Chapter 16. Waste

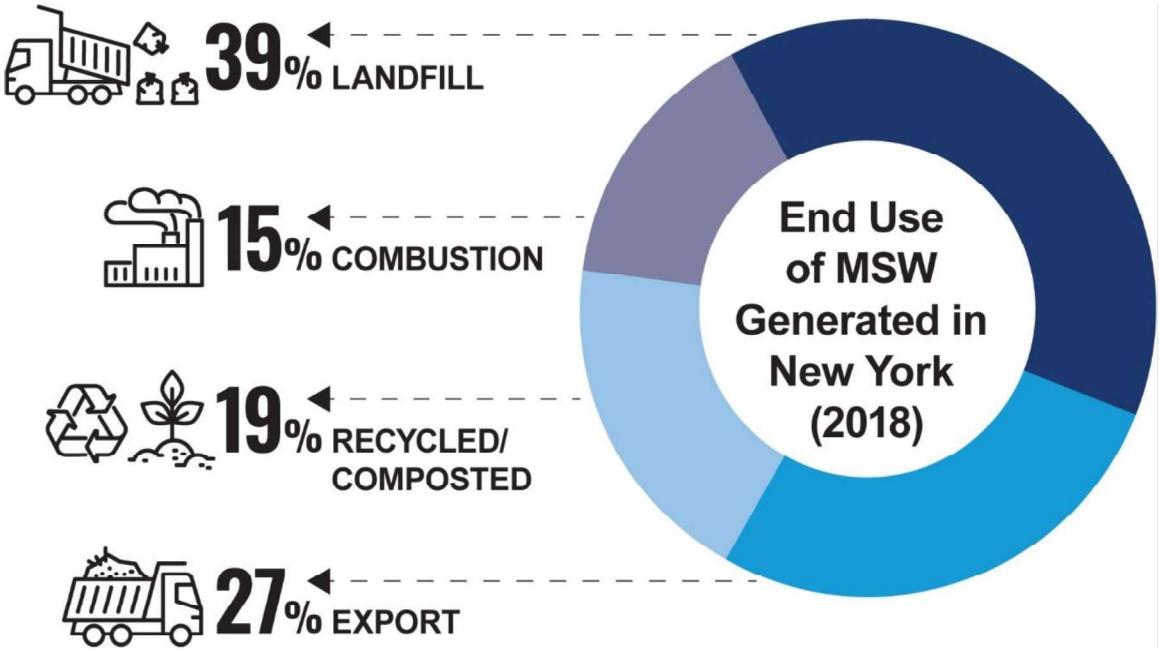
16.1 State of the Sector

Overview

The waste management sector, for the purposes of this Scoping Plan, includes all aspects of materials management and wastewater treatment. Materials management includes waste reduction, reuse, recycling (including organics recycling), combustion, and landfilling. In New York, more than 18 million tons of municipal solid waste (MSW) is generated each year, which equals 1,850 pounds for every person that lives in the State.

MSW generated in New York is managed through recycling (including composting and other organics recycling), combustion, landfilling in-State, and export for landfilling or combustion out of State. As shown in Figure 29, 19% of the MSW generated was recycled, 15% was combusted, 39% was landfilled in New York, and 27% was exported to other states for landfilling or combustion in 2018.

Figure 29. End Use of MSW Generated in New York (2018)



Source: DEC Solid Waste Annual Report.

Many facilities are needed to manage the MSW generated and handled in New York. A variety of facilities are found in the State, including MSW; combustors; recycling facilities, including organics and recyclables handling, and recovery facilities; construction and demolition debris handling and recovery

facilities; and transfer facilities. Combustors have an advantage over landfills related to their ability to recover metals that cannot be recovered through traditional materials recovery facilities.

The number of active MSW landfills in New York has dropped significantly since 1988 and has remained roughly consistent since 2000. In the past, MSW landfills were smaller, local, and less complex. Modern landfills tend to be regional and are sophisticated engineered structures. While many New York communities dispose of their waste within the State, a significant amount of waste is transported for disposal across State borders, both out of and into the State. The flow of waste is influenced by economic and market forces as well as regulatory and policy directives. However, movement of waste across State borders is considered interstate commerce and is therefore governed by federal authority under the U.S. Constitution. In the past, Congress has considered legislation that would allow states to constrain the movement of waste from other states, but no such laws have passed. In the absence of action on the federal level, the export and import of waste across State borders is expected to continue. However, some municipalities in New York have adopted local waste flow control laws that prohibit the exportation within a county, authority, etc. These local controls on the movement of waste were upheld by a Supreme Court decision.

In addition to the quantity of waste generated and how it is managed, the characteristics of the waste stream itself have a major impact on possible climate change impacts. The MSW generated in New York, broken out by material composition, is depicted in Figure 30.

