COMPOSTING AND ANAEROBIC DIGESTION[1]

(September 17, 2013)

I. INTRODUCTION

The primary focus of this paper is to identify opportunities and potential solutions for capturing organic materials that are currently landfilled and putting this material to a more beneficial use as feedstock for composting and anaerobic digestion. Successfully capturing a significant portion of this material for composting or anaerobic digestion is essential to ensure the success of meeting California's waste diversion and GHG reduction goals. In the sections that follow, staff describes how organic waste is processed in California, what happens with the end-use materials, what are California's waste reduction targets and the associated greenhouse gas (GHG) emissions benefits, what are the challenges in meeting and exceeding these targets, the potential solutions to these challenges, and next steps for evaluating the future of composting and anaerobic digestion in achieving Assembly Bill (AB) 32 and waste reduction goals.

II. GENERAL DESCRIPTION OF THE COMPOSTING AND ANAEROBIC PROCESSES

What are the processes involved in composting and anaerobic digestion?

Composting is the biological decomposition of biodegradable solid waste under controlled, predominantly aerobic conditions. Composting can be done at small-scale on-site facilities or at large-scale commercialized facilities that handle high volumes of organic material. Compost facilities have traditionally utilized open windrows to process compostable organics (mostly agricultural and green material) into finished compost. Some compost facilities incorporate more sophisticated technologies, such as aerated static piles and biofilters, to meet air quality requirements. End uses of the compost product include: soil amendment, fertilizer, mulch, boiler fuel, and a small amount used as alternative daily cover at landfills. The most common markets are agriculture and horticulture markets.

Organic material may also be processed via in-vessel digestion. Anaerobic digestion, the biological decomposition of organic material in the absence of oxygen or in an oxygen-starved environment, is the most common form of in-vessel digestion. Anaerobic digesters are fully enclosed structures, such as tanks or other sealed containers, in which the entire digestion process occurs. Anaerobic digestion produces biogas (consisting primarily of methane and carbon dioxide) and digestate. Digestate is the solid and/or liquid residual material remaining after organic material has been digested. There are a variety of controlled systems where anaerobic technology is currently utilized in the United States, including wastewater treatment facilities (also publicly-owned treatment works), and dairy manure digesters. In other countries (primarily Europe), anaerobic technology is utilized in municipal solid waste digesters to produce energy and to reduce the volume of solid waste that must be landfilled. Products produced through anaerobic digestion include biogas, liquid fertilizer, and compost.

[1] Although anaerobic digestion, the biological decomposition of organic material in the absence of oxygen or in an oxygen-starved environment, is the most common form of in-vessel digestion, there are several other digestion technologies that do not utilize anaerobic digestion. Anaerobic digestion is used broadly throughout this paper and includes other lesser used technologies.

While, aerobic digestion technologies have been in use for a long time in waste water treatment plants (WWTP), the technology is being investigated for potential scale-up to commercial level production for organic materials from the waste stream. There is currently one demonstration facility in West Sacramento, California that has been in operation since June 2012. This technology uses freshly discarded food in its process. The current product from the demonstration facility is a liquid soil amendment that can be distributed via a drip system. The end-uses of compostable organics generated through aerobic digestion are soil amendments which reduces synthetic fertilizer use.

There are also other in-vessel digestion technologies that process organic material. For example, fermentation is the biological conversion of carbohydrates into acids or alcohol in the absence of oxygen and aerobic digestion is the biological decomposition of organic material in the presence of oxygen. While the term anaerobic digestion is used broadly throughout this paper, the general discussion applies to these other lesser-used technologies as well.

III. CURRENT STATUS OF COMPOSTING AND ANAEROBIC FACILITIES IN CALIFORNIA

A. Collection

How much organic waste is currently collected that could be diverted to composting and anaerobic digestion?

The composition of currently landfilled solid waste materials according to 2010 data is shown in Table 1. California disposes an estimated 37 million tons of waste in landfills each year, of which roughly 30 percent - more than 10 million tons per year - are compostable organic materials which are suitable for composting and anaerobic digestion. These compostable materials are food waste, green waste, a portion of other organics, and soiled (non-recyclable) paper. Total paper disposed of in landfills was about to 5.4 million tons, with an estimated potential of 39% of these being soiled paper. In addition, about 4.4 million tons of lumber are landfilled annually. Diverting compostable organics from the landfill and using it as feedstock in composting and anaerobic digestion processes will achieve significant GHG reductions as well as waste reduction goals.

