Connecticut Resources Recovery Authority

Transition Plan

Exhibits

A. CT Public Act No. 13-285: An Act Concerning Recycling And Jobs
B. CT Solid Waste Management Plan Executive Summary
C. 5-Year and 10-Year Authority Operating Forecast
D. Solid Waste Disposal Market Assessment
E. Out-of-State Disposal Market Assessment
F. State of CT MSW Supply Assessment
G. Ensuring Capacity for Connecticut's Municipal Solid Waste and Recyclables in Changing Market Conditions
H. New and Emerging Technology Assessment
I. Cost Estimate for Dismantling the South Meadows Facility
J. Valuation Analysis of CRRA's Jet Turbine Facility
K. Statutory Analysis of Dissolution and Sale of CRRA
L. CRRA Landfill Property, Infrastructure, and Operational Information
M. Summary of Public Comments
N. La Capra Associates Summary Letter and Qualifications

November 30, 2013

Exhibit A

CT Public Act No. 13-285: An Act Concerning Recycling And Jobs

November 30, 2013

Substitute Senate Bill No. 1081

Public Act No. 13-285

AN ACT CONCERNING RECYCLING AND JOBS.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

Section 1. Section 22a-207a of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2013):

(a) As used in sections 22a-208d, 22a-208q and subsection (b) of section 22a-228: (1) "Composting" means a process of accelerated biological decomposition of organic material under controlled conditions; (2) "mixed municipal solid waste" means municipal solid waste that consists of mixtures of solid wastes which have not been separated at the source of generation or processed into discrete, homogeneous waste streams such as glass, paper, plastic, aluminum or tire waste streams provided such wastes shall not include any material required to be recycled pursuant to section 22a-241b; [,] and (3) "mixed municipal solid waste composting facility" means a volume reduction plant where mixed municipal solid waste is processed using composting technology.

(b) As used in this chapter, "end user" means any person who uses a material for such material's original use or any manufacturer who uses a material as feedstock to make a marketable product.

Sec. 2. Section 22a-208f of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2013):

Notwithstanding the provisions of section 22a-208a, a scrap metal processor, as described in section 14-67w, shall not be required to obtain a permit under [said] section 22a-208a if on or before [July 1, 1990] July 31, 2014, and annually [on March thirty-first thereafter, he] thereafter, such scrap metal processor submits to the Commissioner of Energy and Environmental Protection, on a form prescribed by the commissioner, the amount of scrap metals generated within the borders of the state and purchased or received [from any municipality, municipal or regional authority, the state or any political subdivision of the state listed by town of origin. He shall also send to each Connecticut municipality included in such listing a copy of such information pertaining to the municipality] by such processor for the prior state fiscal year, including a good faith estimate of the amount received directly from instate construction or

demolition sites. Such report shall identify the monthly amounts of scrap metal generated within the state, other recyclable materials generated within the state and recycling residue generated, each of which was sent out by such processor, and indicate the destination facility type for such materials, including an indication of whether such facility is in this state.

Sec. 3. Subsection (g) of section 22a-220a of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2013):

(g) As used in this section, "collector" means any person who holds himself out for hire regularly to collect solid waste [on a regular basis] from residential, business, commercial or other establishments. "Collector" does not include: (1) Any person who transports solid waste that is incidentally generated during professional or commercial activities unrelated to the collection of solid waste, such as residential property repairs, provided such solid waste is self-generated by such person's professional or commercial activities and such solid waste is transported to an authorized recycling facility, a permitted recycling facility, or a permitted solid waste facility, and (2) any person who transports used materials for the purpose of delivering such materials to a charitable organization that distributes reused household items or to a retail facility that sells reused household items.

Sec. 4. Subsection (a) of section 22a-226e of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2013):

(a) [Not later than six months after the establishment of service in the state by two or more permitted source-separated organic material composting facilities, as defined in section 22a-207, that have a combined capacity to service the needs of commercial food wholesalers or distributors, industrial food manufacturers or processors, supermarkets, resorts or conference centers that each generate an average projected volume of not less than one hundred four tons per year of source-separated organic materials] (1) On and after January 1, 2014, each commercial food wholesaler or distributor, industrial food manufacturer or processor, supermarket, resort or conference center that is located not more than twenty miles from an authorized source-separated organic material composting facility and that generates an average projected volume of not less than one hundred four tons per year of source-separated organic materials shall: [(1)] (A) Separate such source-separated organic materials from other solid waste; and [(2)] (B) ensure that such source-separated organic materials are recycled at [a permitted source-separated organic material composting facility that is not more than twenty miles from such wholesaler, distributor, manufacturer, processor, supermarket, resort or conference center, as applicable] any authorized source-separated organic material composting facility that has available capacity and that will accept such source-separated organic material.