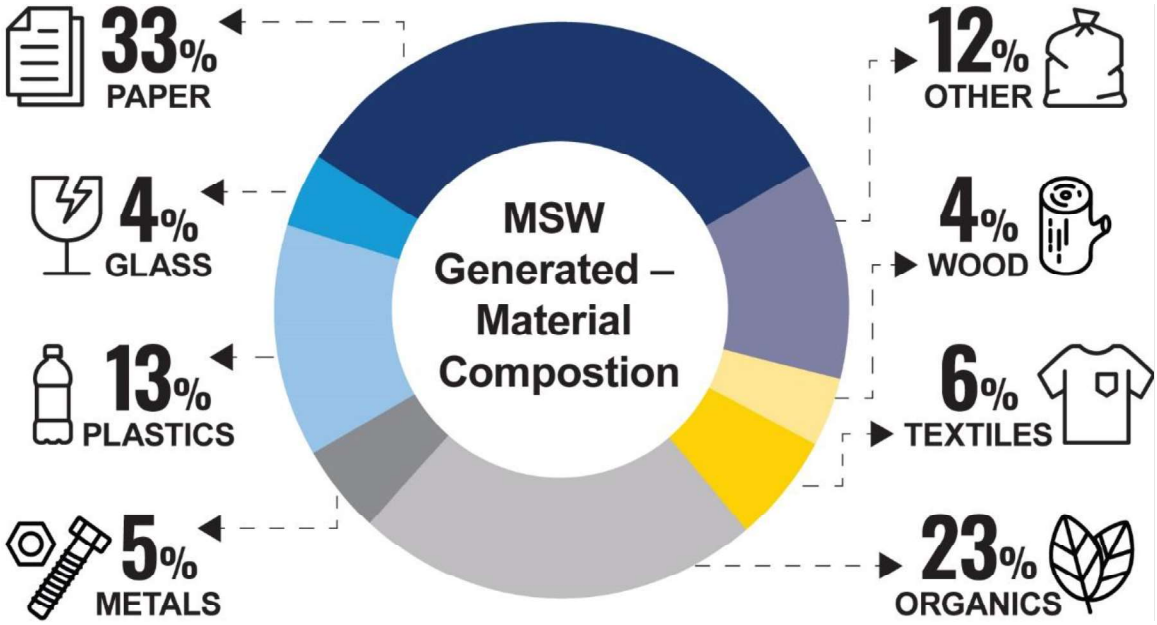
Emissions Overview

GHG emissions from the waste sector represent about 12% of statewide emissions, including landfills (78%), waste combustion (7%), and wastewater treatment (15%). Most of these emissions represent the long-term decay of organic materials buried in a landfill, which will continue to emit methane at a significant rate for more than 30 years. It also represents both waste landfilling in New York and waste export to landfills in other states.

Municipally owned wastewater treatment plants (water resource recovery facilities, or WRRFs) perform a critical function in protecting water quality. There are 612 publicly owned treatment works (also referred to as wastewater treatment facilities) that are owned by public entities in New York that serve 1,610 municipalities. The total design flow for all facilities is approximately 3,800 million gallons per day (mgd), while the reported actual flow rate is approximately 2,400 mgd. Over 70% of the facilities report actual flow rates that are less than 1 mgd. The

facilities range in size from New York City's vast system that processes 1.3 billion gallons of wastewater per day through 14 facilities to small village systems that process less than 100,000 gallons per day.[291]

Figure 30. MSW Generated – Material Composition



Source: Beyond Waste (DEC).

The most obvious and well-documented contribution to GHG emissions from the management of waste is from the uncaptured emissions of methane from landfills. As organic materials break down in a landfill's anaerobic environment, they generate methane, a GHG 84 times more potent than carbon dioxide (CO_2) (20-year global warming potential [GWP] basis). MSW landfills in New York have gas collection systems in place that greatly reduce emissions, but gases still escape through the landfill cap and leak during the active placement of waste. In addition to landfills, there are other waste handling practices that produce GHG emissions, including combustion and anaerobic digestion. Although anaerobic digestion is recognized as a method for recycling organic waste, if there are leaks from the gas-handling system, methane can be lost to the atmosphere. Wastewater treatment plants have GHG emissions through wastewater processing systems and from anaerobic digesters (if present).

Greenhouse implications of waste go beyond waste handling considerations. More than 70% of municipal waste is made up of discarded products and packaging, the production, distribution, and disposition of

[291] New York State Department of Environmental Conservation. 2018. "Biosolids Management in New York State." Albany. Accessed at https://www.dec.ny.gov/docs/materials_minerals_pdf/bsmgmt2015.pdf.

which generate emissions. Every step of the process – mining, harvesting, manufacturing, and distribution – consumes energy and generates pollution. Thus, to the extent that waste can be reduced through extended use of products and materials and through various recovery strategies, those products and materials will not have to be replaced with new materials requiring an equivalent demand on resources and the environment.

The life cycle impacts of waste are described in EPA's report, *Solid Waste Management and Greenhouse Gases: A Life Cycle Assessment of Emissions and Sinks*. For many wastes, the materials in the waste represent what is left over after a long series of steps, including extraction and processing of raw materials, product manufacturing, transportation of materials, consumer use, and waste management.

The most significant GHG emissions impact during the life cycle of products and packaging result not from disposal, but production of the products and packaging that eventually become waste. According to the U.S. Department of Energy's Energy Information Administration, industry worldwide uses more than 50% of the energy consumed.

Waste prevention and recycling can significantly reduce industrial energy consumption. For example, a life cycle study on the paper industry found that recycling paper and using that recycled paper in production reduces the greenhouse impacts of paper manufacturing by two to six times (depending on the paper grade) as compared with virgin manufacturing and landfilling or combustion. The potential for positive impacts of material recovery and reuse in the metals industry is even greater. When manufacturing aluminum, 95% of the GHG emissions can be avoided by substituting scrap vehicle aluminum for virgin feedstock.[292] The GHG emissions reductions related to manufacturing with recycled materials in place of virgin are so substantial that the GHG emissions from transportation of materials for recycling are not a significant factor in the overall carbon footprint of recycling.

There are significant opportunities to reduce or avoid GHG emissions by improving both materials themselves and our materials management practices. Strategies to do this are discussed later in this chapter.

[292] The International Aluminum Institute, "Sustainability," Aluminum for Future Generations, Accessed November 2021, https://recycling.world-aluminium.org/review/sustainability/.

Vision for 2030

For solid waste management and WRRFs, the major contributors to emissions are associated with landfill emissions, though sources are also found at WRRFs and other facilities. To reduce emissions to achieve the required 2030 GHG emission reductions, significant increased diversion from landfills as well as emissions monitoring and leak reduction will be needed. A circular economy approach to materials management is understood and employed.

Vision for 2050

The Climate Act requires a more dramatic decrease in GHG emissions by 2050, achieving at least an 85% reduction (compared with 1990 levels). For solid waste and WRRFs, this necessitates a dramatic shift in the way waste is managed, to the point that landfills and combustors are only used sparingly for specific waste streams, and reduction and recycling are robust and ubiquitous..

In addition, methods to monitor leaks and emissions are well developed and implemented, and those emissions are significantly reduced. The circular economy approach for materials management is fully implemented and embraced.