Table 1. Composition of Currently Landfilled Solid Waste[1]

Material[2]	Amounts (Million Tons[3])	Percentage of Solid Waste
Paper	5.4	14.7%
Glass	0.5	1.4%
Metal	1.5	4.0%
Plastics	3.0	8.2%
Food	4.8	13.0%
Green	4.0	10.9%
Lumber	4.4	12.0%
Other Organics	3.5	9.5%
Other Inerts	6.3	17.0%
Household Hazardous Waste	0.1	0.3%
Special Waste	2.2	6.0%
Electronics	0.2	0.5%
Mixed Residue	0.9	2.5%
Total	**37**	**100%**

1. Source: CalRecycle (2013)
2. Definitions of material types are available at: http://www.calrecycle.ca.gov/wastechar/MatDefs.htm
3. Numbers rounded to the nearest hundred thousand.

B. Capacity

How many composting and anaerobic digestion facilities are currently operating in California and what is the total capacity of these facilities?

Currently, there are almost 140 composting and anaerobic digestion facilities operating in California. Additionally, there are another 160 chip and grind facilities processing organics. Organic materials comprise a wide range of material types: grass, leaves, branches, prunings, stumps, wood waste, agricultural wastes, food waste, and biosolids. A range of facility types are needed to process these diverse materials: chipping and grinding, composting, and anaerobic digestion facilities. In addition, data from 2011 indicates that there are 22 biomass plants that handle about 1.5 million tons per year of urban wood waste combined with forest wood waste to make bioenergy. More recent data shows that the number of biomass plants have increased to about 30. Roughly 10 million tons per year of organic materials are recycled into beneficial products such as compost, mulch, biofuels, and bioenergy. Additional organics processing capacity is needed to handle about 15 million tons that are still being landfilled annually which includes over 4 million tons of wood waste and nearly 5 million tons of food waste.

Chipping and Grinding **–** Chip/grind facilities primarily handle woody materials and do not complete a pathogen reduction process. There are about 160 chip/grind facilities processing 3.6 million tons of material per year. Markets for chip/grind material have been impacted by limited demand for chipped woody materials as a fuel for biomass facilities due to lack of incentives and inexpensive natural gas, competing interests of alternative daily cover at landfills, and concerns regarding land application of mulch products (e.g., pathogens, metals, salts, contaminants like glass or plastics, and invasive pests included in the mulch such as Asian Citrus Psylid or European Grapevine Moth). In fact, land application concerns may dictate that in the future this material should be handled at composting facilities to ensure pathogen and invasive pest destruction. There is some interest in high temperature drying of wood waste as well as gasification to produce electricity or fuel that if deployed commercially in California could increase market demand for woody wastes.

Composting – Compost facilities can handle diverse organic feedstocks, ranging from grass and leaves, branches and wood waste to biosolids, food waste, and digestate depending on the facility design and technology. Composting infrastructure expansion has remained stagnant over the past 10 years because of increased costs of air quality and water quality requirements, feedstock competition due to low landfill tipping fees and alternative daily cover use, and the need for increased demand and use of compost products. Due to these constraints, composting facilities are operating at roughly 70% of total statewide capacity leaving about 2.3 million tons/year of unutilized capacity. Currently, there are more than 130 composting facilities in California processing about 5.8 million tons of organic feedstock per year.

Anaerobic Digestion - There are currently six anaerobic digestion facilities in California handling organic materials from the waste stream with 0.14 million tons per year[2] of processing capacity. Because these facilities use in-vessel processing, they are particularly suited to handle food waste which has high intrinsic energy values and significant odor challenges. Anaerobic digestion technologies include co-digestion at WWTPs, dry fermentation, and high or low solids wet digesters. Currently, anaerobic digestion technologies at some WWTPs are receiving source separated, mostly liquid waste, and are not processing municipal solid waste and therefore not included in the capacity discussion. For the other technologies, it is anticipated that 11 new anaerobic digestion projects under development will add 0.4 million tons per year of digestion capacity. With nearly 5 million tons of food waste still being landfilled, additional incentives are needed in order to achieve widespread deployment of commercial scale anaerobic digestion facilities in California due to the economic disparity between the costs of landfilling versus anaerobic digestion. Additional anaerobic digestion of food waste will result in GHG emissions reductions in addition to production of renewable energy and new job creation.

