NEWMOA Climate-Waste Action Plan to Support State Efforts

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Northeast Waste Management Officials' Association

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About NEWMOA

The Northeast Waste Management Officials' Association (NEWMOA) is a nonprofit, nonpartisan interstate association that has a membership composed of the hazardous waste, solid waste, waste site cleanup and pollution prevention program directors for the environmental agencies in Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. NEWMOA was established by the Governors of the New England states as an official regional organization to coordinate interstate hazardous and solid waste, waste site cleanup, and pollution prevention activities and support state waste programs, and was formally recognized by the U.S. Environmental Protection Agency (EPA) in 1986.

NEWMOA's mission is to develop and sustain an effective partnership of states that helps achieve a clean, healthy, and sustainable environment by exploring, developing, promoting, and implementing environmentally sound solutions for:

- Reducing materials use and preventing pollution and waste,
- Properly reusing and recycling discarded materials that have value,
- Safely managing solid and hazardous wastes, and
- Remediating contaminated sites.

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The mention of any company name in this Action Plan should not be considered an endorsement by NEWMOA or the NEWMOA-member states agencies.

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Background

Each stage of a product's life cycle - from raw materials extraction to manufacturing, transportation, use, and "end-of-life" management - consumes fossil fuels and results in greenhouse gas (GHG) emissions. While many analyses of greenhouse gases from materials and products focus only on the waste management component, a full life accounting of GHG emissions associated with the production and use of products and materials shows that that they represent roughly 35 to 46 percent of the GHG emissions in the U.S. The NEWMOA-member state programs believe that the serious threat of global warming to the planet's climate justifies action to minimize these impacts now.

Organic wastes in landfills significantly contribute to generation of methane gas, which is a more potent greenhouse gas than carbon dioxide (CO_2). Consequently, actions that avoid methane generation and capture and use the methane that cannot be prevented are a priority for this NEWMOA Climate-Waste Action Plan.

Considerable amounts of energy are used at contaminated sites to remove and treat oil and hazardous materials, transport waste materials to offsite disposal facilities, and to monitor environmental conditions on an ongoing basis. Recently, cleanup programs have begun to develop and implement "green remediation" approaches that maintain the ultimate cleanup goal and encourage selection of remediation techniques with low GHG emissions impacts. Through this Action Plan, NEWMOA will be providing training and technical support for state waste site cleanup programs to help them promote greener practices.

Many of the hundreds of closed solid waste landfills, Brownfields, and other contaminated properties across the Northeast that have limited reuse potential may provide opportunities for siting renewable energy projects, such as solar, wind, and methane gas recovery and use, as well as solid waste reuse and recycling facilities. However, ensuring that the intended use at these sites is compatible with their closure and cleanup is critical. Through this Action Plan, the NEWMOA-member state programs will continue to work together to promote these developments at waste sites in the Region.

Storms in the Northeast are expected to become more powerful due to warming sea surface temperatures that can energize them. Effectively responding to these events is a critical aspect of climate change adaptation. In the aftermath of a storm, large quantities of all types of debris need to be quickly and efficiently collected and properly disposed of. The NEWMOA-member state programs plan to continue to improve their capability to handle the anticipated increases in debris after storm events and to encourage greater reuse and recycling.

Action Plan Introduction

The Environmental Commissioners and Directors from the New England States challenged the Northeast Waste Management Officials' Association (NEWMOA)[1] and the air and water interstates to identify regional activities to address climate change as a priority. As a result of this challenge, the NEWMOA Board of Directors, which includes the state environmental agency directors of pollution prevention, hazardous and solid waste management, and waste site cleanup programs, developed this Climate-Waste Action Plan. The Plan presents a strategy for mitigating and adapting to climate Change through improving waste prevention and recycling initiatives, increasing renewable energy on contaminated sites, implementing "greener" site remediation, and improving management and recycling of disaster debris.

This Regional Action Plan is the culmination of a year and half long discussion among the NEWMOA member state Program Directors about their climate actions and waste management efforts, and how these efforts could be made more effective/leveraged through regional collaboration. The Plan draws on discussions of the NEWMOA Board of Directors, interviews conducted by NEWMOA staff with key state waste and pollution prevention managers, and a review of the available literature and states' climate action plans and solid waste management plans. The New England Governors'/Eastern Canadian Premiers Climate Action Plan and the Regional Greenhouse Gas Initiative (RGGI) provided guidance for this Action Plan. The Plan is intended to provide a framework for regional initiatives to advance shared goals; however it recognizes that not all states may be in a position to move forward on all of them.

Summary of Climate-Waste Action Plan Goals & Strategies

All of the NEWMOA-member state environmental agencies implement programs to prevent and properly manage pollution and waste. Redoubling the efforts of these programs are key elements of the NEWMOA Climate-Waste Action Plan. The Plan is designed to ensure that the generation of waste is minimized, that discarded materials are managed to reduce their environmental impacts, and that oil and hazardous material that has been released to the environment is appropriately managed. The experiences of the NEWMOA-member programs have shown that there are significant opportunities for increasing waste prevention and recycling for municipal solid waste, construction and demolition debris, non-hazardous and hazardous industrial waste, and other wastes. The NEWMOA Climate-Waste Action Plan presents a series of recommended actions to address the climate impacts of various waste-related activities.

Over the long term, anthropogenic greenhouse gas emissions must be reduced to levels that no longer pose a dangerous threat to the climate. According to the International Panel on Climate

[1] The NEWMOA member states include Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont.

Change, this will require global reductions of GHG emissions of approximately 75-85 percent below current levels. The New England Governors/Eastern Canadian Premiers' 2001 Climate Action Plan goals are:

- **Short-term Goal**: Reduce regional GHG emissions to 1990 emissions by 2010.
- **Mid-term Goal:** Reduce regional GHG emissions by at least 10 percent below 1990 emissions by 2020, and establish an iterative five-year process, commencing in 2005, to adjust the goals if necessary and set future emissions reduction goals.
- **Long-term Goal:** Reduce regional GHG emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions of 75–85 percent below current levels.

A number of northeastern states have adopted their own specific climate action goals. For many of the states, these generally reference the regional goals established by the New England Governors' Conference (NEGC), and provide a basis for states to develop plans for achieving their own and the regional goals. These long-term goals mirror that of the United Nations Framework Convention on Climate Change, to which both the United States and Canada are signatories. The regional GHG goal may be modified as the understanding of climate science advances.

NEWMOA's overall Climate-Waste Action Plan goals are to:

- Assist Northeast states in achieving their greenhouse gas reduction goals by supporting and helping states implement programs that mitigate the climate, energy, and overall environmental impacts of products and materials use, waste generation, waste management, and site remediation; and
- Promote effective prevention and management strategies to assist states in adapting to the impacts of a warmer climate in the near term.

The Action Plan identifies the following guiding principles for regional climate-waste action:

- Effectively minimizing the contribution of waste management to climate change will require coordination and collaboration in the efforts of the Northeast states.
- A life cycle view should be taken when evaluating the climate impacts of any material or waste, including the impacts of materials throughout the supply chain.
- Actions to foster pollution prevention, reuse, recycling, waste management, and waste site cleanup should be implemented to minimize energy consumption and GHG emissions.
- Actions should focus on the materials and waste streams with the greatest overall climate impact.
- Addressing climate change can have unintended consequences, and these should be addressed proactively (e.g., preventing the generation of wastes containing toxic chemicals from new energy efficiency and renewable energy technologies). Efforts to reduce waste and

mitigate climate change should not result in significant contamination of land, air, and water or negative public health impacts.

- Renewable energy and energy efficiency are critical to successful climate change mitigation because they reduce fossil fuel emissions. Closed landfills, Brownfields, and other contaminated sites can provide sites for developing renewable energy and for supporting waste reuse and recycling activities.
- Waste programs should anticipate the impacts of a warmer climate on the types and amounts of waste generated and develop strategies and initiatives to adapt to these changes.

Through this Action Plan, the NEWMOA-member state programs commit to sharing information, conducting research, discussing and developing joint policy actions, coordinating implementation of programs, and conducting needed training and capacity building to mitigate and adapt to climate change. The following are eight waste-related strategies and recommended actions to mitigate and adapt to climate change that NEWMOA should undertake in conjunction with member states and appropriate partners.

STRATEGY 1: Minimize Life Cycle Impacts of Waste

- Help state programs understand the options for product stewardship by evaluating and exploring regulatory models for implementing product responsibility approaches.
- Support state efforts to work with a variety of entities on product stewardship and promote the views of state regulatory programs in these discussions.
- Explore ways to provide a point of contact for state programs that are addressing the same waste issues to access and share information.
- Help state programs obtain the tools necessary to advance design for the environment concepts, green chemistry, and green engineering by developing and promoting case studies, identifying barriers to successful adoption, measuring outcomes, and integrating successful approaches into available training.
- Help state programs understand their options and evaluate success in their efforts to utilize their purchasing power to promote source reduction and the use of more sustainable materials.
- Assist state programs in their efforts to advance the practical applications of waste prevention (sometimes called zero waste and beyond waste) by providing trainings for state and local officials and sharing experiences of successful programs within and outside of the region.
- Develop training opportunities on the use of more sustainable building practices as well as source separation deconstruction and reuse/recycling techniques.
- Assist state programs with evaluating options for increasing energy efficiency in the transportation of waste for disposal and recycling.
- Provide training on methods of evaluating the carbon foot print of products and waste.

- Provide training on energy efficiency techniques and technology for state and local environmental assistance and pollution prevention staff.
- Support state regulatory, assistance, and pollution prevention programs with promoting energy efficiency through use of improved software tools, such as the Energy and Materials Flow and Cost Tracker (EMFACT).
- Support state programs to collect and share a consistent set of data on the results of their energy efficiency and GHG reduction activities through the online P2 Results Data System.

STRATEGY 2: Increase Waste Reuse & Recycling

- Help state programs to understand barriers to increasing the collection, safe storage, and available end uses for targeted wastes and the necessary actions to address them by providing opportunities for information sharing and regional dialogue.
- Help state programs understand the various technologies available for safe collection and transport of waste for recycling and the results of research on cutting edge recycling techniques by providing opportunities for training and information sharing.
- Help state programs expand their understanding of appropriate regulations and permits designed to increase recycling (i.e., waste disposal bans) and for the potential end uses of various targeted waste streams by providing opportunities for peer-to-peer exchanges.
- Help state programs to understand the emerging technologies for using waste to generate energy and their regulatory implications by providing research and information sharing.
- Identify models that state and local programs can implement for providing financial incentives for increasing recycling, such as Pay-As-You-Throw or Save Money and Reduce Trash programs, their pros and cons, and barriers to implementation.
- Support states' beneficial use determinations programs and promote the reuse of industrial byproducts for which there is no risk to public health or the environment by creating a publically available beneficial use determinations clearinghouse.
- Help state programs develop strategies to increase diversion and recycling of construction and demolition (C&D) debris and reuse of clean C&D materials by identifying barriers, ways to address those barriers, and markets for the recycled waste.
- Help state programs understand and promote energy conversion of biomass-based C&D materials for which recycling opportunities do not exist by conducting research and sharing information and experience.

STRATEGY 3: Reduce Methane Gas Emissions from Landfills

- Identify gaps in science and work with other groups to conduct research to fill key data gaps on landfill gases, including studies of actual methane capture rates in the region.
- Identify opportunities for state agencies to advance organics recycling, such as the establishment of new mechanized food composting and anaerobic digestion facilities, and to address barriers and challenges to increase implementation of these systems.

- Assist state programs with identifying new design and operating standards for landfills that facilitate methane-to-energy development and the capture of landfill gases and conversion to fuel.
- Assist state programs with conducting research into new technologies for capturing lower levels of methane generated as closed landfills age.
- Assist state programs with examining opportunities for additional requirements for small landfills to implement more efficient capture of methane.
- Help state programs work with electric utilities to remove hurdles to establishing connections from landfill gas capture systems into the electric grid and share information about the experience of states agencies where there is legislation and programs to encourage these connections.

STRATEGY 4: Promote Greater Awareness of What the Public Can Do to Reduce Waste & Address Climate Change

- Develop regional messaging and outreach materials on the importance of prevention, recycling, and the waste-to-climate connection that can be modified for used in individual states.
- Promote a dialogue among traditional waste management companies, community organizations, municipal governments, and interested citizens on the relationship between generation of waste and climate change.