Existing Sectoral Mitigation Strategies

In 1988, the Solid Waste Management Act (ECL § 27-0106) established in law the preferred hierarchy of solid waste management. The hierarchy established the following priorities to guide the programs and decisions of the New York State Department of Environmental Conservation (DEC) and other State agencies:

- First, to reduce the amount of solid waste generated
- Second, to reuse material for the purpose for which it was originally intended or to recycle the material that cannot be reused
- Third, to recover, in an environmentally acceptable manner, energy from solid waste that cannot be economically and technically reused or recycled
- Fourth, to dispose of solid waste that is not being reused or recycled, or from which energy is not being recovered, by land burial or other methods approved by DEC

In addition to the hierarchy, the Solid Waste Management Act established:

- Structure and expectations for regional solid waste management planning units to encourage regional cooperation

- Requirements and funding for local solid waste management plans in accordance with the hierarchy of solid waste management methods
- A mandate that municipalities adopt and implement source separation laws or ordinances for recyclables from all generating sectors by September 1, 1992 (less than five years from enactment)
- DEC's role in fulfilling these requirements

The Solid Waste Management Act's requirements were intended to ensure that both State and local governments work actively toward establishing environmentally sound solid waste management systems that integrate the hierarchy of solid waste management methods and emphasize waste reduction and recycling, using landfills only for materials that could not be managed in a more productive way.

Since the enactment of the Solid Waste Management Act, businesses, municipalities, and individuals have embraced recycling and have built infrastructure and systems to further these efforts. In recent years, many businesses have developed formal sustainability goals and programs. These efforts are encouraged and envisioned to continue, but there are limitations to their ability to succeed without dramatic changes to materials management systems. To enhance waste reduction, reuse, and recycling programs, DEC has initiated a number of actions, including but not limited to grants, product stewardship, organics recycling, and education initiatives.

Grants

The Municipal Waste Reduction and Recycling Program, funded by the Environmental Protection Fund (EPF), is the financial backbone of municipal recycling infrastructure in New York, with $83.5 million allocated since 2010. The Municipal Waste Reduction and Recycling Program provides a recycling grant program for municipalities that covers equipment, recycling coordinator salaries, education, outreach, and planning projects, and household hazardous waste collection.

Product Stewardship

The New York State Electronic Equipment Recycling & Reuse Act (E-waste Law) was signed into law on May 28, 2010. The E-waste Law requires manufacturers who sell or offer for sale covered electronic equipment (such as computers, computer peripherals, televisions, small scale servers, and small electronic equipment) in the State to register their brands of covered electronic equipment with DEC and establish a

convenient acceptance program for the collection, handling, and recycling or reuse of electronic waste, free of charge to most consumers.

From April 2011 through December 2020, over 920 million pounds of electronic waste from New York consumers were sent for recycling or reuse, rather than being sent to landfills, waste combustion facilities, or other improper disposal methods. In addition to electronic waste, New York has programs that require manufacturers to collect and recycle rechargeable batteries, retailers to incentivize lead battery return, and manufacturers to collect and manage mercury thermostats, collect and recycle post-consumer paint, and recycle cell phones.

Green Products

The procurement of green products by government entities can drive the market for products made with recycled content and reduce waste. Executive Order 22 builds upon a decade of leadership by New York State Agencies committed to reduce the environmental footprint of their operations. Through the GreenNY Council, New York leverages tremendous purchasing power to drive markets to produce products that utilize recycled content, generate less waste, and adhere to circular economy principles. The GreenNY Council drives State procurement of more sustainable products, from office paper to vehicles.

With these State programs, purchasing green, post-consumer products are made easier and more accessible. New York State Office of General Services (OGS) Procurement Services manages about 1,500 State purchasing contracts, many of which contain environmentally friendly products and services. The GreenNY Council has established a total of 78 green procurement specifications covering commodity, service, or technology products purchased by the State.

New York State Bag Waste Reduction Act

In 2017, it was estimated that New Yorkers used 23 billion bags annually. As of March 1, 2020, all plastic carryout bags (other than an exempt bag) became banned from distribution by anyone required to collect New York sales tax. For sales that are tax exempt, plastic carryout bags are still not allowed to be distributed by anyone required to collect New York State sales tax (unless it is an exempt bag).[293]

[293] ECL Article 27, Titles 27 and 28; 6 NYCRR Part 351.

Outreach and Education

DEC supports robust outreach and education programs to enhance recycling. These include the Recycle Right NY campaign, using social media and other means to educate the public on recycling, the DEC Delivers platform to publicize information, education for students, and market development. To research ways to increase recycling, DEC is funding multiple State colleges to look at paper, glass, plastic, waste composition, public attitudes, and other aspects of recycling.

Food Donation and Food Scraps Recycling Law

In 2019, New York passed the Food Donation and Food Scraps Recycling law. Effective January 1, 2022, large generators of food scraps (defined as generating an annual average of two tons per week or more) must donate edible food and recycle all remaining food scraps if they are within 25 miles of a viable organics recycler. In addition to the Food Scraps Law, DEC has implemented grants programs and multiple outreach efforts to increase food donation and food scraps recycling.[294]

Key Stakeholders

Key stakeholders for this sector include environmental nongovernmental organizations (NGOs), municipalities, State agencies, emergency food relief organizations, businesses, affected workers and unions, solid waste management facilities, and solid waste transporters.

16.2 Key Sector Strategies

The key strategies within this sector are organized into three themes, as shown in Table 17. As described there in greater detail, the labor standards discussed in *Chapter 7. Just Transition* are intended to apply throughout this Scoping Plan, including for the waste sector, as a means of promoting good, family-sustaining, union jobs accessible to all New Yorkers and achieving a true just transition.

[294] ECL Article 27, Title 22; 6 NYCRR Part 351.