C. GHG Emissions

What are the GHG emission benefits from diverting organic materials from landfills and sending it to compost or anaerobic digestion facilities?

Instead of landfilling, using organic material as feedstock for composting and anaerobic digestion can result in reductions of GHG emissions. The GHG emission reductions from these activities would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, and reduction in synthetic fertilizer and water usage.

[2] The Inland Empire-Environ anaerobic digestion project has 0.08 million tons per year processing capacity but is currently operating significantly below capacity.

Table 2 provides a rough estimate of the potential GHG emission reductions from diverting organic material from landfills to composting/digestion. In 2010, 37 million tons of wastes were disposed in California's landfills. Compostable/digestible materials, including food waste, account for roughly 30 percent (more than 10 million tons) of the disposed tonnage. If half of the compostable/digestible materials are diverted from landfills and are processed to usable beneficial products, the resulting GHG emissions benefits are estimated to be approximately 3.0 to 3.7 MMTCO2e. This emissions benefit includes reduced GHG emissions from avoided landfill emissions, decreased synthetic fertilizer usage, decreased water use, increased soil carbon storage, decreased soil erosion, and decreased herbicide use. When 75 percent of compostable/digestible materials are diverted from landfills in 2020 and beyond, which is needed in order to achieve the AB 341 75% recycling goal, the resulting GHG emissions benefits are estimated to be approximately 4.5 to 5.6 MMTCO2e per year. Most of the estimated GHG benefits would occur within California if the infrastructure and market challenges are resolved.

Table 2. Assessment of GHG Emission Benefits from Diverting Organics from Landfills

Process	**Organics Disposed in Landfills** (tons/year)	**Annual Tons Diverted** (50% of total disposed in years 2015 - 2020)	**Resulting GHG Emissions Benefits from 50% Diversion MMTCO2e per year** (2015 -2020)	**Annual Tons Diverted** (75% of total disposed in years 2020 and beyond)	**Resulting GHG Emissions Benefits from 75% Diversion MMTCO2e per year** (2020 and beyond)
Composting		2.5 million	1.65[1] – 2.38[2]	3.75 million	2.48[1] – 3.56[2]
Anaerobic Digestion		2.5 million	1.38[3]	3.75 million	2.06[3]
Total	10 million	5 million	3.03 - 3.76	7.5 million	4.54 – 5.62

[1] Estimated using Emission Reduction Factor (ERF) of 0.42 MTCO2e/ton material processed (ARB draft Mandatory Recycling Report) plus adjusted avoided landfill ERF of 0.24 MTCO2e/ton material processed (adjusted by ARB)

[2] Estimated using ERF of 0.42 MTCO2e/ton material processed (ARB draft Mandatory Recycling Report) plus avoided landfill ERF of 0.53 MTCO2e/ton material processed (CalRecycle)

[3] Estimated using ERF of 0.55 MTCO2e/ton material processed by HSAD (ARB LCFS report). As noted in the Implementation Plan, additional work is on-going to include the downstream process emission benefits in the AD ERF in addition to the avoided landfill methane emissions benefits of AD that are included here.

Additional research is needed to better quantify the benefits from avoided landfill emissions and anaerobic digestion. Staff is presenting a range of emission benefits as some of the emission reduction factors are still considered preliminary and are presented here only to provide the reader with understanding of full potential for GHG emission reduction benefits.

Who currently regulates composting and anaerobic digestion facilities?

Compost and anaerobic digestion facilities are required to obtain permits from local land use and fire agencies, the local air district, the regional water board, and CalRecycle. Local air district permits are in accordance with the Clean Air Act and increasingly will include requirements to reduce fugitive emissions of volatile organic compounds, especially in non-attainment areas. New regulations are requiring facilities to implement best management practices (BMPs) such as using a compost biofilter cap or different technologies such as

aerated static piles or in-vessel systems to meet Clean Air Act standards. Regional Water Board permits have generally required increasingly stricter standards for compost facilities since 2003 when a conditional waiver for "green waste-only" composting facilities was in effect. A change in the law required all waivers to either be renewed or replaced with Waste Discharge Requirements. For CalRecycle, compost and anaerobic digestion facilities are typically regulated Compostable Materials Handling Operations and Facilities Regulatory Requirements, Title14, CCR 17850 et seq. These regulations take into consideration the type of feedstock, activity, location of the activity, and the volume of materials involved. The California Department of Food and Agriculture (CDFA) requires facility licensing and product registration and labeling of bulk compost intended for organic production, or for any compost sales where nutrient claims are made. Livestock and poultry carcasses from farms and parts or products of animals disposed of by United States Department of Agriculture and CDFA inspected slaughter and processing establishments, retail stores, and custom processors are required to go to CDFA licensed rendering plants, pet food processors or collection centers.