STRATEGY 5: Improve Overall Data Gathering & Waste Planning Support

- Work with state programs to help them understand different metrics and the potential use of common measures, where possible, for evaluating the success of their waste prevention, reuse, and recycling efforts.
- Gather available data and promote studies needed to develop regional quantitative targets for source reduction, recycling, and organics recovery to enhance the ability of the states to achieve their climate action goals and solid waste planning targets.
- Help state programs evaluate other products, materials, and waste streams for their climate impacts and potential strategies that may impact these wastes.
- Gather and share information and data to inform the Northeast states on the potential materials and climate benefits of source reduction options and strategies.
- Share information from materials and waste characterization studies.
- Collaborate with other interstate organizations to identify valuable sources of information and develop achievable reduction and recycling targets.
- Develop and implement a methodology for measuring the success of this Action Plan and identify and gather the data that are needed to track the impact of the Action Plan recommendations.

STRATEGY 6: Increase the Use of Former Solid Waste Landfills & Other Contaminated Sites for Renewable Energy & Waste Reuse & Recycling Development

- Assist state programs in developing criteria to assess the feasibility of waste sites and closed landfills for suitability for renewable energy and reuse and recycling development.
- Assist state programs with exploring new opportunities to site renewable energy and recycling development on former waste sites by developing model legislation and other support documents.
- Help states programs and property owners understand the variety of ways in which these projects can be financed and constructed.
- Improve the capacity of municipal agencies, state programs, and developers to more efficiently utilize waste sites for renewable energy and recycling projects by providing regular opportunities for information exchange and training through workshops and other outreach activities.

STRATEGY 7: Promote Green Remediation Practices at Waste Site Cleanups

- Develop trainings, conferences, and workshops for state waste site cleanup program staff related specifically to green remediation principles.
- Facilitate meetings among the state program personnel and U.S. EPA to discuss experiences and approaches to incorporating green remediation strategies.
- Gather and disseminate to NEWMOA state members information on green remediation, including new laws and regulations, guidance documents, white papers, scientific studies, and general case studies from around the country.

STRATEGY 8: Improve Planning for Management of Disaster Debris

- Assist state agencies by providing technical assistance for the development of state and local disaster debris plans.
- Assist state programs in the development of criteria for the identification and siting of staging areas for the efficient collection of disaster debris to promote increased recycling and proper waste management in the event of a storm or other disaster.

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1.0 Introduction

The Environmental Commissioners from the New England States challenged the Northeast Waste Management Officials' Association (NEWMOA) and the air and water interstates to identify regional activities to address climate change as a priority. As a result of this challenge, the state environmental agency directors of pollution prevention, hazardous and solid waste management, and waste site cleanup programs developed this Climate-Waste Action Plan to present a strategy for mitigating and adapting to climate change through improving waste prevention and recycling initiatives, increasing renewable energy on contaminated sites, implementing "greener" site remediation, and improving management and recycling of disaster debris.

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- Introductory information about waste generation in the Northeast that is relevant to mitigating climate change;
- Background information on how products, materials, and wastes generate greenhouse gases and contribute to climate change;
- An overview of how waste prevention, recycling, composting, and waste site cleanup programs can contribute to climate mitigation strategies;
- Background on how waste programs on a regional basis can collaborate on creating adaptation strategies for addressing anticipated climate impacts on waste generation;

[2] The NEWMOA member states include Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. For a list of Board members see: http://newmoa.org/about/board.cfm.

- Proposed guiding principles for selecting and implementing regional pollution prevention and waste-related strategies that can assist states in achieving their climate action goals; and
- Recommended NEWMOA strategies and regional actions.

If approved by the member-state Environmental Commissioners, the NEWMOA-member states will consider this a blueprint for coordinated action through NEWMOA.

All of the waste management and waste site cleanup programs operated by the NEWMOA-member state agencies aim to ensure that wastes are properly managed to minimize their environmental impacts, and that waste sites are cleaned up to protect public health and the environment. Over the last 20-30 years, managers of these programs have increasingly recognized that reducing waste at its sources (in terms of both quantities and toxicity), and diverting discarded materials into new uses are effective ways to minimize the "end-of-life" environmental impacts of discarded materials. Today, all of the waste prevention and management programs in the NEWMOA-member states are working in a variety of ways to minimize waste generation and to maximize reuse and recycling of discarded materials, while continuing to ensure that wastes that must be disposed of are managed safely, and that waste sites are cleaned up to protect public health and the environment.

Waste management and waste site cleanup activities can be significant sources of greenhouse gas emissions, which in turn present significant opportunities to reduce these emissions and contribute to the achievement of the Northeast states' climate action goals. These sources and resulting greenhouse gas mitigation opportunities are described in Sections 2 and 3 below.

2. 0 Waste Management in the Northeast

2.1 Municipal Solid Waste (MSW) Management

U.S. EPA estimates that in 2007, approximately 254 million tons of municipal solid waste (MSW) was generated in the U.S. Each resident generated approximately 4.6 pounds of municipal solid waste per day in 2007.[3] NEWMOA's research has found that approximately 52 million tons of municipal solid waste was generated in the Northeast in 2005 (the most recent year for which a full data set is available).[4] Of this waste, NEWMOA-member states estimate that approximately 36 million tons was disposed of either in landfills or by incineration.

[3] http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf.
[4] NEWMOA, "2005 Municipal Solid Waste (MSW) Interstate Flow and Disposal in the Northeast States," September 2007. Report prepared for the NEWMOA-member state solid waste programs.

MSW consists of everyday items, including product packaging, grass clippings, furniture, clothing, bottles, cans, food scraps, newspapers and other paper products, and batteries. U.S. EPA estimates[5] that, in 2007, the major components of the municipal solid waste stream were:

- Paper and paperboard (33 percent)
- Yard trimmings (13 percent)
- Food scraps (13 percent)
- Glass, metals, plastics, and wood (each accounted for between 5 and 12 percent)
- Rubber, leather, and textiles (combined for 8 percent)
- Miscellaneous wastes (approximately 3 percent)

The NEWMOA-member state programs believe that MSW generated in the Northeast is generally similar in composition to the U.S.-wide population.

In 2007, approximately 63 million tons of MSW was recycled nationally, and another almost 22 million tons was composted. The overall recovery rate in the U.S. for all MSW was approximately 33 percent in 2007 or an estimated 550 million tons of avoided emissions of CO_2 equivalent, 1.3 quadrillion BTUs (about 10 percent of U.S. residential energy consumption) reduced, or about 50 power plants that the country did not have to operate in one year.[6]

The average U.S. household annually recycles approximately 187 pounds of newspaper; 160 6-packs of aluminum cans, 210 steel cans, 240 plastic bottles (PET); and 113 glass bottles, saving approximately 1,315 pounds of CO_2 equivalents per year. As shown in Figure 1, the overall MSW recycling rates in the U.S. have been increasing since the 1960s. However, recycling rates vary among the states. For the Northeast states, MSW recycling rates in 2005 (the most recent year for which a complete data set is available), ranged from 20 to 42 percent. This amounted to almost 16 million tons of MSW recycled for the Region in that year. Among the Northeast states, the major components of MSW that are recycled include glass, paper and cardboard, plastics, aluminum and steel cans, and yard and food waste.[7]

As shown in Figure 2, there are significant differences in the recycling rates of various materials in the U.S. Steel packaging (mostly cans), aluminum cans, yard waste, and paper and paperboard containers and packaging have been recycled at the highest rates. Glass and plastic containers and packaging in MSW have been recovered at relatively lower rates. Overall, Figure 2 indicates that for all of these various products and materials, there is significant room for improving recycling and recovery.

[5] http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf.
[6] http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw07-rpt.pdf.
[7] Estimate of recycling in the Northeast was based on the results of a NEWMOA phone survey of the state environmental agencies in the Region conducted in January 2009.

A wide variety of "players," including municipalities, generators, haulers, consolidators, recyclers, and disposal facilities manage wastes in the Northeast. Municipalities educate their residents about how to properly manage their trash and often establish arrangements for collecting and hauling the waste to a recycling or disposal facility. The haulers, consolidators, recyclers, and disposal facilities, including resource recovery facilities, generally pick up, transport, process, and manage the waste. Most disposal facilities in the Northeast are operated by private companies, although some are operated by government agencies that own them.

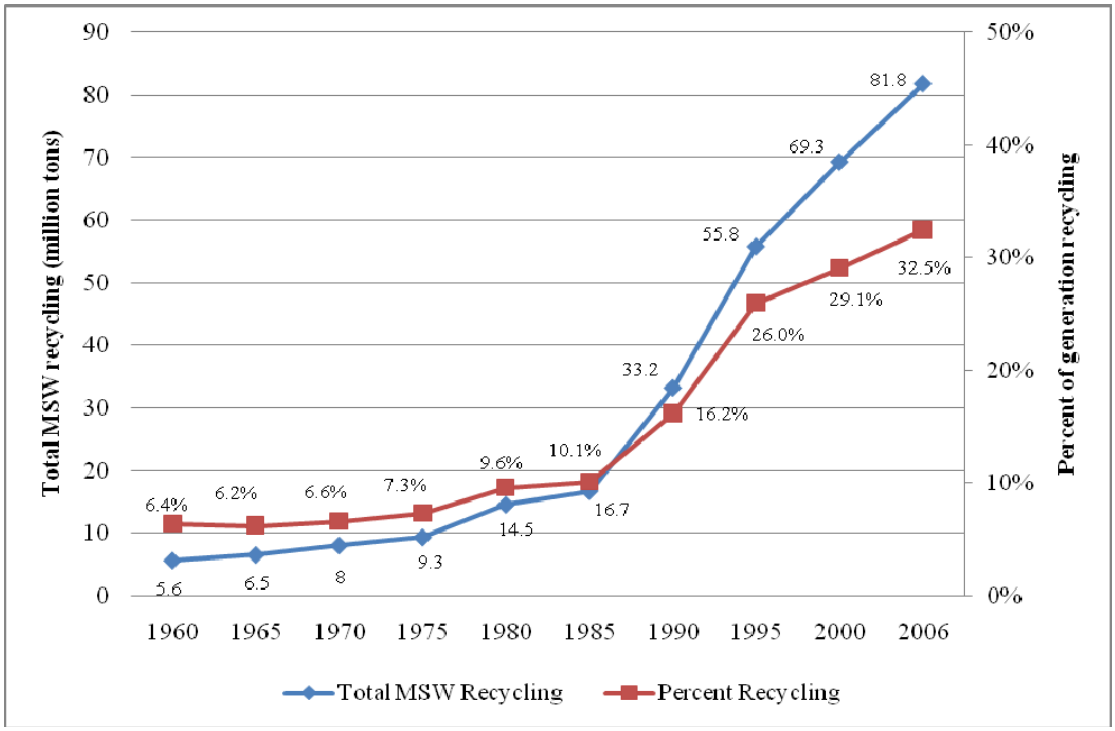
The roles of state agencies include establishing, implementing, and enforcing regulations and requirements for the proper management of MSW; funding selected programs; collecting and analyzing data on MSW and conducting studies; and educating the public, municipalities, and waste management industry on the rules and requirements. Most of the NEWMOA-member state agencies develop long range plans for solid waste management that include goals for waste prevention, recycling, and reuse, and these plans are updated and revised periodically. State governments do not control the generation of waste by their residents. They also do not control the markets for recycled goods. Therefore, state programs that encourage waste prevention and diversion of waste from disposal:

- rely on a variety of incentives for decisions by the private sector and local governments;
- educate the various parties about why it is important to reduce, reuse, and recycle waste and how to do it; and
- invest in the development of recycling infrastructure and market development.

To support its member state solid waste management programs, NEWMOA has conducted a number of studies over the past 10 years on the flow of waste materials among the states in the region. Overall, these analyses have found that to a significant extent, the region is a "waste shed". Most of the municipal solid waste generated in the region is disposed of or recycled within the region: almost 74 percent of the municipal solid waste that was disposed of in Northeast states went to facilities within the region in 2006.[8] All of the NEWMOA states export municipal solid waste to at least one other NEWMOA state for disposal. Economies of scale, transportation costs, challenges with permitting municipal solid waste disposal and recycling facilities, and the status of waste as a commodity that is bought and sold have created a situation where the infrastructure for managing these wastes is distributed among the states. As a result, the Northeast states benefit significantly from cooperating on their efforts to reduce the generation of waste and increase recycling.