Table 17. Waste Sector Key Strategies by Theme

Theme	Strategies
Reduce, Reuse, and Recycle Waste	W1. Organic Waste Reduction and Recycling W2. Waste Reduction, Reuse, and Recycling W3. Extended Producer Responsibility / Product Stewardship W4. WRRF Conversion W5. Refrigerant Leak Reduction and Destruction
Monitor, Detect, and Reduce Fugitive Emissions	W6. Reduce Fugitive Emissions and Co-Pollutants from Solid Waste Management Facilities W7. Reduce Fugitive Emissions and Co-Pollutants from WRRFs
Establish Markets for Recovered Resources and Biogas Utilization	W8. Recycling Markets W9. Biogas Use

Reduce, Reuse, and Recycle Waste

Waste reduction, reuse, and recycling is critical to achieve the requirements and goals of the Climate Act. To achieve these directives, a fundamental shift in consumer habits, including purchasing practices, will be needed. The strategies described below are ambitious, fundamentally shifting the way New York currently produces, uses, and handles products and materials at end-of-life. Significant GHG impacts from this sector include the uncaptured emissions of methane from landfills, specifically from organic materials. There are also significant GHG impacts from the creation and distribution of products and packaging. Therefore, the following strategies are aimed at addressing the full life cycle of materials and products from product creation to the beneficial use of materials that would have otherwise been wasted. For waste management facilities located in Disadvantaged Communities, reducing the volume of material handled and capturing methane reduces odors that significantly impact quality of life for those communities and pose potential health impacts. Reducing waste volumes will also reduce the need for transfer facilities and will reduce truck traffic from transportation of waste that can impact Disadvantaged Communities. The strategies in this theme recognize that combustion and landfilling of some components of the waste stream will continue beyond 2050, although the amount of material disposed will be dramatically reduced, and ultimately facilities needed for disposal will be few. No new solid waste combustion facilities are envisioned, but the existing combustors, held to high environmental performance standards pursuant to 6 NYCRR Part 251's case-specific limits, may be needed to handle waste that cannot otherwise be reused, reduced, or recycled (residual waste). Permits for solid waste combustion facilities, including renewals, will need to meet all permitting requirements, including Section 7(2) and 7(3) of the Climate Act, to ensure these actions are consistent with achievement of the emission limits and do not disproportionately burden Disadvantaged Communities and prioritize reductions of GHG emissions and co-pollutants in Disadvantaged Communities. Existing combustor capacity may be needed

to avoid the GHG impacts that would be associated with the transport and disposal of this waste to facilities located outside of New York. The applicability of the zero-emission electricity requirement and the specifics of how it will be implemented after 2040 will be addressed by the New York State Public Service Commission (PSC) in coordination with the New York State Energy Research and Development Authority (NYSERDA), DEC, and other agencies (see Strategy E10), including how electricity generation from waste management processes will be handled.

W1. Organic Waste Reduction and Recycling

Reducing the disposal of organics, including food scraps (food grown for human consumption that has not been consumed and is destined for recycling or disposal), is key to reducing the methane and CO_2 emissions at landfills and combustion facilities. Food scraps make up 18% of the total MSW stream in New York. A portion of this is wholesome, edible food that should first be source-separated and provided to people in need. This can be achieved by introducing and implementing legislation, new regulations, and financial support statewide. Proven technologies exist and successful existing systems for managing these materials can be replicated, but there are challenges related to financial limitations, behavioral change, and logistics. The relatively low cost of landfilling (particularly in Western New York) makes recycling less attractive to both the private and municipal sectors. The development of infrastructure for additional organics recycling capacity and improving food donation systems is costly. However, when implemented correctly, these costs can be partially shifted from existing waste disposal costs and may allow organic wastes to be used as feedstocks for bioenergy products (see *Chapter 15. Agriculture and Forestry*, Strategy AF20). Economically viable markets must also exist for the soil amendments and other resultant products of organics recycling to make sustainable systems.

The Climate Justice Working Group (CJWG) agrees that ending the disposal of food scraps and yard trimmings at landfills and combustors is probably the single most important action the State can take to cut emissions from this sector. The CJWG recommends stronger programs to require major food generators, farms, supermarkets, restaurants, and institutions like universities and hospitals to develop sophisticated programs that transfer excess edible foods to local food banks and other programs designed to feed the hungry.

Components of the Strategy

- **Significantly reduce the disposal of organics:** The State should enact legislation to amend and expand the existing Food Donation and Food Scraps Recycling Law (2019) to include generators of one ton per week or more beginning in 2024, one-half ton per week in 2025, and all generators

by 2028. Also, the law should be amended immediately to eliminate the 25-mile requirement and the exemptions.

- **Financial assistance for food donation:** The State should provide additional funds for emergency food relief organizations to expand food donation.
- **Reduction of food supply chain losses:** The State should provide funding to research food loss throughout the food supply chain, from farm to table, and financially support means to reduce waste at all points in the system.
- **Financial assistance for organics recycling infrastructure:** The State should expand existing financial assistance programs for organics recycling facility infrastructure, including collection and processing, for small-scale and larger-scale operations.
- **Expand food scraps collection and recycling at multi-family buildings:** DEC and appropriate housing authorities should expand and replicate successful models of organics collection and recycling programs inclusive of multifamily buildings and public housing.
- **Markets for compost, digestate, and similar products:** DEC should facilitate research and other means to increase markets for compost, digestate, and other products derived from organic waste.
- **Food waste reduction and donation for businesses:** DEC should continue to develop food waste reduction education and outreach specific to the business sector and encourage greater food donation.
- **Composting on public park land:** The State should enact legislation that will allow composting facility operation on public parks.
- **Outreach and education to promote organics recycling:** DEC should continue and expand outreach and technical assistance to expand all aspects of organics recycling (drop-off programs, household food waste reduction, school programs, facilities, etc.).
- **Engagement with the farming community:** The State should work with the farming community to increase the use of organic products, explore the potential for organics recycling facilities on farms, increase the use of food scraps for animal feed, and explore the potential for increased food donation from farms.

W2. Waste Reduction, Reuse, and Recycling

Waste reduction, reuse, and recycling initiatives significantly reduce the methane and CO_2 emissions at landfills and combustion facilities by avoiding disposing of waste in the first place. Outside of direct State agency impact, municipalities and nonprofit organizations are already implementing successful and replicable waste reduction, reuse, and recycling programs. However, having consistent and sufficient

funding, staff, and technical support to establish and operate these programs will lead to greater success. The CJWG is supportive of policies that reduce waste and encourage recycling. The CJWG recommends convenient recycling collection programs throughout the State and that these programs receive adequate funding.

