, NC. In November 2007, the city of Kinston modified its recycling program, giving residents 95-gallon wheeled carts. Also, instead of workers collecting the recycled materials once a week, they collected it once a month. Once a month collection requires less fuel, and automated collection makes it possible to reuse the same trucks used for waste pick-up. According to Rhonda Barwick with the Kinston Department of Public Services, residents are more likely to participate since the carts are easier for the elderly to wheel to the street and offer a cover to keep out rain and pests. Kinston says the city has realized $100,000 in fuel savings and now requires fewer collection personnel.	*http://www.epa.gov/region4/rcra/mgtoolkit/*
Pay-As-You-Throw Success Stories. PAYT (charging for MSW based on the amount of trash disposed rather than through the tax base) has helped several local communities reduce the waste they landfill. Examples of 1000's of successful PAYT programs exist all across the country.	*http://www.epa.gov/waste/conserve/tools/payt/tools/success.htm*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Website
Put-in-Bay Township, OH. The Township of Put-in-Bay includes nine islands in the middle of Lake Erie with a population of 763 full time residents, but climbs to between 600,000 and 750,000 tourists each year during the summer. Waste management has been difficult; all solid waste must be removed from the islands. After receiving an ODNR Division of Recycling & Litter Prevention grant, the township was able to purchase two new packer units in which to collect and compact recyclable materials at a rate of six to one. This greatly reduced the number of trips off the islands and increased the amount of materials the township could collect, as previously bins were always full. The project was so successful that the township has expanded into commercial recycling, thus saving additional time and resources while further increasing recycling rates. Area businesses are now able to use the recycling services on the island for a nominal fee.	*http://www.ohiodnr.com/tabid/23095/default.aspx*
Smart Communities Network. The Smart Communities Network Website showcases many sustainable development success stories from communities across the country.	*http://www.smartcommunities.ncat.org/management/sstoc.shtml*
Waste Prevention, Recycling, and Composting Options: Lessons from 30 Communities. This EPA report analyzes the actual operating experience of 30 diverse communities and draws lessons for communities wanting to strengthen their own programs.	*http://www.epa.gov/osw/conserve/downloads/recy-com/index.htm*
WasteWise Success Stories. EPA's WasteWise has more than 1,700 members that have reduced a combined 120 million tons of waste. The WasteWise website publishes success stories for all organization types, including local and state governments.	*http://www.epa.gov/epawaste/conserve/smm/wastewise/success.htm*
Information Resources for Resource Conservation and Recovery Activities	
Food Recovery Guide. EPA's Guide for Feeding the Hungry and Reducing Solid Waste through Food Recovery discusses the link between food recovery, waste reduction, and feeding the hungry.	*http://www.epa.gov/osw/conserve/materials/organics/pubs/wast_not.pdf*
GHG Equivalencies Calculator. EPA's GHG Equivalencies Calculator translates emissions amounts into terms that are more easily understandable, including equivalencies for avoided emissions through waste reduction.	*http://www.epa.gov/cleanenergy/energy-resources/calculator.html*
Household Emissions Calculator. EPA's Household Emissions Calculator allows individuals to estimate their annual GHG emissions (including those from waste) and explore ways to reduce them.	*http://www.epa.gov/climatechange/emissions/ind_calculator.html*
ICLEI Local Governments for Sustainability. This organization is an association with more than 1,220 local governments committed to sustainable development. Members come from 70 countries and represent more than half a billion people.	*http://www.iclei.org/index.php?id=iclei-home*
Individual Waste Reduction Model (iWARM). The iWARM tool is similar to WARM, but geared toward individuals. It helps consumers understand the life-cycle GHG savings associated with recycling common household products.	*http://www.epa.gov/waste/conserve/tools/iwarm/*
Life-Cycle Assessments of Waste Materials. EPA's Solid Waste Management and Greenhouse Gases: A Life-Cycle Assessment of Emissions and Sinks reports on GHG emissions from management of common materials in municipal solid waste. For the materials covered in WARM, EPA has published background documents detailing the methodology and data used to develop the emission factors.	*http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html*