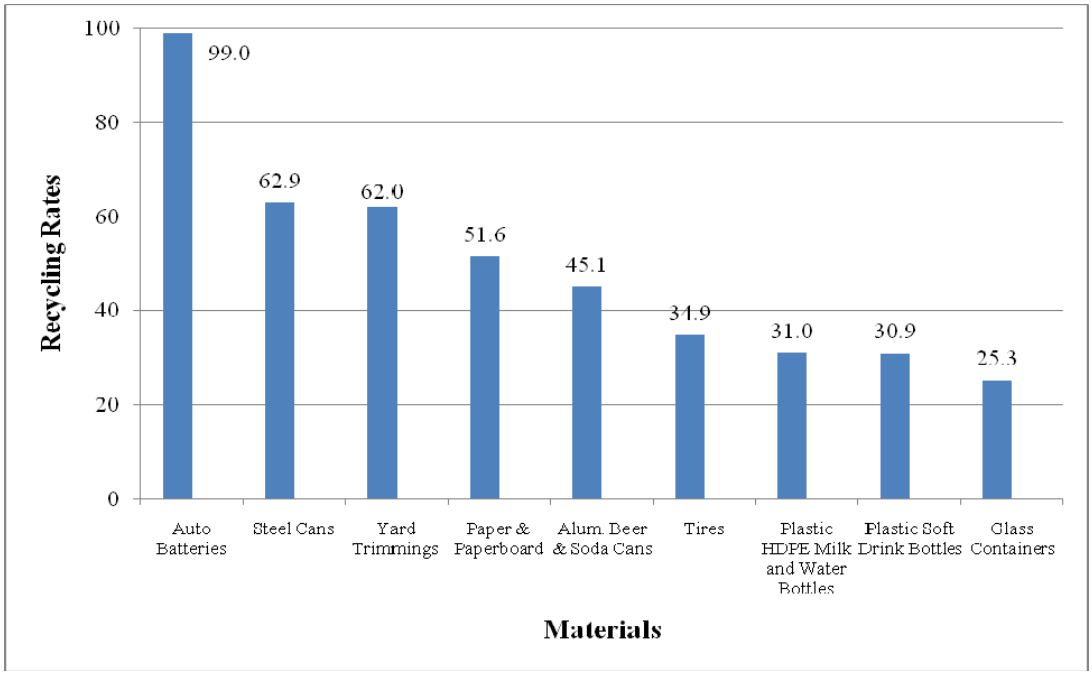
[8] NEWMOA, "MSW Interstate Flow 2006 Data, Final Report" July 2008. Report prepared for the NEWMOA-member state solid waste programs.

Figure 1
MSW Recycling Rates, 1960-2006



Source: http://www.nrc-recycle.org/resources.aspx.

Figure 2
Recycling Rates of Selected Materials, 2006



Source: http://www.nrc-recycle.org/resources.aspx.

2.2 Construction & Demolition (C&D) & Industrial Wastes

Debris from construction and demolition activities, industrial non-hazardous and hazardous waste, and waste from commercial and institutional sources are generally not classified as municipal solid waste.

Debris from building construction and demolition, which includes asphalt, brick, concrete, metal, wood, gypsum wall board, glass, and roofing materials, is a significant component of the total non-hazardous waste stream in the Northeast states. NEWMOA recently completed a study that found that nearly 10.9 million tons of C&D waste was generated in the Region in 2006.[9] The per-capita generation of C&D waste varies widely among states. However, on average, C&D waste generation is estimated to be 1.7 pounds per person per day.[10]

NEWMOA's analysis has found that the management of construction and demolition waste is regional in the Northeast. All states import and/or export C&D wastes, and states are interdependent for its management. C&D waste is mainly disposed in landfills – either landfills permitted just to receive C&D waste, or landfills that primarily receive municipal solid waste (MSW). Due to its relatively inert makeup, C&D waste is generally not managed at waste-to-energy (WTE) facilities. The total estimated quantity of C&D wastes generated in the NEWMOA-member states that was disposed in 2006 was over 7 million tons, or 66 percent of the total estimated C&D waste generation.

Mixed C&D waste is frequently processed at facilities that are specifically designed to recover components of the waste stream for reuse and recycling. However, there is wide variability in how wastes are handled and the quantity and types of materials that are recovered. The constituents of C&D waste that can be marketable include: metal; wood; asphalt, brick, and concrete (ABC) aggregate; gypsum wallboard; asphalt shingles; plastic; and cardboard. In 2006, the main materials that were recovered from C&D processing in the Northeast were metal, wood, and ABC aggregate. Markets for gypsum recovered from wallboard and asphalt shingle recovery and recycling were just starting to develop in the Region at that time.[11]

The U.S. EPA estimates that, nationwide, U.S. industrial facilities generate and dispose of approximately 7.6 billion tons of industrial non-hazardous solid waste each year. Pro-rating the national estimate based on the population, approximately 1.1 billion tons of industrial non-hazardous waste is generated in the Northeast per year. These materials include cardboard, plastic shrink wrap, pallets, paper and paper products, equipment, packaging, and other non-hazardous waste materials.

[9] NEWMOA, "Construction & Demolition Waste Management in the Northeast," March 2009, www.newmoa.org.
[10] www.mass.gov/dep/recycle/reduce/07cdstdy.pdf.
[11] NEWMOA, "Construction & Demolition Waste Management in the Northeast," March 2009, www.newmoa.org.

Industrial hazardous waste is a subset of solid waste that EPA defines as "by-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. …possesses at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity), or appears on special EPA lists."[12] Hazardous wastes can be liquids, solids, gases, or sludges. They can be discarded commercial products, like cleaning fluids or pesticides, or the by-products of manufacturing processes.

According to EPA, in 2007, 2,922 generators generated just over 2.19 million tons of hazardous waste in the Northeast.[13] Most (85 percent) of these generators were classified as large quantity generators (LQGs) or those that generate more than 2,200 pounds of hazardous waste per month. State environmental agencies may define and regulate hazardous waste more stringently than EPA, and those state-regulated wastes may not be included in the available EPA estimates for the Region.

Because of their toxic and hazardous constituents, EPA and the states have established a cradle-to-grave regulatory system that governs the management of hazardous waste.[14] Each type of hazardous waste may require special handling and waste management. Some of these wastes are treated and then disposed in special hazardous waste facilities and some are recycled.

"Universal wastes" are a subset of hazardous waste and include:

- batteries
- pesticides
- mercury-containing equipment
- bulbs (lamps)[15]

EPA and the states have established streamlined hazardous waste management standards for these widely generated wastes. The regulations govern their collection and management and are designed to ease the regulatory burden on retail stores and others that wish to collect these wastes and encourage the development of municipal and commercial programs to reduce the quantity going to municipal solid waste landfills or combustors. States can modify the federal universal waste rule and add additional universal waste(s) in their regulations.

A wide variety of private entities, including generators, haulers, consolidators, recyclers, and disposal facilities, manage C&D and industrial non-hazardous and hazardous wastes in the Northeast. The haulers, consolidators, recyclers, and disposal facilities, including resource recovery facilities, generally pick up, transport, process, and manage the waste. State agencies

[12] http://www.epa.gov/OCEPAterms/hterms.html.

[13] http://www.epa.gov/osw/inforesources/data/br07/index.htm.

[14] http://www.epa.gov/osw/hazard/index.htm.

[15] http://www.epa.gov/osw/hazard/wastetypes/universal/index.htm.

develop and enforce regulations, collect data on selected waste streams, and educate the commercial entities about compliance and proper management of these wastes.

2.3 Waste Site Cleanup

Northeast state waste site cleanup programs have identified just over 51,000 sites where oil and/or hazardous materials were improperly disposed of, and are undergoing some kind of cleanup activity under a variety of federal and state programs, including:

- Federal Superfund
- Resource Conservation and Recovery Act (RCRA) Corrective Action
- State mandatory cleanup programs
- Voluntary cleanup programs
- Brownfields
- Real estate due diligence
- Petroleum/Leaking Underground Storage Tank (LUST) programs

At these contaminated sites, significant amounts of energy are used to remove and treat oil and hazardous materials, transport waste materials to offsite disposal facilities, and monitor environmental conditions on an ongoing basis. For example, U.S. EPA estimates that more than 14 billion kilowatt-hours (kWh) of electricity will be consumed through the use of the five most energy-intensive technologies, including pump-and-treat (P&T), thermal desorption, multi-phase extraction, air sparging, and soil vapor extraction (SVE) at federal Superfund sites from 2008 through 2030 and will result in total emissions of approximately 9 million metric tons of CO_2 equivalents ($MMTCO_2E$).[16]

While federal Superfund sites are among the largest and most complex sites, they make up only a small percentage of the total number of contaminated sites in the Northeast. Remediation of sites under other government programs use many of the same technologies, and are expected to result in significant aggregate emissions (even though emissions from each individual site are likely to be lower).

3.0 Climate Impacts from Discarded Materials & Products

Each stage of a product's life cycle - from raw materials extraction to manufacturing, transportation, use, and "end-of-life" management - consumes fossil fuels and energy and results

[16] U.S. EPA OSWER, Office of Superfund Remediation and Technology Innovation, *Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites* Technology Primer: EPA 542-R-08-002. April 2008.

in greenhouse gas (GHG) emissions. Decisions about how materials and products are produced and handled throughout their useful lives have a significant impact on their "carbon footprint". The ways in which these activities generate GHGs throughout the life cycle of a product or material are illustrated in Figure 3 below.

3.1 Greenhouse Gases & Waste

The following sections describe assessments of the GHG impacts of products and materials (including impacts from managing these products and materials at the end of their useful lives) as a basis for targeting waste prevention, recycling, and waste management programs that will have important co-benefits for mitigating GHG emissions.

3.1.1 Greenhouse Gases from Products' & Materials' Full Life Cycles

Recent U.S. EPA evaluations of the greenhouse gas impacts of products and materials based on a full inventory of their impacts estimate that approximately 35 to 46 percent of the GHG emissions in the U.S can be attributed to the provision of goods and materials.[17] These estimates differ from those in the U.S. EPA's "Inventory of U.S. Greenhouse Gas Emissions and Sinks" because they are based on life cycle approaches.[18] This EPA GHG inventory evaluated emissions from the following categories of activities: energy,[19] industrial processes, solvent and other product use, agriculture, land-use change and forestry, and waste.[20] It assessed waste-related emissions from the following waste management activities: landfills, wastewater treatment, and composting and estimated that GHSs from these activities comprise just over 2 percent of national emissions.[21] [22] This GHG inventory and others that follow the IPPC "Guidelines for National Greenhouse Gas Inventories" combine emissions associated with specific industrial sectors into overall categories and treat GHG emissions associated with transportation of materials and goods similarly. These estimates do not evaluate the GHGs associated with the extraction, transportation, manufacturing, and use of raw materials for products. As a result, these inventories do not adequately capture the greenhouse gases associated with materials, products, and waste from a life cycle perspective.

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[17] According to the U.S. EPA, on a life-cycle basis, 46 percent of the national GHG inventory is related to the energy and fuel consumed in the use and management of the materials that become waste, including food. Source: "U.S. EPA Efforts to Reduce GHG Emissions from Solid Waste Management," William Brandes, Chief, EPA Office of Solid Waste, Waste Treatment Branch, at Waste-to-Energy Research and Technology Council Bi-Annual Meeting, October 17, 2008. http://www.seas.columbia.edu/earth/wtert/meeting2008/presentations/Brandes.pdf

[18] http://www.epa.gov/climatechange/emissions/downloads/08_Waste.pdf.