Components of the Strategy

- **Fee per ton on waste:** As stated in Strategy W1, the State should enact legislation in 2023 to establish a disposal disincentive (fee per ton) on all waste generated in New York to provide financial support for reduction, reuse, and recycling.
- **Enact "By Request Only" legislation:** The State should enact legislation requiring "By Request Only" policies for single-use products and require reusable/refillable options for consumer goods in retail stores.
- **Phase out single use packaging:** The State should enact legislation that supports the reduction and eventual elimination of single-use packaged items for use in stores.
- **Container deposits:** The State should enact legislation to implement expanded deposit container programs where feasible and needed (if not covered by Extended Producer Responsibility [EPR] programs).
- **Right to Repair:** The State should enact legislation to support "Right to Repair" and other legislation that requires manufacturers of products sold in New York to provide information to consumers and third-party technicians about how to repair damaged products.
- **Materials exchanges:** The State should encourage the use of materials exchanges and sharing platforms through development of resources and facilitate the development of avenues for material reuse and product sharing opportunities for used goods.
- **Elementary school education:** DEC should partner with the State Education Department and New York State Department of Health (DOH) to develop and promote sharing table and donation guidance for P-12 schools.
- **School curriculum:** The State should educate students on the connections between waste and the environment through curriculum development and use.
- **Reusable/Refillable containers:** The State should enact legislation that incentivize reusable and refillable solutions across the full spectrum of the packaged goods sectors, such as refill at home, return from home, refill on the go, and return on the go.
- **Research on reusable packaging:** The State should support colleges and universities to research the viability of reusable shipping and packaging materials.

- **Assistance for reuse:** The State should establish a targeted grant funding program to support reuse.
- **Reuse of construction materials:** The State should support policy approaches that increase the capture and use of building deconstruction materials and recovered aggregate for a variety of applications. This may include government requirements (procurement standards, bid specifications, etc.) to include recycled or reused deconstruction materials. (See also *Chapter 12. Buildings,* Strategy B11.)
- **Support for local facilities:** The State should provide financial support from new funding provided to implement the Climate Act and other sources, for local reuse centers, material exchanges, and repair shops to move beyond volunteer-run operations.
- **Workforce development:** The State should support workforce development, job training and trade skills in repair, refurbishment, remanufacturing, recycling, and innovative materials reuse.
- **Textile recycling:** The State should implement comprehensive textile waste reduction and recycling programs.
- **Buildings solutions:** The State should expand and replicate successful models of recyclables collection and outreach programs inclusive of multifamily buildings and public housing and fund infrastructure development (such as eco-hubs) to increase access to reuse and recycling opportunities for multifamily housing and campuses.
- **Outreach:** The State should implement new and expand existing statewide campaigns for reduction, reuse, and recycling targeting New York residents and businesses and increase research collaborations and expand upon existing partnerships to improve outreach and education efforts. The State should also support peer-to-peer education and outreach campaigns in underperforming and Disadvantaged Communities around reduction, reuse, and recycling.
- **Support municipalities:** The State should support coordination between local and regional municipalities to enhance regional recycling initiatives and provide funding to hire local enforcement officers for municipal recycling programs, encouraging cross-jurisdiction and multi-planning unit collaboration.
- **State procurement standards:** The State should codify its GreenNY procurement program in statute to ensure the long-term success of the program and continued progress on issuing new green procurement standards for products that reduce GHG emissions, are energy-efficient, produce less waste and are made with recycled content, and reduce the usage of toxic chemicals in State operations.
- **Research and evaluation of current standards:** The State should evaluate the feasibility of requiring deposit-driven, universal restaurant reusables, evaluate the feasibility of requiring

reusable shipping containers and padding to replace packaging material from online retailers, support innovative zero-waste product development and business projects, and support digital demand software and technologies to monitor and reduce over-production across all sectors.

- **Tool development:** The State should develop a life cycle analysis model and solid waste management decision-making tool.
- **Enhanced local solid waste management plans:** The State should enact legislation that would require municipalities to develop and implement local solid waste management plans or to become affiliated with planning units with approved local solid waste management plans.
- **Reduce toxics in products:** The State should enact additional legislation to ban materials and chemicals that may be found in products that are of concern for human health or environmental impacts. DEC should support research and activities that will lead to less toxic alternatives.

W3. Extended Producer Responsibility/Product Stewardship

Enacting broad EPR or product stewardship requirements to cover end-of-life management of post-consumer products will allow the State to ensure their sustainable management. Successful EPR legislation and programs already exist in New York for beverage containers, electronic waste, mercury thermostats, post-consumer paint, cell phones, pharmaceuticals, and rechargeable and lead-acid batteries. Products that could benefit from new EPR legislation include packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, all batteries, appliances (especially those containing refrigerants), mattresses, and other methane-generating wastes. Paper and wood comprise more than a third of the waste stream and they will produce methane as they degrade in a landfill, so EPR and other means to recycle these materials are crucial. While it may require the development of additional infrastructure to collect and recycle additional materials, EPR strategies shift responsibility for the end-of-life management onto the producers and manufacturers of consumer goods and away from the general public. This also encourages sustainable product design and waste prevention measures higher up the product chain.

While opposed by some industries, legislation to create a framework for EPR, or individual legislation targeting products with the greatest GHG reduction impact, can significantly reduce these potent gases that are generated when consumer goods and packaging are disposed in landfills and at combustion facilities. In addition, the end-of-life management of solar panels and large-scale batteries will become more of a concern as renewable energy technologies are implemented and grow. The CJWG is strongly supportive of policies focused on waste reduction and has expressed support for EPR, indicating that passage of an EPR bill should be a priority for addressing emissions from the waste sector.