10 ADDITIONAL EXAMPLES AND INFORMATION RESOURCES *(cont.)*

Title/Description	Website
Materials Management and Climate Change – An Introduction. This scripted presentation from the West Coast Climate and Materials Management Forum explains how material conservation actions reduce GHG emissions. It is designed for local and state governments and can be used to educate policy makers, inform climate action planning, and help support projects that minimize the impacts from materials.	*http://www.epa.gov/region10/pdf/climate/wccmmf/materials_management_and_climate_change_presentation.pdf*
Materials Management Approaches for State and Local Climate Protection Toolkit. This wiki is a materials management toolkit developed through the West Coast Climate and Materials Management Forum compiling climate protection actions, examples of climate action plans, new approaches to GHG inventories, measurement tools, links to resources, and more. The Forum was convened in 2008 by EPA Regions 9 and 10, and is a partnership of federal, state, and local government stakeholders from the western states committed to advancing materials management strategies to reduce GHG emissions.	*http://captoolkit.wikispaces.com/*
Materials Management Webinars. EPA's West Coast Forum on Climate Change, Waste Prevention, Recovery and Disposal is a series of webinars to educate stakeholders on the connection between climate change and materials management, and how state and local governments can use resource conservation as part of their climate strategy.	*http://yosemite.epa.gov/r10/ECOCOMM.NSF/Programs/wcf*
Mid-America Regional Council. The Mid-America Regional Council, located in Kansas City, Missouri, runs an online educational series on recycling and solid waste management.	*http://www.marc.org/Sustain/smm_web-academy.asp*
Municipal Solid Waste Decision Support Tool (MSW-DST). EPA's MSW-DST calculates life-cycle environmental burdens for all waste management activities including collection, transportation, material recovery facilities, transfer stations, composting, remanufacturing (of recovered materials), landfilling, and combustion, as well as offsets for the potential benefits from conservation of energy and materials. As of July 2012, EPA was in the process of updating MSW-DST to make it web-accessible; information on the tool is available via the link at right.	*http://www.epa.gov/nrmrl/appcd/combustion/cec_models_dbases.html*
Office Carbon Footprint Tool. EPA's Office Carbon Footprint Tool helps offices estimate the GHG impact of their operations, including waste reduction.	*http://www.epa.gov/wastes/conserve/smm/wastewise/carboncalc.htm*
Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices. This EPA report finds significant potential to reduce the country's GHG emissions through materials management (e.g., recycling and waste prevention), and land management (e.g., brownfield redevelopment, land restoration, and smart growth).	*http://www.epa.gov/oswer/docs/ghg_land_and_materials_management.pdf*
Quantifying the Environmental Value of Building Reuse. This report by Preservation Green Lab of the National Trust for Historic Preservation provides an analysis using life-cycle assessment of the potential environmental benefits of building reuse as compared to new construction. The report's key findings offer policy-makers, building owners, developers, architects, and engineers compelling evidence of the merits of reusing existing buildings as opposed to tearing them down and building new.	*http://www.preservationnation.org/information-center/sustainable-communities/sustainability/green-lab/lca/The_Greenest_Building_lowres.pdf*
Recycled Content (ReCon) Tool. EPA's ReCon tool helps organizations, companies, and individuals estimate life-cycle GHG emissions and energy impacts from purchasing and/or manufacturing materials with varying degrees of post-consumer recycled content.	*http://www.epa.gov/climatechange/wycd/waste/calculators/ReCon_home.html*

Title/Description	Website
Recycling Measurement Tool. EPA's Recycling Measurement Tool assists local governments in assessing their recycling efforts. This tool allows local governments to compare recycling rates of other communities and provides useful information for setting up a recycling program.	*http://www.epa.gov/epawaste/conserve/tools/recmeas/index.htm*
SMART BET. EPA's SMART BET is designed to help waste managers decide whether a PAYT program is the right model for waste management in their community.	*http://www.epa.gov/waste/conserve/tools/payt/tools/smart-bet/index.htm*
Sustainable Materials Management: The Road Ahead. This EPA report suggests a roadmap for the future based on materials management—fulfilling human needs and prospering, while using fewer materials, reducing toxics, and recovering more of the materials used.	*http://www.epa.gov/epawaste/conserve/smm/vision.htm*
Waste Reduction Model (WARM). EPA created WARM to help solid waste planners and organizations track and voluntarily report GHG emissions reductions from several different waste management practices. WARM calculates and totals GHG emissions of baseline and alternative waste management practices, including source reduction, recycling, combustion, composting, and landfilling.	*http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html*

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