IV. GOALS FOR INCREASING COMPOSTING AND ANAEROBIC DIGESTION AND ACHIEVING GHG BENEFITS

The use of composting and anaerobic digestion processes can play a significant role in achieving California's goals for reducing GHG emissions and reducing the volume of material deposited in landfills. The GHG emission reductions from these activities would occur due to avoided landfill emissions, displacement of fossil fuel with biogas, reduction in synthetic fertilizer and herbicide usage, decreases in soil erosion, and less water usage.

Discussed below are some of the existing state programs, regulation, and goals for reducing GHG emissions through composting and anaerobic digestion processes.

Are there established goals that must be met for the waste sector?

AB 32 and Executive Order S-3-05, established goals of reducing GHG emissions to 1990 levels by 2020 - a reduction of approximately 30 percent (20% AB 32 and 10% S-3-05), and then an 80 percent reduction below 1990 levels by 2050. These near and long-term goals will guide the process in evaluating the waste sector, pointing to a sustainable, low-carbon and near-zero-waste future.

With the adoption of AB 341 (Chesbro, Chapter 476, Statutes of 2011), a clear mandate was established to achieve a statewide recycling goal of 75% by 2020. Preliminary estimates are that about 22 million tons per year of material will need to be removed from the landfill waste stream and used in non-disposal alternatives by 2020. Achieving AB 341's 75% recycling mandate will result in an estimated 20 to 30 MMTCO2e reduction in 2020 compared to business as usual. Meeting these combined GHG and recycling goals will require greater utilization of existing alternative pathways for waste processing and development of new alternative pathways. A significant portion of the solid waste is compostable/digestible organics. Diverting organic waste from landfilling and using it as feedstock in composting and anaerobic digestion processes will achieve GHG reductions and will be critical in achieving our waste reduction goals.

Are there other regulations, policies, or programs that provide incentives for composting and anaerobic digestion?

Additional programs that provide incentives to advance composting and anaerobic digestion are shown in Table 3 below.

Table 3: Additional Programs that Provide Incentives for Composting and Anaerobic Digestion

Regulatory Programs	Description
Landfill Methane Control Measure	This measure reduces emissions of methane, a GHG, from MSW landfills by requiring installation of control equipment and good operating practices.
Cap-and-Trade Program	The Cap-and-Trade program is established under AB 32 to reduce GHG emissions. The program will cover major sources of GHG emissions in the State such as refineries, power plants, and other large industrial facilities. The Cap-and-Trade program includes an enforceable GHG cap that will decline over time. ARB will distribute allowances equal to the emission allowed under the cap. It is estimated that about 23 manufacturing facilities that use recyclable material as feedstock are currently under the Cap-and-Trade program.
Low Carbon Fuel Standard (LCFS)	The LCFS requires fuel producers to ensure that fuels sold in California would meet a declining standard for GHG emissions. This regulation is likely to incentivize and provide a market for biogas.
Renewable Portfolio Standards (RPS)	RPS applies to all electricity retailers in the state including publicly owned utilities (POUs), investor-owned utilities, electricity service providers, and community choice aggregators. All of these entities must adopt the new RPS goals of 20 percent of retail sales from renewables by the end of 2013, 25 percent by the end of 2016, and the 33 percent requirement being met by the end of 2020. This regulation is likely to incentivize and provide a market for biogas.
AB 1900 (Gatto, 2012) and AB 2196 (Chesbro, 2012)	AB 1900 requires the Office of Environmental Health Hazard Assessment (OEHHA) to determine the health protective levels for all constituents of concern that appear in biogas at concentrations significantly higher than in natural gas that could pose risks to human health. The California Air Resources Board (ARB) then must determine the allowable concentrations of those constituents. Under AB 1900, the California Public Utilities