Components of the Strategy

- **EPR framework legislation:** The State should enact and implement new legislation in 2023 that creates an EPR/product stewardship framework. Alternatively, individual legislation should be enacted targeting products with the greatest GHG impact (such as packaging and printed paper, carpet, tires, textiles, solar panels, wind turbines, batteries, appliances, especially those containing refrigerants, and mattresses).
- **Electronic Equipment Recycling and Reuse Act:** The State should enact legislation to amend the Electronic Equipment Recycling and Reuse Act to improve overall program performance for e-waste by, for example, moving away from a target-based collection approach to a consumer convenience model. DEC should provide outreach to the regulated community and consumers regarding the manufacturers' requirements.
- **Rechargeable Battery Recycling Law:** The State should enact legislation to amend to the Rechargeable Battery Law to require the collection and recycling of additional consumer battery types (alkaline, electric and hybrid vehicle batteries, etc.). DEC should increase program compliance monitoring and enforcement in accordance with existing statute to improve manufacturer engagement, retailer participation and consumer convenience.
- **Mercury Thermostat Collection Act:** The State should enact legislation to amend the Mercury Thermostat Collection Act to extend the program beyond the current January 1, 2024, sunset date and to improve overall program performance.
- **Post-Consumer Paint Collection Program:** DEC should amend the 6 NYCRR Part 373 Universal Waste regulations and the 6 NYCRR Part 360 series regulation to help streamline the management of post-consumer paint in New York.

W4. Water Resource Recovery Facility Conversion

Transforming wastewater treatment plants from a waste disposal priority to WRRFs that emphasize the capture of beneficial products is a key component of the circular economy. WRRFs, which represent much of the existing capacity for organics materials management in New York, present tremendous opportunity for reducing GHG emissions. However, the funding for WRRFs is tied to municipal water and sewer rates, is generally constrained, and is largely dedicated to improving water quality, making it difficult to self-fund beneficial reuse projects. In addition, market conditions and regulations currently favor the landfilling of biosolids and digestate byproducts, which contributes to methane emissions at landfills, over beneficial reuse. Rising landfill prices may push some municipalities to beneficially reuse naturally, but others that have agreements with local landfills and will require additional incentives to

transition to recycling systems. Many municipalities are already working toward these goals and would benefit from additional State support.

Capital investments will be necessary to unlock the GHG emissions reduction potential of new resource recovery approaches and fully utilize the infrastructure as well as maintain a state-of-good-repair. Biogas and digestate products resulting from beneficial reuse can be valuable if markets are aligned with GHG emission reducing priorities, and incentivizing biogas production could reduce costly infrastructure upgrades at WRRFs. Existing treatment plants have high thermal demands to operate digesters used to stabilize sludge. Boilers and engines on site are often able to replace fossil natural gas with a WRRF's own digester gas, yet some engines are easily fouled by the impurities in the biogas. The use of biogas onsite, where feasible and practical, is preferred before refinement of biogas into RNG for on-site use with emphasis placed on non-combustion applications such as use in fuel cells. Some facilities may be well situated to provide local communities and co-located facilities with their excess biogas resource. The limited supply of the biogas resourceshould be targeted to strategic uses, such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints. The CJWG favors on-site use of biogas captured from waste management and that no significant new transmission infrastructure should be allowed to support additional biogas.

Components of the Strategy

- **Beneficial use:** The State should support beneficial use of biosolids and biogas that demonstrate air quality, health, and GHG benefits, including requirements to avoid localized pollution in Disadvantaged Communities, recognizing that water treatment process waste generation is unavoidable. Self-supply of energy needs at WRRFs should be incentivized, particularly when it provides electric system capacity for electrification of transportation and buildings with a focus on Disadvantaged Communities.
- **Optimize and expand anerobic digestion:** The State should support energy production and methane mitigation following a full life cycle analysis, including measurement and abatement of methane leakage, consideration for avoided emissions, and supporting co-digestion programs at anaerobic digesters with existing capacity and include organics generated off site, such as food processing waste, food scraps and fats, oils, and grease. Programs that incentivize anerobic digestion should require systems be built (or retrofit) for maximum methane mitigation to ensure development of well-managed, low emissions biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG

production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices.

- **Research co-pollutants:** The State should evaluate the extent and impact of co-pollutants such as emerging contaminants and advance the use of control technologies to reduce or eliminate these emissions.

W5. Refrigerant Leak Reduction and Destruction

Hydrofluorocarbons (HFCs), widely used as refrigerants in appliances, are potent GHGs with very high GWPs. HFCs contained inside well-maintained appliance systems pose minimal threat to the environment; however, 90% of fugitive emissions of these gases happen during end-of-life management of the appliance. Policies incentivizing the destruction of refrigerants at end-of-life would encourage the retirement of old, energy-inefficient equipment so that these materials are not released to the atmosphere. These policies should be coupled with continued alternative refrigerant and system efficiency research and production.

An EPR program has the potential to be cost-effective and its impact easily quantified with reporting requirements. There are a wide range of manufacturers, products, and types of refrigerants used in new and existing appliances. Enforcement may be challenging due to the large number of facilities managing these end-of-life appliances, and there is currently a lack of comprehensive disposal data.

Components of the Strategy

- **End of Life:** DEC should promulgate regulations to address leaks at end-of-life by requiring reclamation or destruction of refrigerants from appliances and institute requirements for verification and reporting. The State should enact EPR legislation for refrigerant-containing appliances.
- **Appliance Servicing:** DEC should promulgate regulations banning the sale of virgin high GWP refrigerants for servicing with an exception for reclaimed refrigerants.
- **Reporting:** DEC should create a registry and reporting requirements (to track sales, stockpiles, and leaks) for large refrigeration and heating, ventilation, and air conditioning (HVAC) systems and refrigerant wholesalers and distributors.
- **Research:** DEC should research end-of-life management for various refrigerants and their alternatives.

Monitor, Detect, and Reduce Fugitive Emissions

The quantification of GHG impacts from fugitive emissions at solid waste management facilities and WRRFs are currently under-reported and will vary based on several site-specific factors such as waste composition and facility design. Assessing these systems both during and beyond the active life of operation as well as minimizing/repairing equipment releasing fugitive emissions (leaks) can significantly reduce waste sector GHG emissions. The CJWG strongly supports controlling fugitive emissions from landfills, sewage plants, and other methane sources as a critical step in reducing emissions from the waste sector.