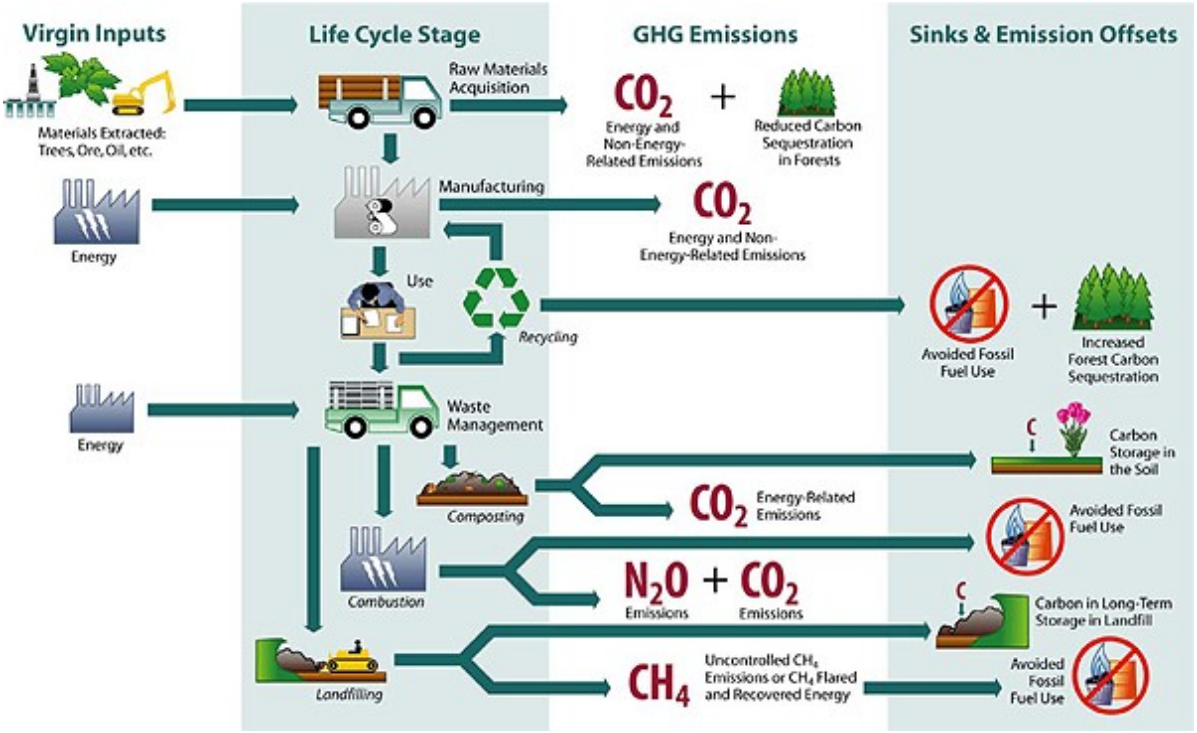
[19] "Energy" includes power generation from coal, oil, natural gas and other fuels, and waste incineration facilities.

[20] http://www.epa.gov/climatechange/emissions/downloads/08_ES.pdf.

[21] http://www.epa.gov/climatechange/emissions/downloads/08_Waste.pdf.

[22] http://www.epa.gov/climatechange/emissions/downloads/08_Waste.pdf.

Figure 3
Greenhouse Gases Associated with Materials Consumption & Waste Management



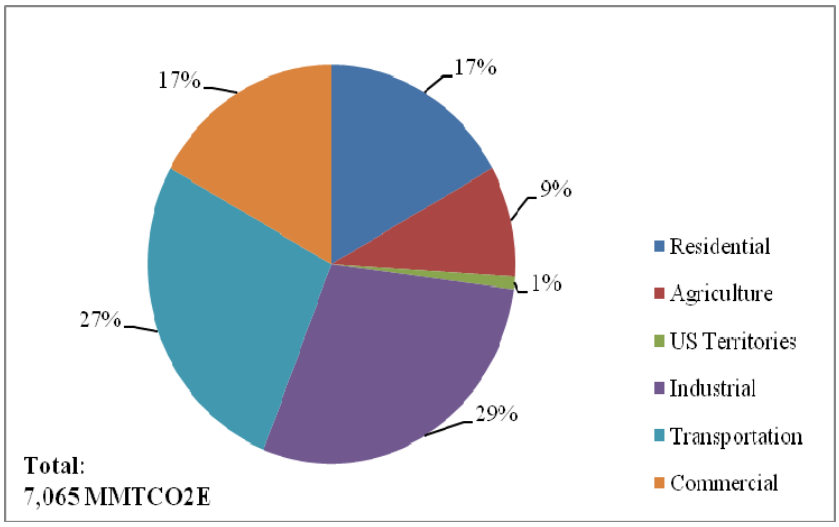
Source: http://epa.gov/climatechange/wycd/waste/lifecycle.html.

A full understanding of the contribution to GHG emissions of various products and materials requires that emissions related to raw material extraction, transportation, processing, manufacturing, and shipping of goods be included in the assessment.

The efforts to identify GHG emissions within manufacturing, such as carbon registries and "carbon footprint" analyses have initially focused on direct emissions and those associated with purchased electricity (typically referred to as Scope 1 and 2 emissions). According to one estimate, these emissions represent only about 26 percent of the "cradle-to-gate" emissions.[23] [24] More refined analyses of energy use by the industry sector can create a clearer picture of the GHG impacts and the "embodied energy" associated with categories of products and commodities. Embodied energy refers to the quantity of energy required to manufacture and supply to the point of use, a product, material, or service.[25] Figures 4-1 and 4-2 present one such analysis of industrial energy use. Materials with high levels of embodied energy have a

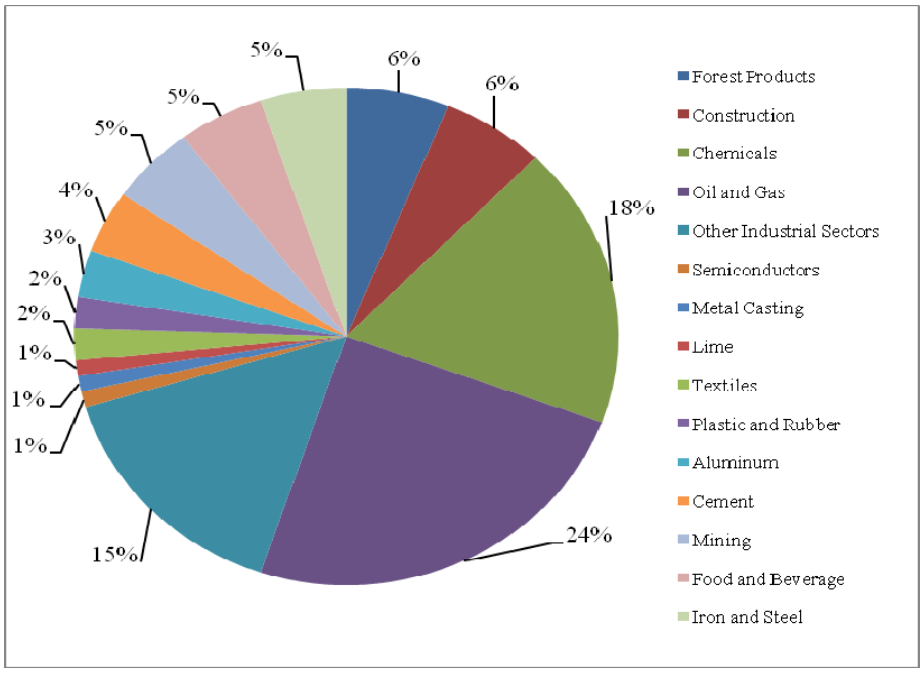
[23] "Cradle-to-gate" is an assessment of a partial product life cycle from manufacture ('cradle') to the factory gate, i.e. before it is transported to the consumer. The use phase and disposal phase of the product are usually omitted. http://en.wikipedia.org/wiki/Life_cycle_assessment#Cradle-to-gate.
[24] Mathews, H. Scott, et.al. "The Importance of Carbon Footprint Estimation Boundaries," *Environmental Science and Technology*, Vol. 42, No. 16, 2008.
[25] http://en.wikipedia.org/wiki/Embodied_energy.

Figure 4-1
Total 2002 U.S. Greenhouse Gas Emissions by Sector ($MMTCO_2E$) Factoring in Purchased Electricity



Source: U.S. EPA, "U.S. Inventory of Greenhouse Gas Emissions and Sinks, 1990-2006"; Note: $MMTCO_2E$ stands for million metric tons of carbon dioxide equivalent. Emissions from electricity have been distributed among economic sectors.

Figure 4-2 Total 2002 U.S. Greenhouse Gas Emissions from Industrial Sources, by Sector ($MMTCO_2E$) Factoring in Purchased Electricity



Source: U.S. EPA, "Quantifying Greenhouse Gas Emissions from Key Industrial Sectors in the United States," Working Draft, May 2008, p. 1-1. http://www.epa.gov/ispd/pdf/greenhouse-report.pdf. Note: "other industrial sectors" emissions represent the emissions remaining withn the industrial sectors beyond those estimated for the 14 sectors.

significant upfront "investment" of energy that can be capitalized for GHG reductions throughout their life cycle. They also have "sunken costs" associated with the emissions that result from the use of electricity and fossil fuels to manufacture, transport, and use these products.

For many products, the production and use of the products are the phases of their life cycle that consume the greatest amounts of energy as shown in Figures 5 and 6. These Figures demonstrate that different types of materials and products, such as aluminum, carpet, glass, certain plastics, and tires, require more energy throughout their life cycle than other products and materials.[26]

Materials or products with high levels of embodied energy present the greatest opportunities for GHG emission reductions. Increased source reduction, reuse, and recycling of high GHG materials and products could be targeted to recapture this embodied energy and reduce climate impacts. For example, according to the U.S. EPA,[27] as much as one third of all non-industrial solid waste is packaging. If the volume of this packaging can be reduced and the amount recycled increased, the GHG emissions associated with the manufacture of packaging can be significantly reduced. The National Recycling Coalition[28] estimates that the amount of lost energy from discarding aluminum and steel cans, plastics, and glass containers, newsprint, and corrugated packaging was equivalent to:

- The amount of electricity consumed by 10 million people in the U.S. in one year; or
- The amount of gasoline used in 6.5 million passenger automobiles in one year.

A 10 to 50 percent increase in the amount of cans, bottles, newsprint, and corrugated packaging currently recovered and recycled (or diverted from disposal) would result in:

- new energy savings of between 77,191 and 383 million BTUs (MBTU)s, which in terms of crude oil represents a savings of between $957 million to $4.8 billion;
- 3.9 to 19.3 fewer megatons of waste to landfills; and
- 11.6 to 58 fewer megatons of GHG emissions into the atmosphere, which is equivalent to 44 percent of all the GHG emissions from U.S. landfills.

Some manufacturers have recently initiated programs to reduce packaging. For example, several computer companies are aggressively minimizing the packaging associated with their products. In 2008, Dell announced a plan to reduce the packaging for its computers by 200 million pounds over four years, and anticipates a savings of $8 million. Hewlett Packard recently redesigned the

[26] http://yosemite.epa.gov/r10/ECOCOMM.NSF/Programs/wcf/$FILE/101-1-presentation.pdf.
[27] http://www.epa.gov/osw/partnerships/stewardship/products/packaging.htm.
[28] http://www.nrc-recycle.org/fact-sheet.aspx.

packaging for one of its computers by replacing conventional shipping materials and boxes with a messenger bag made from 100 percent recycled materials. This new design reduces the packaging by 97 percent, conserves fuel, and reduces CO_2 emissions by removing the equivalent of one out of every four trucks needed for delivery.[29] These examples demonstrate that reducing excess packaging and increasing the recycling of various forms of packaging can reduce the demand for waste management in the Northeast and associated greenhouse gases.

Considerable resources, both financial and energy, are expended managing hazardous waste and universal waste properly. The raw materials extraction, manufacturing, transportation, use, and special handling, and end-of-life management of hazardous waste can be energy intensive. However, relatively less research has been conducted to date on the greenhouse gas impacts of hazardous materials and waste than for municipal solid waste.