	Commission (CPUC) must also establish safety standards, monitoring and reporting requirements, and open pipeline access rules for the use of biomethane. Further, it must adopt policies that promote in-state production and distribution of biomethane. Additionally, the State Energy Resources Conservation and Development Commission (a.k.a. California Energy Commission or CEC) must hold public hearings to identify impediments to the procurement of biomethane in the State, and offer solutions to those impediments in its biennial Integrated Energy Policy Report. Among other things, AB 2196 amends the definition of a renewable electrical generation facility under the California Energy Commission's Renewable Energy Resources Program.
Funding Programs	**Description**
AB 118 (Núñez, Statutes of 2007, Chapter 750)	Directs the California Energy Commission (CEC) to develop the Alternative and Renewable Fuel and Vehicle Technology Program. Implementation of this program can provide funding in furthering the use of anaerobic digestion in producing renewable energy.
Recycling Market Development Zones (RMDZ) loans	The intent of the RMDZ loan program is to help California manufacturers increase their processing capabilities and create additional markets for recycled-content products. Eligible applicants are businesses with manufacturing and processing facilities in California that produce recycled-content materials and products.
California Pollution Control Financing Authority (CPCFA)	CPCFA's Tax-Exempt Bond financing Program gives California businesses help with acquisition and installation of new equipment.
Tax Credits	Federal and State tax credits may be available for green equipment purchases

Other programs that provide financial and other assistance include the Go-Biz program, Small Business Development Centers (SBDC), Service Corp of Retired Executives (SCORE) and Employment Training Panel (ETP) assistance.

V. CHALLENGES TO MEETING GOALS

Currently, about 30 percent of the solid waste going into landfill is comprised of materials, such as food and green waste, which are suitable for composting and anaerobic digestion.

Successfully capturing a significant portion of this material for composting and anaerobic digestion is essential to ensure the success of meeting California's waste diversion and GHG reduction goals. This section discusses the current and future challenges facing increases in composting and anaerobic digestion. The challenges discussed below are further divided into short-term and long-term actions.

A. Short-Term

The first step in meeting the challenges involves identifying and prioritizing immediate actions that could be taken to meet the 2020 GHG and waste diversion goals for the waste sector. Some of the challenges to increasing the use of composting and anaerobic digestion technologies are addressed below.

GHG Emissions Reduction Quantification

- To better understand the role composting and anaerobic digestion can play in meeting our GHG and waste reduction goals, the direct and avoided emissions from the use of these technologies need to be analyzed and quantified.

Permitting of New and Expansion of Existing Composting and Anaerobic Facilities

- Cross media and multi-jurisdictional challenges including: multiple permits and regulatory compliance requirements, the length of time for approval processes, CEQA issues, federal law issues, and local/regional planning and acceptance, including environmental justice concerns.
- Lack of consensus that for California to meet its GHG and waste reduction goals there needs to be greater acceptance of ownership for the waste generated within California.

Financial Risk

- The relatively low cost of landfilling and the lack of financial incentives for non-landfilling alternatives may hinder increases in composting and anaerobic digestion.

Market Development

- Markets for compost and digested commodities are not adequate to accommodate what is needed to reach the waste reduction goals.
- Insufficient organics pre-processing close to feedstock sources to remove contaminants.

Regulatory Development

- Determine the need to develop additional regulations to achieve GHG and waste reduction goals.

Public Acceptance

- There are difficulties in siting compost or anaerobic digestion facilities in proximity to urban areas where most of the compostable organics are generated. There is currently low public acceptance of these facilities in these neighborhoods.
- Contamination in green and food materials, in particular post-consumer materials, increases operating costs for processors and can adversely affect the salability of compost and digestate made from these materials.

B. Long-Term

Some of the long-term challenges, those beyond 2020, include: developing the needed infrastructure, increasing the markets for composted or digested commodities, improving the quality of composted or digested commodities, and addressing research needs

Infrastructure Improvements

- Increases in production or use of compost and end products of the anaerobic digestion technologies will require continuous infrastructure development.

Market Development

- Glass and plastic contaminants are difficult to remove from feedstocks and finished products.
- Benefits of composted products are often undervalued as an agricultural input.

Future Research

- Identify and fund future research needs to achieve the stated goals.

VI. POTENTIAL SOLUTIONS FOR MEETING GOALS

Discussed below are some potential solutions to the challenges described above in our effort to achieve waste diversion and GHG reduction goals. As with the discussion of "Challenges," the potential solutions are organized by short-term and long-term categories. There may be additional solutions to the challenges beyond those mentioned below.