W6. Reduce Fugitive Emissions of Methane and Co-Pollutants from Solid Waste Management Facilities

The anaerobic decomposition of organic materials in MSW landfills and digesters generate a combination of gases, predominately methane and CO_2. Existing regulations require landfills to install gas collection systems and provide continued monitoring well beyond the active life of the facility. Fugitive GHG emissions have also been detected at anaerobic digestion facilities from operation, malfunctioning flares, or gas management systems during the downtime or maintenance on the units or from the storage of various undigested materials on site. The current GHG emissions levels from these point sources can vary significantly among individual facilities and are likely being under-reported (as shown in a study on California's methane super-emitters).[295] While monitoring technologies continue to improve, there are significant technological and financial limitations on the facilities and municipalities. The ability to accurately measure methane leakage is currently limited.

Identifying and reducing fugitive emissions of methane from landfills and anaerobic digesters through baseline measurement, increased monitoring, and engineering and regulatory programs can reduce leaks and provide facilities with comprehensive data on their operations.

In addition to GHG emissions, actions must be taken to reduce the impact associated with co-pollutants that may be present with solid waste management facilities. Control can be exercised by siting controls, regulatory criteria, and enforcement of existing rules and standards.

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[295] Duren, R.M., A.K. Thorpe, K.T. Foster, et al. "California's methane super-emitters." *Nature* 575, 180–184 (2019). https://doi.org/10.1038/s41586-019-1720-3

Components of the Strategy

- **Landfill gas capture for active landfills:** DEC should enhance existing regulations, before 2025, for landfills that will lead to less methane leakage, such as a requirement to install gas collection systems sooner after waste placement, install specialty landfill gas collectors for difficult to access areas, and enhance gas dewatering systems to increase collection efficiency.
- **Control emissions from closed landfills:** The State should provide additional funding for the municipal landfill closure and landfill gas management grant program.
- **Enhanced landfill cover systems:** DEC should develop regulations for enhanced landfill covers to increase oxidation of methane.
- **Emission monitoring and emission reduction:** DEC should require improved emissions monitoring programs at all applicable solid waste management facilities, utilizing new technologies (such as drones). Also, DEC should require reductions in emissions at these facilities.
- **Funding to aid municipal landfills:** The State should provide funding for the proper closure of municipal landfills and reduce emissions.
- **Research:** DEC should research comprehensive landfill GHG emissions to evaluate monitoring techniques, quantify fugitive GHG emissions, and evaluate most appropriate uses for the gas during the transition to statewide electrification. DEC should research methods to improve estimates of methane emissions from anaerobic digestion and strategies to reduce or eliminate these emissions, including consideration of a regulatory framework to ensure best practices to minimize methane and co-pollutant emissions from anerobic digestion and RNG production.
- **Co-pollutant control:** DEC should use regulations, monitoring, and enforcement to reduce the impact from co-pollutants associated with solid waste management facilities. The State should enact legislation to support reduction of toxic substances in consumer products, as well as EPR (see Strategy W2 and Strategy W3), since these efforts will also reduce the potential for co-pollutants present at solid waste management facilities.

W7. Reduce Fugitive Emissions of Methane and Co-Pollutants from Water Resource Recovery Facilities

Similar to solid waste management facilities, comprehensive data on existing fugitive GHG emissions from WRRFs is not available, and additional regulations and funding sources will be critical to address wastewater sector impacts. Wastewater infrastructure was not always designed to mitigate GHG emissions. Municipalities will need to measure and reduce GHG emissions from WRRFs, septic, and

sewer systems, which can be difficult without the proper equipment and training. There is very limited data currently available concerning the quantity of emissions from these facilities.

Where density and local conditions allow, septic tanks should be eliminated and converted to municipal sewer collection systems or advanced onsite treatments. Larger municipalities may be able to absorb some of these costs, but medium and smaller municipalities do not have the funding to accomplish this without State support. Total sewering costs will vary based on the availability and proximity of a local WRRF, local soil conditions, and other factors. Fortunately, some larger municipalities are already implementing these techniques and can provide guidance for others to replicate successful programs. Some communities have high septic costs because of soil conditions and may be willing to transition. Emissions from wastewater treatment plants lead to odors and potential health impacts, which have a significant impact on neighboring communities. Prioritizing the reduction of these leaks in Disadvantaged Communities will improve air quality in these communities.

Components of the Strategy

- **Capture and beneficially reuse fugitive biogas:** DEC, EFC, and NYSERDA should work with local utilities and municipalities to repair and consistently operate WRRF flares, boilers, engines, or other equipment on-site and identify strategic beneficial uses of captured biogas before flaring excess capacity (see Strategy W9).
- **Monitoring:** DEC should require emissions monitoring and leak reduction at WRRFs.
- **Ensure proper maintenance of septic systems at the municipal level:** The State should enact legislation to establish a municipal funding mechanism to allow contractual services for routine maintenance on septic systems.
- **Encouraging transition to sewer:** The State should provide financial assistance for sewer hookups to defray high upfront costs of sewering.
- **Operator training:** The State should provide financial support and job training to wastewater system operators.
- **Research:** DEC should support research on the emission profile of WRRFs and how they can be controlled.
- **Co-pollutant control**: The State should use regulations, monitoring, and enforcement to reduce the impact from co-pollutants associated with WRRFs. The State should enact legislation to support reduction of toxic substances in consumer products, as well as EPR (see Strategy W2 and

Strategy W3), since these efforts will also reduce the potential for co-pollutants present at WRRFs.

Establish Markets for Recovered Resources and Biogas Utilization

The recycling industry needs viable and consistent markets to continue to capture the economic value of materials and promote them for their highest and best use. Support for domestic recycling facilities and markets for the resulting recovered resources is critical in keeping the recycling strategies in this Scoping Plan financially feasible and easy to replicate.

While it is recommended that solid waste management facilities and WRRFs follow all other strategies in this Scoping Plan to achieve the maximum reduction, reuse, and recycling of waste, it is recognized that some wastes (including biosolids) are unavoidable. In addition, the organic fraction of waste already disposed of in landfills will produce methane in place for many years. Capturing these unavoidable gases for strategic and local use while the State transitions to electrification will help meet the requirements and goals of the Climate Act while avoiding future reliance on fossil fuels.