In summary, all efforts to more efficiently utilize the embodied energy in materials and products help to mitigate GHG emission by displacing new energy consumption. Extending the useful life of materials and products through reuse and recycling takes advantage of the energy investment in these materials, while mitigating energy use and subsequent emissions that would otherwise occur when processing new raw materials and products. Additional research is needed to quantify the GHG impacts of the various municipal solid waste, universal wastes, C&D wastes, and non-hazardous and hazardous industrial waste product categories and use the results to prioritize and target materials and products for greater prevention and recycling.[30]

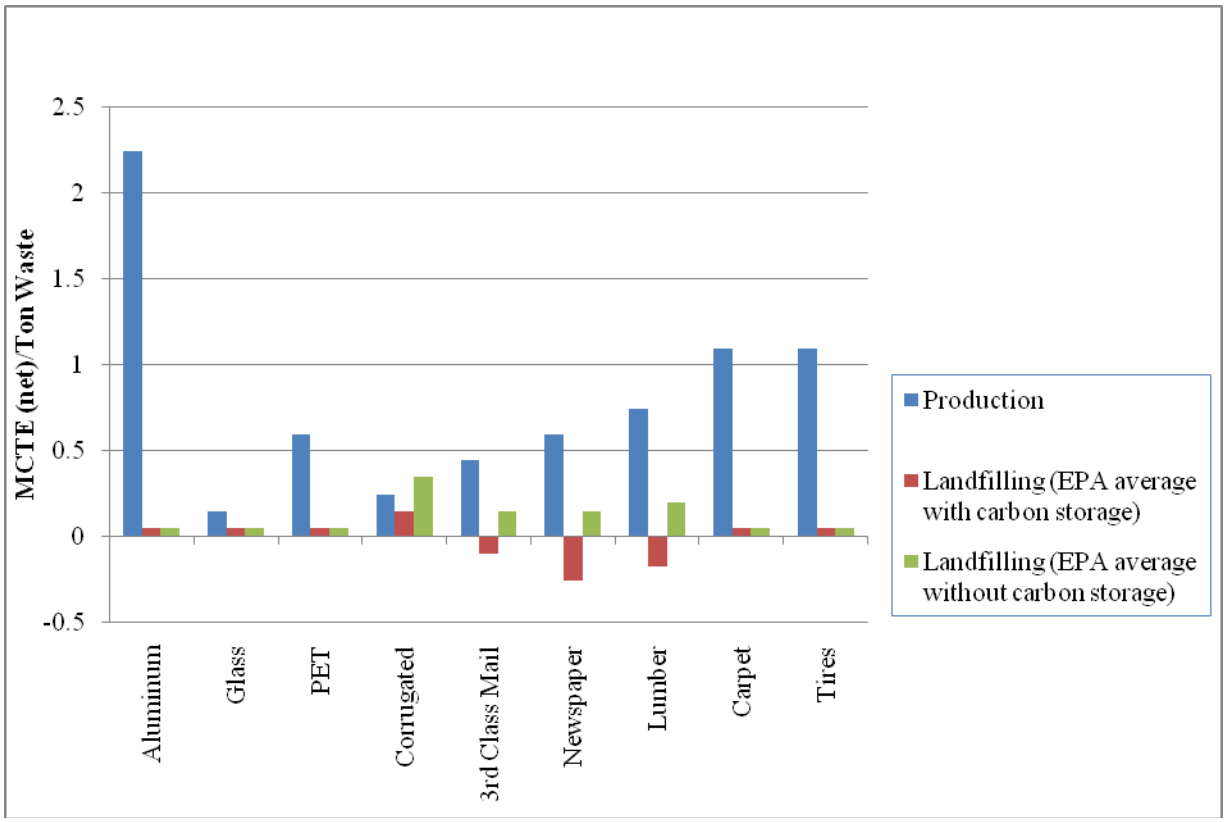
3.1.2 Climate Impacts of Organic Materials & Waste Disposal

Organic materials, including yard trimmings, food scraps, wood, and paper and paperboard products, make up more than two-thirds of the U.S. solid waste stream. Gas is created as these organic wastes decompose in a landfill. Landfill gas consists of almost half methane (CH_4, the primary component of natural gas) and close to half carbon dioxide (CO_2), with a small amount of non-methane organic compounds.

[29] http://www.environmentalleader.com/2008/12/16/dell-says-green-packaging-will-save-8m-20m-lbs-packaging.

[30] California Air Resources Board, Planned Air Pollution Research, "Retail Climate Change Mitigation: Life-Cycle Emission Labels and Standards", pp. 44-45.

Figure 5
Comparison of Production & Waste-related GHG Emissions of Various Materials

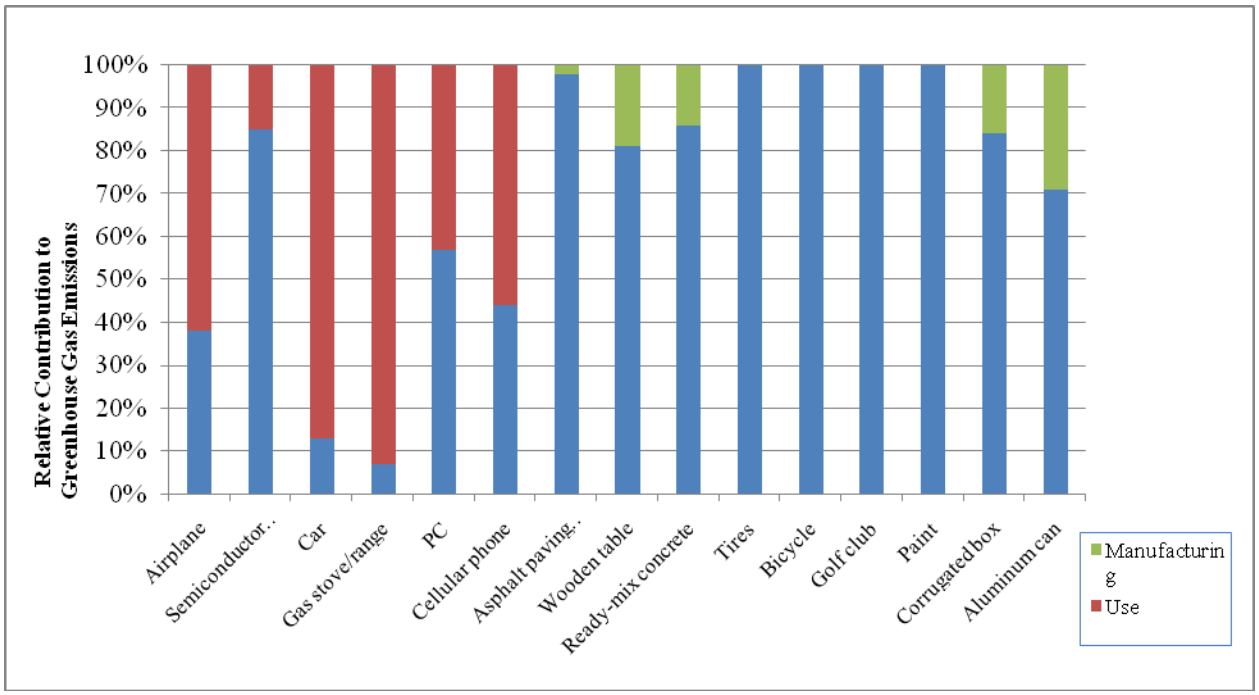


Source: David Allaway, Oregon Department of Environmental Quality, Presented at the West Coast Forum on Climate Change; Waste Prevention, Recovery, and Disposal; "Materials Management, Climate and Waste: Making the Connections," June 26, 2008.
http://yosemite.epa.gov/r10/ECOCOMM.NSF/Programs/wcf/$FILE/101-1-presentation.pdf

The U.S. EPA considers municipal solid waste landfills to be the second largest source of human-related methane emissions in the United States, accounting for nearly 23 percent of these emissions in 2006.[31] Methane gas from landfills is estimated to have a global warming potential of between 21 and 72 times greater than CO_2, depending on the time frame that is evaluated.[32] At most Northeast landfills, methane emissions are captured (to prevent exposure of facility neighbors to the harmful gas). At many closed landfills, the captured gas is used to generate

[31] http://www.epa.gov/lmop/overview.htm.
[32] In 1995 the IPPC estimated that methane gas has a global warming potential that is at least 21 times greater than CO_2, based on a 100-year timeframe. This is the value used in international reporting of emissions. IPCC has more recently estimated the 100 year GWP to be 23. However, some researchers have recently found the potential to be much greater: using methane's actual life expectancy in the atmosphere of 12 years, they have estimated the GHG impact of methane to be roughly 72 times greater than CO_2.

Figure 6
Illustration of Life Cycle Greenhouse Gas Impacts by Product Category



Source: West Coast Climate and Waste Webinar Series, David Allaway, Oregon DEQ.

electricity, which is used by a neighbor or is fed into the electric grid. Using captured methane as a fuel can provide an alternative to fossil fuels.[33] The benefits of capturing and recovering methane for energy production include the reduced GHG emissions from the fossil fuels that would otherwise occur during their extraction and processing.

However, methane recovery at landfills can be challenging because a large percentage of the gas can be released before the landfill is capped and a gas capture system installed. While Northeast states have generally been aggressive in ensuring that landfill owners install key components of gas capture systems as new cells are built, some landfills in the Region do not have these systems. Where these systems have been installed, they cannot capture all of the methane gas released. Absent methane capture systems, the methane is often flared, releasing GHGs directly to the atmosphere. At these sites, the methane is not being used to generate electricity, at least in part due because of the challenges associated with the distance to transport the gas, location of the existing power transmission lines, or lack of connections to the electrical grid. The costs of developing such connections can be significant. At landfills that have been capped and closed for some time, methane levels decrease as the waste mass ages, eventually reaching a point where

[33] CO2 is emitted when methane gas is burned as a fuel, however, with much lower overall GHG impacts.

recovery of the gas is no longer economically feasible. Due to these inefficiencies, diverting organic material that is the source of methane can be a more beneficial management option than landfilling from a climate impact perspective.

In traditional waste-to-energy disposal facilities, organic wastes have a negative fuel value because their high moisture content detracts from the energy value of the waste stream. Therefore, incinerating organics can be an ineffective waste management option from a GHG perspective.[34] [35]

Composting, anaerobic digestion (AD), or onsite conversion of organics to methane for direct energy uses avoid most of the methane emissions from landfills and the inefficiencies associated with incineration.

4.0 Greenhouse Gas Mitigation Associated with NEWMOA-Member State Programs

There are a number of GHG mitigation strategies and approaches that waste programs can take, including promoting increased waste prevention, reuse, and recycling; greening cleanups of waste sites, and encouraging increased renewable energy and recycling infrastructure development on contaminated sites, including landfills and Brownfields.

4.1 Climate Impacts of Preventing, Reusing, & Recycling Waste

As described in Section 3.0, the climate benefits associated with increasing waste prevention, reuse, and recycling can be significant. The following Sections present strategies available to pollution prevention and waste programs in the Northeast for advancing them.

4.1.1 Climate Benefits of Reducing the Quantity & Toxicity of Waste at its Sources

Pollution prevention, which includes source reduction and other practices that reduce or eliminate pollutants through increased efficiency in the use of raw materials, energy, water, or other resources, or protection of natural resources by conservation, can be an effective means of mitigating greenhouse gas emissions.[36] Avoiding unnecessary materials reduces the demand for raw materials that would otherwise have to be extracted and processed.

[34] "Waste Management Options and Climate Change, Final Report the European Commission," July 2001. Excerpt from the Executive Summary, p.iii: "… overall, source segregation of MSW followed by recycling (for paper, metals, textiles and plastics) and composting /AD (for putrescible wastes) gives the lowest net flux of greenhouse gases, compared with other options for the treatment of bulk MSW."

[35] http://www.defra.gov.uk/environment/waste/wip/newtech/pdf/ClimateChange3.pdf.

[36] Throughout this document the terms pollution prevention, waste prevention, and source reduction are used to mean: reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste stream.

This reduces emissions of carbon dioxide from fossil fuels, preserves carbon stocks in trees, and reduces transportation needs and associated fuel consumption and vehicle pollution. The effect of this savings is cumulative throughout a product's life cycle, reducing significant emissions of greenhouse gases. Key aspects of waste and pollution prevention strategies are design for the environment, green chemistry, product stewardship, and environmentally preferable purchasing.

In the early 1990s, manufacturers started to identify qualities or traits in their products and processes that could be redesigned to reduce or prevent downstream environmental and energy impacts. These companies began to implement the concept of design for the environment, which focuses on the development of products, processes, and technologies that are competitive but environmentally preferable, including reduction of GHG impacts.

Green chemistry is a key element for product designers and manufacturers to implement design for the environment concepts. In a "green" or "sustainable" chemistry approach to product design and manufacture of chemical products, the use and generation of hazardous substances are reduced or eliminated, and product manufacturing and use require less energy. Green chemistry applies across the life cycle, including the design, manufacture, and use, of a product. Green chemistry technologies provide a number of benefits, including:

- reduced waste;
- safer products;
- reduced use of energy and resources;
- more recyclable materials; and
- improved competitiveness of chemical manufacturers and their customers.

U.S. EPA and the state environmental agencies have increasingly supported green chemistry initiatives in recent years as a strategy to reduce the toxic content of products and the amount of energy used to make them. Managing and handling hazardous and toxic materials consumes energy. Products with reduced levels of toxic and hazardous chemicals generally require less energy for their proper use and end-of-life management, and therefore have smaller carbon footprints.[37] Many safer alternatives that are becoming available also have lower overall life cycle greenhouse gas emissions associated with them.

[37] There are a number of examples of projects among the recipients of U.S. EPA's Presidential Green Chemistry Challenge Award that have demonstrated significant energy and environmental benefits. U.S. EPA recognized Battelle and several partners, for example, in 2008 for developing a laser printer soy-based toner system that greatly enhances the ability to recycle office paper. Based on a life-cycle analysis, the system has significant energy savings and reduced carbon dioxide emissions, including the resin manufacture using bio-based feedstock for toner production and the recovery of secondary fibers from the office waste stream.