A. Short-Term

The key to determining the most efficient and effective solutions for reducing GHG emissions and achieving the waste management goals are by continuing to evaluate possible strategies and prioritizing immediate and future actions. To this effect, staff has identified some potential solutions to overcome some of the short-term challenges stated above. Some of the short-term solutions include:

GHG Emissions Reduction Quantification

- Revise the compost emission reduction factor to include avoided landfill emissions.
- Develop new emission reduction factors for the anaerobic and aerobic digestion processes which include the GHG benefits of any renewable energy or liquid fuels produced.
- Complete research on GHGs from compost production and use.

Permitting of New and Expansion of Existing Composting and Anaerobic Facilities

- Continue to work with other agencies, districts, and jurisdictions to identify and address redundant or conflicting permitting and regulatory requirements for composting and anaerobic digestion facilities/operators.
- Prepare a programmatic EIR and/or model permits for compost facilities that provide enhanced air and water quality protection and odor control.
- Support the co-location of organics processing at existing POTWs and landfills, including integrated facilities that combine composting, AD, low-carbon electricity and fuel production, or other related processes.

Financial Risk

- Develop incentive payment and/or grant programs for compost and anaerobic digestion organics infrastructure that processes organic materials while providing environmental protection and GHG reduction.
- Identify opportunities and develop the framework for composting and anaerobic digestion activities to be a source of GHG offsets. Offsets could provide funding to build and expand infrastructure, reduce the cost differential between these activities and landfilling, or provide emission offsets for new facilities.
- Investigate the feasibility of criteria pollutant offset banks for new composting facilities, and the generation of offsets by upgrading existing facilities to reduce emissions.
- Continue to provide regulatory certainty that fuel produced from anaerobic digestion of organic waste can qualify for Low Carbon Fuel Credits.
- Provide funding for facility improvement to meet air, water, and environmental justice goals.
- Establish feed-in-tariffs for electricity production to make in-state renewable energy production more competitive with low-cost natural gas.
- Increase AB 118 funding to make more funding available for anaerobic digestion projects.
- Continue pursuing pathways for Low Carbon Fuel Credits for anaerobic digestion.
- Expand sustainable financing for the RMDZ program and for compost and digestion facilities throughout the State of California.
- Take advantage of technical support through GoBIZ.

Market Development

- Provide incentives to move materials out of landfills.
- Disallow the use of green waste Alternative Daily Cover (ADC) to count as recycling.
- Increase compost and anaerobic digestion products purchasing by Federal, State and local government agencies.
- Increase agricultural, rangeland and landscaping markets for composting and anaerobic digestion products. This may be accomplished via financial incentives and promoting the highest standards for product safety and quality.
- Support third-party product-quality standards for composted and digested products.
- Work with stakeholders to promote the sorting of urban organics, particularly food, at transfer stations, MRFs and other locations, in order to provide clean feedstocks for composting and digestion.
- Support development of advanced processes and/or equipment that enables cost-effective removal of contaminants from the organics waste stream, particularly glass and plastic.

Regulatory Development

- Complete updates to CalRecycle regulations for composting and anaerobic digestion of food materials and other highly putrescible wastes.
- Consider ARB regulations requiring phasing organics out of landfills and into composting and anaerobic digestion alternatives.
  Consider mandatory organic waste recycling for large commercial generators.

Public Acceptance

- Outreach and education to the public on the benefits of using products derived from organic residuals, and to encourage the public to correctly sort organics materials.

- Promote next-generation composting facilities that minimize odors and emissions and can be sited closer to urban centers.

B. Long-Term

Staff has identified some potential solutions to overcome some of the long-term challenges stated above. Some of the long-term solutions include:

Infrastructure Improvements

- Develop a sustainable waste management system that can adequately handle the increase in municipal solid waste that needs to be shifted from landfill to compost and anaerobic digestion processes to meet GHG and waste reduction goals.
- Foster State, local, and private cooperation in achieving the Waste Sector goals.
- Encourage new technologies that handle food waste and make value-added products such as fuels or fertilizers.

Market Development

- Continue to support incentives, education, and product quality standards for compost and anaerobic digestion products that will increase demand from agricultural markets.

Future Research

- Improve the characterization of the direct and avoided GHG emission from composting and anaerobic digestion of organic waste.
- Characterize the properties of the digestate from anaerobic systems and determine its suitability for various uses.
- Continue to support research and development projects demonstrating the newest best management practices for composting and anaerobic digestion processes.
- Investigate carbon sequestration and water savings potential of compost use in agricultural settings such as irrigated croplands and rangelands.