(2) On and after January 1, 2020, each commercial food wholesaler or distributor, industrial food manufacturer or processor, supermarket, resort or conference center that is located not more than twenty miles from an authorized source-separated organic material composting facility and that generates an average projected volume of not less than fifty-two tons per year of source-separated organic materials shall: (A) Separate such source-separated organic materials from other solid waste; and (B) ensure that such source-separated organic materials are recycled at any authorized source-separated organic material composting facility that has

available capacity and that will accept such source-separated organic material.

Sec. 5. (NEW) (Effective October 1, 2013) The Commissioner of Energy and Environmental Protection, in consultation with other state agencies or quasi-public agencies, shall identify opportunities for the establishment of a new, or the expansion of any existing, recycling infrastructure investment program.

Sec. 6. (NEW) (Effective October 1, 2013, and applicable to assessment years commencing on or after said date) (a) For the purposes of this section:

(1) "Municipality" has the same meaning as provided in section 12-129r of the general statutes.

(2) "Recycling" has the same meaning as provided in section 22a-207 of the general statutes.

(b) Any municipality may, by ordinance adopted by its legislative body, provide an exemption from property tax for any machinery or equipment used in connection with recycling that is installed on or after October 1, 2013. Any such exemption shall apply only to: (1) The increased value of the commercial or industrial property that is attributable to such machinery or equipment, and (2) the first fifteen assessment years following installation of such machinery or equipment.

Sec. 7. (NEW) (Effective from passage) (a) Not later than June 30, 2013, the Department of Energy and Environmental Protection, in consultation with the Office of Policy and Management, shall initiate one or more audits of the Connecticut Resources Recovery Authority. The Connecticut Resources Recovery Authority shall cooperate fully with any such audit and shall pay the cost of any such audit provided such payment shall not exceed a cumulative total of five hundred thousand dollars. Any such audit may include, but need not be limited to, a review or analysis of: (1) The results of any such audits, review of any investigation of said authority or by said authority that occurred prior to the effective date of this section, (2) the financial condition of said authority, (3) said authority's short and long-term liabilities, including, but not limited to, such liabilities to bond holders, employees, former employees and such liabilities from lawsuits, leases, contractual obligations and any other matter, (4) said authority's existing and projected revenues, (5) said authority's cash flow projections for each of the next three calendar years, (6) said authority's operations, including, but not limited to, human resources, facilities use, information technology services, and identification of potential operating efficiencies, (7) said authority's internal controls, financial management and risk management practices, and (8) any transaction of said authority.

(b) On or before October 30, 2013, the Department of Energy and Environmental Protection, in conjunction with the Office of Policy and Management, shall provide a summary of the findings of such audits to the Governor and the joint standing committees of the General Assembly having cognizance of matters relating to the environment, appropriations and government administration.

Sec. 8. (Effective from passage) (a) There is established a Resources Recovery Task Force to study the operations, financial stability and business models for resource recovery facilities operating in the state.

(b) The task force shall consist of the following members:

(1) One appointed by the speaker of the House of Representatives, who shall be a municipal official or a representative of an organization that represents municipalities;

(2) One appointed by the president pro tempore of the Senate, who shall be a municipal official or a representative of an organization that represents municipalities;

(3) One appointed by the minority leader of the House of Representatives, who shall be a municipal official or a representative of an organization that represents municipalities;

(4) One appointed by the minority leader of the Senate, who shall be a municipal official or a representative of an organization that represents municipalities;

(5) One appointed by the majority leader of the House of Representatives, who shall be a representative of the solid waste hauling industry;

(6) One appointed by the majority leader of the Senate, who shall have experience in energy procurement;

(7) Four appointed by the Governor, each of whom shall represent resource recovery facilities in this state or have experience in energy procurement;

(8) The Commissioner of Energy and Environmental Protection, or the commissioner's designee;

(9) The Secretary of the Office of Policy and Management, or the secretary's designee; and

(10) The Commissioner of Administrative Services, or the commissioner's designee.