Investments in product redesign research and development can be expensive. Many manufacturers are reluctant to implement design for the environment approaches unless they perceive a clear market advantage and the associated financial return on investment. To use market forces to accelerate the adoption of green chemistry and design for the environment, government agencies at all levels have initiated various approaches, including product stewardship and environmentally preferable purchasing.

Product stewardship, a principle that directs all participants involved in the life cycle of a product to share responsibility for the impacts to human health and the natural environment resulting from its production, use, and end-of-life management, has emerged as a complimentary strategy for promoting waste prevention and recycling. A major focus of product stewardship is on creating incentives for manufacturers to use design for the environment and green chemistry approaches to product design. This makes product stewardship valuable for waste prevention-based climate action initiatives.

Product stewardship initiatives usually involve providing incentives to manufacturers to consider the entire life-cycle impacts of a product and its packaging in product design. Product stewardship also attempts to increase reuse and recycling by engaging participation by all stakeholders, including manufacturers, government entities, retailers, haulers, recyclers, and generators in taking increasing responsibility for the end-of-life management of the products they produce (either voluntarily or through government regulation). Northeast states have successfully undertaken many product stewardship initiatives to address key waste issues in the past ten years, including legislation and programs to reduce mercury use in products and to extend product responsibility for mercury-added thermostats, switches, and fluorescent light bulbs; and to enact legislation and implement programs to extend producer responsibility for such electronics wastes as computers and televisions.

The roles of state agencies in product stewardship have included educating the public and municipalities, developing and enforcing rules and regulations (if needed), evaluating the effectiveness of the program and tracking progress, and facilitating communications among various parties, including retailers, consumer and local groups, and manufacturers. Municipalities and retailers often provide convenient end-of-life collection points for discarded products and educating their customers and residents about how to participate in the program. Waste haulers and recyclers are critically important to the infrastructure for reuse and recycling for any product stewardship initiative.

Environmentally preferable means "products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose".[38] This comparison applies to raw materials, manufacturing, packaging,

[38] http://www.epa.gov/epp/pubs/about/about.htm#a.

distribution, use, reuse, operation, maintenance, and disposal. Governments at all levels are large consumers. Their purchasing power can help exert an influence on which products and services are available in the marketplace. State-sponsored environmentally preferable purchasing (EPP) activities ensure that the state is utilizing its buying power to increase availability of environmentally preferable products, which in turn minimizes environmental impacts. Some of the benefits of these efforts include:

- Improved ability to meet environmental goals, such as GHG reductions
- Improved worker safety and health
- Reduced liabilities
- Reduced health and disposal costs
- Reduced prices for environmentally preferable products when government agencies implement EPP programs due to large scale purchasing
- Increased research and development for new green products when companies compete for large government contracts and thereby grow the availability of environmentally preferable products in the marketplace

Traditionally, EPP efforts have focused on promoting efforts to buy products with high recycled content and lower toxicity as a way to increase demands and availability of these choices. In the past year, however, these efforts have also begun to focus on the climate impacts of products. Some manufacturers are evaluating the carbon footprint of their products so that consumers can use that information as a basis for comparing the climate impacts of similar products. These firms now perceive a competitive advantage to being able to demonstrate that their products have lower GHG impacts. For example, PepsiCo is working with the Carbon Trust to evaluate the carbon footprint of its Tropicana orange juice products.[39] This analysis is helping PepsiCo to understand the aspects of the product's life cycle that contributes the most to GHGs and to target their efforts to reduce those emissions first. Through public reporting of the results of these kinds of efforts, state and local programs involved with environmentally preferable purchasing activities can use the information to help inform their understanding of the GHG impacts of the products they are choosing to buy.

In the Northeast, state and local agencies have implemented EPP programs to address a number of key product categories, including paper, electronics, and cleaning products. In these efforts the environmental agencies often coordinate with the agencies involved with developing state purchasing contracts to establish EPP standards and contract specifications and recycled product purchasing opportunities and goals. These agencies work with key stakeholders and participate in environmentally preferable purchasing conferences and roundtables.

[39] http://phx.corporate-ir.net/phoenix.zhtml?c=78265&p=irol-newsArticle&ID=1247276&highlight.

4.1.2 Climate & Other Benefits of Expanding Waste Reuse & Recycling

The energy and associated GHG emissions required to extract and process virgin raw materials is usually greater than the energy needed to recycle materials, generally making recycling more attractive than landfilling or incineration.[40] Different recycled products have different GHG reduction impacts. Diverting one ton of glass from disposal can save about 60 pounds of CO_2 over landfilling that glass. Similarly, diverting one ton of aluminum from disposal can save 190 tons of CO_2 over landfilling that material.[41] As illustrated in Figure 7, aluminum made from recycled materials uses approximately 95 percent less energy to make than aluminum made from virgin materials, and recycled plastic uses approximately 66 percent less energy than "new" plastic. In these cases, there is a net quantifiable GHG benefit for such recycling because it capitalizes on the embodied energy and fuel used to process the raw materials.[42]

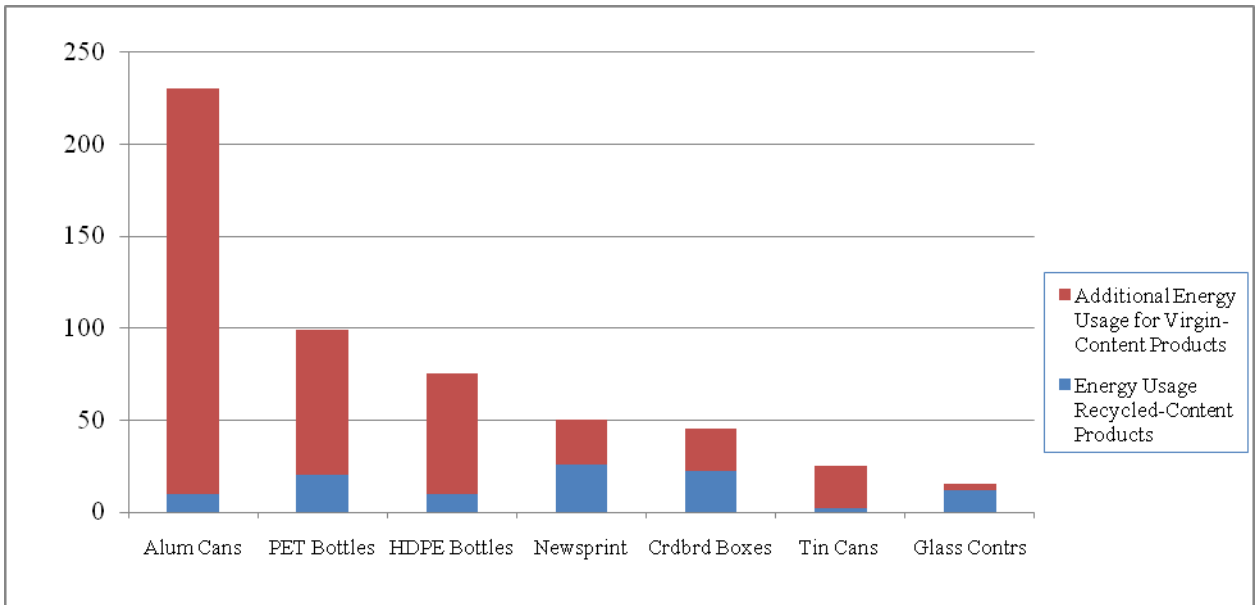
Northeast states are among the national leaders in recycling, however, recycling growth in the region has leveled off over the last several years. There is significant room for improving the recycling of plastics, glass, paper, aluminum cans, food waste, C&D debris, and industrial waste, which would have the potential to reduce greenhouse gases associated with these products. However, there are important challenges facing state and local government in the Northeast with increasing recycling, including the available infrastructure for collecting and recycling significantly larger quantities of various wastes and the capacity of available markets for the recycled materials. Making the collection of recycled products and materials easy and convenient for the public and creating financial incentives for public involvement are also important barriers. Government action is needed to address these challenges because of the up-front expenses associated with establishing recycling programs and the need for ongoing public education and because of the perception that landfill disposal and incineration are relatively inexpensive.

State and local government programs have been actively involved with promoting the development of markets for recycled products for a number of years. These actions have included sponsoring research and studies; creating dialogue and engagement with recyclers, manufacturers, and other stakeholders; including recycled content specifications in state purchasing contracts; and educating the public about buying products with recycled content.

Creating a financial incentive for participation can increase collection of materials and products for recycling. Programs that establish such incentives, such as "Pay-As-You-Throw" or "Save Money and Reduce Trash" programs are a different way of paying for waste collection and disposal services. In some of these programs, households are charged for each bag or can of waste they generate. In others, residents are billed based on the weight of their trash. Either

[40] Ibid, AEA Technology, p. 75, http://ec.europa.eu/environment/waste/studies/pdf/climate_change.pdf.
[41] Ibid, AEA Technology, p. 75, http://ec.europa.eu/environment/waste/studies/pdf/climate_change.pdf.
[42] Ibid, AEA Technology, p. 75, http://ec.europa.eu/environment/waste/studies/pdf/climate_change.pdf.

Figure 7
Energy Use for Virgin & Recycled Content Products



Source: Jeff Morris, Sound Resource Management, Seattle Washington, personal communication, January 8, 3008, available at www.zerowaste.com; and Jeff Morris, "Comparative LCAs for Curbside Recycling Versus Either Landfilling or Incineration with Energy Recover," *International Journal of LifeCycle Assessment* (June 2004).

way, the system motivates people to recycle more and to think about ways to generate less waste in the first place. U.S. EPA and state studies have shown that these programs can lead to positive changes in consumer behavior and increases in recycling.[43] State and local agencies are increasingly investigating these alternative financing programs to help increase their recycling rates.

Increasing waste recycling has been shown to have the important added benefit of creating green jobs. A study of 10 states in the Northeast region found that more than 100,000 people are employed in firms that process recyclables or use them in manufacturing. The study also estimated that more than $7.2 billion in value is added to recyclables in the Northeast through processing and manufacturing.[44] Increasing the infrastructure for recycling has recently become a critical component of the focus of state agencies on green climate-friendly jobs development.

4.2 Mitigating GHG Emissions during Waste Site Remediation

Historically, site cleanup approaches have focused on the end point of reducing the risks posed by contaminated sites to public health and the environment. This was and still is accomplished by removing or isolating contaminants contained in particular environmental media (i.e., soil,

[43] http://www.epa.gov/osw/conserve/tools/payt/tools/ssfalmou.htm.
[44] http://www.nerc.org/documents/recycling_economic_information_study_final_report_2000.pdf; http://www.nerc.org/documents/bulletin/200903.html#reiupdatemarch09.

water, sediment) at the individual site. Not much attention was given to the indirect and broader environmental impacts produced by the cleanup effort, including energy consumption and greenhouse gas emissions as well as others.

U.S. EPA defines green remediation as "the practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup options."[45] Green remediation maintains the ultimate cleanup goal of protection of public health and the environment, but encourages selection of remediation techniques with the lowest GHG emissions and energy impacts throughout the cleanup process. Opportunities to reduce GHG emissions and energy impacts can be found at all phases of the cleanup process, from initial investigation through remedy selection, design, construction, to long-term operation and monitoring. Approaches that can specifically help to reduce energy consumption and GHG emissions include:

- incorporating an evaluation of the energy demands and GHG emissions into the evaluation of remedial options prior to remedy selection;
- designing treatment systems with optimum efficiency;
- incorporating renewable energy to meet on-site treatment system power demands;
- using alternative fuels to operate on-site machinery and vehicles; and
- purchasing off-site power produced from renewable resources.

While technically not a part of remediation, consideration of site redevelopment during the cleanup process can also result in the reduction of GHG emissions. Preserving and enabling the reuse of on-site facilities and infrastructure reduces the energy and natural resource needs of subsequent redevelopment.

While the waste site cleanup programs vary among the Northeast states from primarily privatized to full regulatory oversight, there is an important role each state agency and NEWMOA can play to encourage and facilitate the implementation of greener cleanup approaches. The actions can range from setting examples through activities at publically-funded sites, education and outreach, preparation of guidance, to development and implementation of regulations.