W8. Recycling Markets

Some markets may exist currently, but the prices paid for secondary materials are rarely enough to sustain the cost of the collection and processing systems. In addition, developing more local and regional opportunities for materials management can lessen the impact of global economic market fluctuations (such as China's National Sword policy).[296] In support of this market development work, New York has entered into contracts to fund research at several State University of New York (SUNY) universities to assess overall domestic recycling markets development, plastics recycling research, and glass processing innovations. OGS implements existing green procurement rules to obtain recycled content materials at State agencies and Empire State Development (ESD) has previously assisted with funding recycling markets for materials such as glass and tires. Implementing additional funding resources for municipalities and implementing sound post-consumer content requirements across different sectors can make secondary material processing cost competitive with virgin materials, conserve resources, and reduce the GHG emissions impact from the disposal of otherwise recyclable materials. The CJWG is

[296] China's National Sword policy, first announced in 2017, implemented bans on the import of certain recyclable materials, including mixed plastics, unsorted mixed paper, and textiles, impacting global recycling markets.

supportive of recycling programs that cut the need for virgin materials and reduce emissions from the manufacturing of consumer goods.

Components of the Strategy

- **Market development for recovered resources:** The State should support domestic recycling facilities and markets for recovered resources (including compost, digestate, and recycled aggregate/building deconstruction materials) and incentivize public-private partnerships for recycling facility development. The State should also enact legislation to require a minimum level of recycled content in certain products and packaging.
- **Reuse of building materials:** The State should provide financial assistance to research the increase of capture and reuse of building deconstruction materials and recovered aggregate. This may include government requirements (such as procurement standards and bid specifications) to include recycled or reused deconstruction materials. (See also *Chapter 12. Buildings* Strategy B11.)
- **Recyclables in green procurement:** DEC and OGS should enhance and implement new green procurement programs to require the use of recyclables (such as compost and construction aggregate) by State and local entities and those contracting with the government.
- **Production tax credit for recycled products:** The State should enact a production tax credit, similar to the credit for clean energy systems, that is applied to companies that turn recycled materials into intermediate products if they locate their facilities in New York.
- **Organics roadmap:** DEC should conduct a market study of the quantity and characteristics of organics (food waste, biosolids, other high strength waste) produced statewide, including possible end uses of such products (such as agriculture, mine reclamation, roadside soil amendments, recycled bioproducts such as bioplastics, and erosion control).
- **Research on markets:** The State should continue financial support of colleges and universities within New York in researching recycling market challenges, plastics recycling, low-grade paper recycling, and glass processing innovations for New York.
- **State purchasing:** State agencies, authorities, and local governments should support greater purchasing of products with recycled content as well as the purchase of recycled products (compost, etc.).

W9. Biogas Use

During the implementation of aggressive waste reuse, reduction, and recycling techniques, it is recognized that some amount of waste generation will be unavoidable. Biogas generation from landfills and from anaerobic digestion will continue, and a viable use for the biogas is needed. Self-supply of energy needs at landfills and WRRFs through biogas capture and use should be incentivized where it can provide electric system capacity for greater levels of buildings and transportation electrification, with particular focus on Disadvantaged Communities. Boilers and engines on site are often able to replace fossil natural gas with a facility's own digester gas, yet some engines are easily fouled by the impurities in the biogas. The use of biogas on site, where feasible and practical, is preferred before refinement of biogas into RNG for on-site use. The limited supply of biogas or RNG should be targeted to strategic uses such as locations where it can provide electric system capacity for buildings and transportation electrification by alleviating system constraints. Assessing use in the waste transportation sector, electric co-location, or cogeneration opportunities for energy and heat intensive industries and challenging to electrify users is an avenue for biogas use, and emphasis should be placed on non-combustion applications such as use in fuel cells. Infrastructure needs for biogas or RNG from waste management should be consistent with the framework outlined in *Chapter 18. Gas System Transition*. Alternative revenues at organics recycling facilities, such as energy revenue, will allow lower tip fees to attract organics at competitive levels. Stable, enhanced energy revenue will attract investment to aggressively manage methane in existing disposal facilities and existing and new organics recycling facilities. The CJWG expressed that biogas could play a role in environmentally sound waste disposal, but caution should be taken to avoid biogas use that intentionally or inadvertently leads to the extended use of fossil fuels.

Components of the Strategy

- **Strategic use of biogas:** NYSERDA and New York State Department of Public Service (DPS), along with utilities, should evaluate strategic and local uses of generated fuels, electricity, or other energy produced from biogas for essential needs during the transition to electrification and other low-emissions energy sources. This evaluation should stress the use of fuel cells for electricity in lieu of generators or pipeline use, fuel uses in the waste transportation sector, electric co-location or cogeneration opportunities for energy/heat intensive industries, challenging to electrify uses, heat for buildings, and difficult to electrify medium- and heavy-duty transportation. This evaluation should demonstrate air quality, health, and GHG benefits before implementation, including requirements to avoid localized pollution in Disadvantaged Communities.

- **Funding for organics recycling infrastructure:** NYSERDA and DPS, along with utilities, should identify energy pricing models and conduct a market-based study for waste-generated biogas. Programs that incentivize anerobic digestion should require systems be built (or retrofit) for maximum methane mitigation to ensure development of well-managed, low emissions biogas or RNG production such as utilizing emissions minimizing technologies and techniques, minimizing fossil fuel use in biogas or RNG production, minimizing emissions from biosolids/digestate, and consideration of a regulatory framework to ensure best practices. The State should also provide a funding mechanism to support an organics recycling infrastructure.
- **Research:** DEC should complete a comprehensive landfill gas and WRRF emissions research study. The study should evaluate emissions monitoring techniques, quantify fugitive emissions, and evaluate the most appropriate uses for the gas during the transition to statewide electrification. The study should also seek to improve estimates of methane emissions from anaerobic digestion and methods to reduce or eliminate these emissions.