4.3 Siting Renewable Energy & Waste Recycling Facilities at Closed Landfills & Waste Sites

Developing increasing and substantial amounts of energy through renewable sources is a key strategy for the Northeast states in achieving their greenhouse gas reduction goals. Many of the hundreds of closed solid waste landfills, Brownfields, and other contaminated properties across the Northeast that have limited reuse potential may in some cases provide opportunities for siting renewable energy projects, such as solar, wind, and methane gas recovery and use. However,

[45] http://www.cluin.org/download/remed/Green-Remediation-Primer.pdf.

ensuring that the intended renewable energy use is compatible with the site's closure and cleanup is critical. The US Army Corps of Engineers has estimated that there are approximately 1,350 waste sites (including federal Superfund, RCRA Corrective Action, states-only, and Brownfield sites) in the Northeast that could be further evaluated for potential renewable energy development.

Furthermore, a critical aspect of the states' focus on improving their overall economies is creation of green jobs through development of renewable energy and services. Renewable energy development on Brownfields and other former waste sites can provide useful locations for siting facilities that produce these kinds of jobs.

Commercial viability of methane extraction has already been evaluated for most municipal landfills in the Northeast, and many successful landfill gas projects are in various stages of operation. There are a few solar and wind projects located on landfills and contaminated sites, and interest is growing. For example, there is a 1.8 MW Vestas Wind Turbine installed at a closed landfill in Hull, MA; a 20 MW Steelwinds project on a Brownfields site in Lackawanna, NY; and a 535 MWH/year Brightfields solar project on a contaminated site in Brockton, MA.

There is greater potential for more renewable energy on waste sites if the proper informational tools and guidance are available to developers, including municipalities. The technical and financial considerations associated with such development require an understanding of a formidable body of information. Organizing and presenting this information for municipal officials and other newly interested stakeholders can go a long way toward de-mystifying the requirements for successful development.

As stated above, if states are going to increase waste recycling and reuse (and benefit from the associated GHG reductions), they need to identify and develop increased collection and recycling locations. Development of former waste sites to support waste reuse and recycling infrastructure could help. Closed landfills and other contaminated sites may offer developed infrastructure, lower cost land, and other attributes that would assist waste recycling and reuse activities. Such development would also help create green jobs.

5.0 Adapting to Climate Impacts of Increasing Intensity of Storms & Other Disasters

The International Panel on Climate Change (IPCC) has noted that an increase in the average global temperature is likely to lead to changes in precipitation and moisture because of changes in atmospheric circulation and increases in evaporation and water vapor. Climate models suggest:

- An increase in global average annual precipitation during the 21st century, although changes in precipitation will vary from region to region;

- An increase in the intensity of precipitation events, particularly in regions that experience overall increases in precipitation; and
- Annual average precipitation increases over most of the northeastern United States.

In the Northeast, storms and hurricanes are expected to become more intense, produce stronger peak winds, and produce increased rainfall over some areas due to warming sea surface temperatures that can energize them. The relationship between sea surface temperatures and the *frequency* of tropical storms is less clear, and there is currently no scientific consensus on how future climate change is likely to affect the frequency of tropical and other severe storms.[46]

5.1 Increased Waste Generation Associated with More Intense Storms & Other Disasters

Storm debris can consist of large quantities of the typical building materials and municipal solid wastes as well as appliances, electronic products (e.g., televisions and computers), furniture, bedding, and carpet. In the aftermath of a storm, large quantities of all types of debris need to be quickly and efficiently collected and properly disposed of. For example, according the Massachusetts Department of Environmental Protection (MassDEP), a category three storm in the state was estimated to result in more than 138 million cubic yards of debris statewide, with estimates for individual counties ranging from 30.4 million cubic yards for the largest and more urbanized county to 485,000 cubic yards for the smallest and most rural county. The MassDEP has used these estimates to calculate the acreage of storage space that would be required to stockpile the debris that such a storm would produce. These estimates range from more than 3,000 acres in the largest urbanized county to about 50 acres in the smallest county. Some of this material can be reused and recycled (e.g., metal and wood), but specific arrangements and plans need to be made ahead of time. In the rush to manage the rapid influx of storm and other disaster debris, opportunities for reuse or recycling are frequently overlooked.

5.2 Improved Planning & Waste Handling Capacity to Address Increased Storm Debris

If the Northeast is likely to experience more intense storms in the future, the states need to adapt and continue to improve their capability to handle the associated waste debris. Individual municipalities and states often do not have adequate capacity to manage significantly large quantities of debris, or to haul the material to central locations for pick up and management, in a compressed period of time. In addition, to promote greater reuse and recycling of the debris requires identification of locations for the separation, collection, handling, storage, and coordination with the recyclers. Currently individual states do not necessarily have the facilities within their borders to support all of these activities. Improving this situation requires inter-municipality and interstate cooperation to identify potential areas for sorting and storing debris,

[46] http://www.epa.gov/climatechange/science/futurepsc.html#ref.

and to identify recyclers and other management facilities that can process it in a timely and safe manner.

6.0 Proposed Regional Climate-Waste Action Plan

While greenhouse gases are a global problem that ultimately requires a global solution, the Northeast States have been playing a leadership role in addressing the issue of climate change in the U.S. The Northeast states have also implemented actions to promote sustainable materials management, develop and implement product stewardship and environmentally preferable purchasing programs, prevent waste, and promote greater reuse and recycling. Individual states have or are developing climate action plans. These plans highlight areas related to materials use and waste management and their climate impacts. On a parallel track, state agencies are updating their solid waste management plans, which provide the framework for states' efforts on solid waste prevention, product stewardship, reuse, and recycling.

Experience regionally with implementation of the New England Governors' Conference Mercury Action and Climate Action Plans and Regional Greenhouse Gas Initiative (RGGI) have demonstrated that states are able to accomplish more and have a greater impact by working together than working alone on challenging regional and global environmental issues. The NEWMOA-member state programs believe they can more effectively use their pollution prevention and waste management strategies to meet regional climate action goals through interstate cooperation and action. Through NEWMOA, the Northeast state program Directors plan to continue to share information on Climate-Waste developments.

NEWMOA works in partnership with other groups, including the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), Northeast States for Coordinated Air Use Management (NESCAUM), New England Interstate Water Pollution Control Commission (NEIWPCC), Northeast Recycling Council (NERC), Product Stewardship Institute (PSI), and others on strategies to address shared priorities. These groups are also taking important steps to address climate change and its impacts. The NEWMOA State Directors intend to promote implementation of this Action Plan through partnerships with other agencies and these and other appropriate groups.

This Action Plan identifies guiding principles, followed by the proposed goals and recommendations for NEWMOA action that are broken into eight separate strategies. These strategies aim to provide a framework for coordinated efforts and highlight initial NEWMOA priorities.

6.1 Guiding Principles

The NEWMOA Directors identified the following key guiding principles to inform actions and recommendations:

- Effectively minimizing the contribution of waste management to climate change will require coordination and collaboration in the efforts of the Northeast states.
- A life cycle view should be taken when evaluating the climate impacts of any material or waste, including the impacts of materials throughout the supply chain.
- Actions to foster pollution prevention, reuse, recycling, waste management, and waste site cleanup should be implemented to minimize energy consumption and GHG emissions.
- Actions should focus on the materials and waste streams with the greatest overall climate impact.
- Addressing climate change can have unintended consequences, and these should be addressed proactively (e.g., preventing the generation of wastes containing toxic chemicals from new energy efficiency and renewable energy technologies). Efforts to reduce waste and mitigate climate change should not result in significant contamination of land, air, and water or negative public health impacts.
- Renewable energy and energy efficiency are critical to successful climate change mitigation because they reduce fossil fuel emissions. Closed landfills, Brownfields, and other contaminated sites can provide sites for developing renewable energy and for supporting waste reuse and recycling activities.
- Waste programs should anticipate the impacts of a warmer climate on the types and amounts of waste generated and develop strategies and initiatives to adapt to these changes.

6.2 Regional Climate–Waste Action Goal

Over the long term, anthropogenic greenhouse gas emissions must be reduced to levels that no longer pose a dangerous threat to the climate. According to the International Panel on Climate Change, this will require global reductions of GHG emission of approximately 75-85 percent below current levels.[47] The New England Governors/Eastern Canadian Premiers' 2001 Climate Action Plan goals are:

- **Short-term Goal**: Reduce regional GHG emissions to 1990 emissions by 2010.
- **Mid-term Goal:** Reduce regional GHG emissions by at least 10 percent below 1990 emissions by 2020, and establish an iterative five-year process, commencing in 2005, to adjust the goals if necessary and set future emissions reduction goals.

[47] http://www.ipcc.ch/index.htm

- **Long-term Goal:** Reduce regional GHG emissions sufficiently to eliminate any dangerous threat to the climate; current science suggests this will require reductions of 75–85 percent below current levels.[48]

A number of northeastern states have adopted their own specific climate action goals. Many of these generally reference the regional goals established by the New England Governors' Conference (NEGC), and provide a basis for states to develop plans for achieving their own and the regional goals. These long-term goals mirror that of the United Nations Framework Convention on Climate Change, to which both the United States and Canada are signatories. The regional goals may be modified as the understanding of climate science advances.

NEWMOA's overall Climate-Waste Action Plan goals are to:

- Assist Northeast states in achieving their greenhouse gas reduction goals by supporting and helping states implement programs that mitigate the climate, energy, and overall environmental impacts of products and materials use, waste generation, waste management, and site remediation; and
- Promote effective prevention and management strategies to assist states in adapting to the impacts of a warmer climate in the near term.

6.3 Proposed NEWMOA Recommended Strategies & Actions

This NEWMOA Climate-Waste Action Plan identifies ways in which the Association is already assisting its member-states in meeting their climate action goals and identifies additional strategies and actions that NEWMOA would like to initiate to further these efforts. The strategies are described for the Northeast Region in aggregate; their shape and level of effort may vary by state on an individual basis. The differences in characteristics, social and political systems, economic profiles, and resources will lead to varying approaches among the states in contributing to regional goals. However, the states agencies in the Region have been working together through NEWMOA to advance this important effort, and plan to continue to do so in partnership with other agencies and interstate organizations.

Through this Action Plan, the states commit to sharing information, discussing and developing joint policy actions, conducting research, coordinating implementation of programs, and conducting needed training and capacity building. On an annual basis, the NEWMOA Board of Directors develops the Association's work plans that establish product and waste priorities and focus on particular initiatives. As these plans are developed, additional opportunities for regional collaboration are expected to be identified. NEWMOA will use its annual planning process to update this Action Plan and expand it as needed.

[48] http://www.negc.org/documents/NEG-ECP%20CCAP.PDF.

The following strategies outline key recommended actions for NEWMOA in partnership with member state agencies and other appropriate organizations to address climate change by improving waste prevention and management.

STRATEGY 1: Minimize Life Cycle Impacts of Waste

Regional Goal

NEWMOA will continue to support its member state programs in their source reduction/pollution prevention programs and initiatives and will continue to assess how these efforts contribute to greenhouse gas reductions.

Basis for Action

To minimize the climate impacts of the life cycle of products, waste and pollution prevention should be implemented to the maximum extent that is feasible. NEWMOA will assist states in implementing product stewardship, design for the environment and green chemistry, energy efficiency outreach and assistance, and environmentally preferable purchasing approaches as key strategies for achieving greater waste and pollution prevention in the region.

Current Activities

NEWMOA has coordinated a regional pollution prevention program that has focused on facilitating information sharing and conducting regional training on waste prevention successes and initiatives, environmentally preferable purchasing strategies and methods, product stewardship, energy efficiency programs and methods, and promoting safer chemical alternatives to priority toxics. NEWMOA's Pollution Prevention Resource Exchange (P2Rx) Regional Center has been a national leader in facilitating the sharing of information on successful source reduction programs and initiatives. NEWMOA's efforts have also provided extensive training and promoted capacity building of state officials for pollution prevention.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Help state programs understand the options for product stewardship by evaluating and exploring regulatory models for implementing product responsibility approaches.
- Support state efforts to work with a variety of entities on product stewardship and promote the views of state regulatory programs in these discussions.
- Explore ways to provide a point of contact for state programs that are addressing the same waste issues to access and share information.
- Help state programs obtain the tools necessary to advance design for the environment concepts, green chemistry, and green engineering by developing and promoting case studies, identifying barriers to successful adoption, measuring outcomes, and integrating successful approaches into available training.
- Help state programs understand their options and evaluate success in their efforts to utilize their purchasing power to promote source reduction and the use of more sustainable materials.

- Assist the states in their efforts to advance the practical applications of waste prevention (sometimes called zero waste and/or beyond waste) by providing trainings for state and local officials and sharing experiences of successful programs within and outside of the region.
- Develop training opportunities on the use of more sustainable building practices as well as source separation deconstruction and reuse/recycling techniques.
- Assist state programs with evaluating options for increasing energy efficiency in the transportation of waste for disposal and recycling in the Region.
- Provide training on methods of evaluating the carbon foot print of products and waste.
- Provide training on energy efficiency techniques and technology for state and local environmental assistance and pollution prevention staff.
- Support state regulatory, assistance, and pollution prevention programs with promoting energy efficiency through use of improved software tools, such as the Energy and Materials Flow and Cost Tracker (EMFACT).
- Support state programs to implement and share a consistent set of data on the results of their energy efficiency and GHG reduction activities through the online P2 Results Data System.

STRATEGY 2: Increase Waste Reuse & Recycling

Regional Goal
Increase waste reuse and recycling in the Northeast above the current levels.

Basis for Action
Research has shown that reusing and recycling discarded materials can produce significant greenhouse gas benefits because the energy demands and GHG emissions required for these activities is generally lower than those needed to support extraction, processing, and transportation of virgin raw materials.

The states in the Northeast have achieved significant gains in increasing waste recycling during the past 30 years, but there remain opportunities for improvement. There is a need to improve the capture of conventional recyclables from commercial and industrial facilities, institutions, public spaces, events, and others where capture rates are not yet adequate.

Construction and demolition waste (C&D) are generated in significant quantities in the Northeast. Properly managing these materials has been a particularly challenging problem in the Region in recent years. Increasing reuse and recycling of C&D may have associated climate change benefits. The beneficial reuse of industrial byproducts maximizes the use of the embodied energy in these materials and mitigates the climate impacts that would otherwise be associated with raw materials extraction and processing.

Current Activities
NEWMOA has been active in promoting reuse and recycling of a variety of target materials, including commercial solid waste, C&D debris, tires, agricultural plastics, fluorescent lamps, industrial by-products, and others. For example, NEWMOA has initiated a Workgroup that coordinates state efforts to target waste generated by hospitality facilities. These efforts have resulted in programs benefiting from learning about and adopting similar approaches to these sectors and waste streams. For example, the Vermont Department of Environmental Conservation and Maine Department of Environmental Protection developed certification programs for hospitality facilities and other states (e.g., Connecticut and Rhode Island) learned about these initiatives through NEWMOA and have used them as a model as they develop their certification programs. In another project with similar goals, NEWMOA has developed a database of state beneficial use determinations (BUDs) so that the states can share basic information about the non-hazardous industrial wastes and the corresponding reuses they have approved so that the programs can learn from each other. During the past year, NEWMOA has initiated a regional training program to promote greater collection and recycling of plastics used in agricultural operations.

For many years, NEWMOA has coordinated state efforts to improve the management of construction and demolition debris, focusing recently on compiling and analyzing available data on the generation, reuse, and recycling of construction and demolition materials in the region and holding stakeholder sessions on the various management options. On-going efforts include facilitating the development of regional markets for gypsum wallboard, asphalt shingles, and both clean and painted/stained wood.

A few of the Northeast states have initiated bans that are designed to keep specific wastes out of landfills and incinerators. In order for these bans to be successful, there must be an adequate collection and recycling infrastructure available to properly manage the materials. NEWMOA has assisted state programs with understanding what bans are in effect in the region, how state agencies have implemented and enforced their bans, and the impact the bans are having on solid waste recycling and disposal.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Help state programs to understand barriers to increasing the collection, safe storage, and available end uses for targeted wastes and the necessary actions to address them by providing opportunities for information sharing and regional dialogue.
- Help state programs understand the various technologies available for safe collection and transport of waste for recycling and the results of research on cutting edge recycling techniques by providing opportunities for training and information sharing.
- Help state programs expand their understanding of appropriate regulations and permits designed to increase recycling (i.e., waste disposal bans) and for the potential end uses of various targeted waste streams by providing opportunities for peer-to-peer exchanges.
- Help state programs to understand the emerging technologies for using waste to generate energy and their regulatory implications by providing research and information sharing.
- Identify models that state and local programs can implement for providing financial incentives for increasing recycling, such as Pay-As-You-Throw or Save Money and Reduce Trash programs, their pros and cons, and barriers to implementation.
- Support states' beneficial use determinations programs and promote the reuse of industrial byproducts for which there is no risk to public health or the environment by creating a publically available beneficial use determinations clearinghouse.
- Help state programs develop strategies to increase diversion and recycling of construction and demolition (C&D) debris and reuse of clean C&D materials by identifying barriers, ways to address those barriers, and markets for the recycled waste.
- Help state programs understand and promote energy conversion of biomass-based C&D materials for which recycling opportunities do not exist by conducting research and sharing information and experience.

STRATEGY 3: Reduce Methane Gas Emissions from Landfills

Regional Goal

Maximize the reduction of organic materials in landfills and promote the capture and use of methane from existing landfills wherever technically and economically feasible.

Basis for Action

Methane is a potent greenhouse gas, and emissions from organics in landfills are the single largest anthropogenic source of methane emissions. Many closed landfill sites in the Northeast already have methane capture systems. However, there still remain some completely or partially undeveloped sites and sites where the methane is flared and not used for energy. The states and U.S. EPA have begun to identify and target the underdeveloped landfill sites to assess the feasibility of increasing methane capture and use for energy in the region.

Current Activities

The NEWMOA-member state programs have been aggressively promoting the development and expansion of organics recovery facilities for a number of years. This includes both onsite and other organics recovery systems at institutions and businesses and commercial facilities. As part of these efforts, they have been researching and promoting effective "cutting edge" organics recovery techniques for large scale operations, such as anaerobic digestion. The state programs have been conducting outreach and education to households to promote greater public participation in organics recovery activities for food and lawn and garden waste.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Identify gaps in science and work with others group to conduct research to fill key data gaps on landfill gases, including studies of the actual methane capture rates in the Region.
- Identify opportunities for state agencies to advance organics recycling, such as the establishment of new mechanized food composting and anaerobic digestion facilities, and to address barriers and challenges to increase implementation of these systems.
- Assist states with identifying new design and operating standards for landfills that facilitate methane-to-energy development and the capture of landfill gases and conversion to fuel.
- Assist state programs with conducting research into new technologies for capturing lower levels of methane generated as closed landfills age.
- Assist state programs with examining opportunities for additional requirements for small landfills to implement more efficient capture of methane
- Help state programs work with electric utilities to remove hurdles to establishing connections from landfill gas capture systems into the electric grid and share information about state agencies' experience where there is legislation and programs to encourage these connections.

STRATEGY 4: Promote Greater Awareness of What the Public Can Do to Reduce Waste & Address Climate Change

Regional Goal

State agencies will work together to educate the public about the actions they can take at home and at work to reduce the generation of waste and associated releases of greenhouse gases.

Basis for Action

For source reduction and recycling programs to succeed, public awareness and involvement must be high. The state programs in the Region require the support and participation of their citizens to achieve regional climate change goals.

Current Activities

There is a substantial amount of public education already underway to promote pollution prevention and recycling in the Northeast. These efforts have been initiated by the state and local government agencies, various non-governmental organizations, as well as the private sector. However the climate mitigation link is just beginning to be incorporated into these efforts.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Develop regional messaging and outreach materials on the importance of prevention, recycling, and the waste-to-climate connection that can be modified for used in individual states.
- Promote a dialogue among traditional waste management companies, community organizations, municipal governments, and interested citizens on the relationship between generation of waste and climate change.

STRATEGY 5: Improve Overall Data Gathering & Waste Planning Support

Regional Goal

State agencies will continue to share waste and climate planning information and analysis, develop improved analyses to quantify the climate benefits of improved source reduction and recycling, and establish a regional reduction and recycling planning effort that will be reviewed every five years.

Basis for Action

The process of better understanding the climate impacts of various products and materials and solid waste generation and management in the Region will assist state programs in the identification of specific measures that will reduce greenhouse gas emissions. A fuller understanding of the present circumstances and a more complete assessment of source reduction opportunities for action in various sectors of the economy are essential for state agencies to improve waste prevention and management and address climate changes effectively.

Current Activities

NEWMOA has been assisting its member states in analyzing the generation and flow of solid waste for disposal among the states in the Region, comparing state solid waste plans, coordinating solid waste staff, and providing training on advances in solid waste management practices and technologies.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Work with state programs to help them understand different metrics and the potential use of common measures, where possible for evaluating the success of their waste prevention, reuse, and recycling efforts.
- Gather available data and promote studies needed to develop regional quantitative targets for source reduction, recycling, and organics recovery to enhance the ability of the states to achieve their climate action goals and solid waste planning targets.
- Help state programs evaluate other products, materials, and waste streams for their climate impacts and potential strategies that may impact these wastes.
- Gather and share information and data to inform the Northeast states on the potential materials and climate benefits of source reduction options and strategies.
- Share information from materials and waste characterization studies.
- Collaborate with others to identify valuable sources of information and develop achievable reduction and recycling targets.
- Develop and implement a methodology for measuring the success of this Action Plan and identify and gather the data that is needed to track the impact of the Action Plan recommendations.

STRATEGY 6: Increase the Use of Former Solid Waste Landfills & Other Contaminated Sites for Renewable Energy & Waste Reuse & Recycling Development

Regional Goal

Maximize the utilization of landfills and other contaminated sites for solar and wind and recycling and reuse development.

Basis for Action

Former landfills and other contaminated sites can provide valuable locations for development of renewable energy, particularly solar and wind, and recycling and reuse facilities. Facilitating this development will have important co-benefits for the creation of green jobs.

Current Activities

In 2008, NEWMOA initiated a project to promote renewable energy development, such as wind and solar, on former landfill and other contaminated sites. NEWMOA held a successful workshop that brought together a variety of key stakeholders to learn from the experience of communities that have successfully sited such projects and to discuss what was critically needed in the future to promote an increase in this development.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Assist state programs in developing criteria to assess the feasibility of waste sites and closed landfills for suitability for renewable energy and reuse and recycling development.
- Assist state programs with exploring new opportunities to site renewable energy and recycling development on former waste sites by developing model legislation and other support documents.
- Help state programs and property owners understand the variety of ways in which these projects can be financed and constructed.
- Improve the capacity of municipal agencies, state programs, and developers to more efficiently utilize waste sites for renewable energy and recycling projects by providing regular opportunities for information exchange and training through workshops and other outreach activities.

STRATEGY 7: Promote Green Remediation Practices at Waste Site Cleanups

Regional Goal

Implement cleanup approaches that are protective of public health and the environment and that minimize the production and emission of GHGs.

Basis for Action

Opportunities exist at all phases of the waste site cleanup process to reduce the environmental impacts of remediation, including the reduction of energy consumption and GHG emissions, while still achieving cleanups that are protective of public health and the environment. To date, such opportunities have not been a significant consideration in the site cleanup process and have not been pursued on a regular basis.

Current Activities

For many years, NEWMOA has assisted its member states in the Waste Site Cleanup and Brownfields programs on a variety of technical issues by providing conferences, workshops, and training in relevant topics and by facilitating meetings among the states and with U.S. EPA. NEWMOA-member state programs are also active in the efforts of an Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Workgroup to promote green remediation, and NEWMOA coordinates its efforts with them.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Develop trainings, conferences, and workshops for state waste site cleanup staff related specifically to green remediation principles.
- Facilitate meetings among the state personnel and U.S. EPA to discuss experiences and approaches to incorporating green remediation strategies.
- Gather and disseminate to NEWMOA- member programs information on green remediation, including new laws and regulations, guidance documents, white papers, scientific studies, and general case studies from around the country.

STRATEGY 8: Improve Planning for Management of Disaster Debris

Regional Goal

Coordinate the disaster recovery planning and programs in the Northeast to improve the efficiency and responsiveness of the programs and to maximize the potential for reuse and recycling of materials associated with disaster events. This is an important aspect of adapting to a changing climate

Basis

The climate is already in a significant cycle of warming, and adapting to the impacts of such warming, including the increasing intensity of storms and flooding, in the Northeast is critical for the foreseeable future.

Current Activities

In 2007, NEWMOA initiated a project to improve the state planning efforts for managing disaster debris and creating an improved infrastructure for recycling of this material. The initial project meetings of the various agencies and programs in the Northeast helped promote cooperation within states and among states and federal programs in the disaster planning.

In conjunction with member states and appropriate partners, recommended NEWMOA actions include:

- Assist state agencies by providing technical assistance for the development of state and local disaster debris plans.
- Assist state programs in the development of criteria for the identification and siting of staging areas for the efficient collection of disaster debris to promote increased recycling and proper waste management in the event of a storm or other disaster.