(c) All appointments to the task force shall be made not later than thirty days after the effective date of this section. Any vacancy shall be filled by the appointing authority.

(d) The Commissioner of Energy and Environmental Protection, or the commissioner's designee, shall serve as the chairperson of the task force. Such chairperson shall schedule the first meeting of the task force, which shall be held not later than sixty days after the effective date of this section.

(e) The administrative staff of the Department of Energy and Environmental Protection shall serve as administrative staff of the task force.

(f) Not later than December 15, 2013, the task force shall submit a report on its findings and recommendations to the joint standing committee of the General Assembly having cognizance of matters relating to energy, in accordance with the provisions of section 11-4a of the general statutes. Such report shall include:

(1) A review of the applicable statutes and regulations regarding renewable energy certificate credits provided to resource recovery facilities in the state and a recommendation on whether

such statutes should be modified. For any such recommendation, the task force shall specify the expected economic impact that such recommendation will have on resource recovery facilities, municipalities and energy consumers in the state;

(2) An analysis of the financial status of the resource recovery facilities operating in the state and recommendations to improve such status, including, but not limited to, whether bilateral purchasing agreements between resource recovery facility-based businesses and the state or municipalities would provide a mechanism for improving the long-term financial stability of such facilities;

(3) Recommendations for any changes to the statutes and regulations concerning bilateral purchase agreements and a description of the effect that such recommendations would have on the anticipated structure of such agreements and the financial impacts such agreements would have on resource recovery facilities, municipalities, and energy consumers in the state;

(4) A recommendation on whether resource recovery facilities in this state should be defined as an "electric municipal utility" for the purpose of the municipalities such facilities serve; and

(5) Any other recommendations the task force deems appropriate concerning the future of resource recovery facilities in the state and the long-term financial status of such facilities.

(g) The task force shall terminate on the date it submits such report or December 15, 2013, whichever is later.

Sec. 9. (NEW) (Effective from passage) The Connecticut Resources Recovery Authority shall develop a transition plan for: (1) Achieving a sustainable business model that improves the long-term financial stability of said authority, or (2) conducting the dissolution of said authority and the disposing of said authority's assets. Such plan shall be transmitted to the Governor and the joint standing committees of the General Assembly having cognizance of matters relating to energy and the environment on or before November 30, 2013. Such plan shall be developed in consultation with the Resources Recovery Task Force established in section 2 of this act. In developing such plan, the authority shall detail and give consideration to, but not be limited to, an assessment of:

(A) The benefits and consequences of: (i) The closure or sale of the Mid-Connecticut Resource Recovery Facility, (ii) the transition of such facility to an alternative use such as a solid waste management facility, and (iii) the sale of other authority assets;

(B) The reductions in authority expenses, including, but not limited to, management fees, labor costs, contract obligations and legal fees;

(C) Said authority's financial and legal liabilities and an evaluation of whether such liabilities may be eliminated or mitigated;

(D) The operational requirements of said authority's regional transfer stations, landfills and any other functional role of said authority;

(E) Said authority's state-wide role in the areas of bonding, education and development and

how such transition plan affects that role; and

(F) The post-closure responsibilities and liabilities of said authority for landfills under said authority's care and control.

Sec. 10. Section 22a-261 of the general statutes is repealed and the following is substituted in lieu thereof (Effective from passage):

(a) There is hereby established and created a body politic and corporate, constituting a public instrumentality and political subdivision of the state of Connecticut established and created for the performance of an essential public and governmental function, to be known as the Connecticut Resources Recovery Authority. The authority shall not be construed to be a department, institution or agency of the state.

(b) On and before May 31, 2002, the powers of the authority shall be vested in and exercised by a board of directors, which shall consist of twelve directors: Four appointed by the Governor and two ex-officio members, who shall have a vote including the Commissioner of Transportation and the Commissioner of Economic and Community Development; two appointed by the president pro tempore of the Senate, two by the speaker of the House, one by the minority leader of the Senate and one by the minority leader of the House of Representatives. Any such legislative appointee may be a member of the General Assembly. The directors appointed by the Governor under this subsection shall serve for terms of four years each, from January first next succeeding their appointment, provided, of the directors first appointed, two shall serve for terms of two years, and two for terms of four years, from January first next succeeding their appointment. Any vacancy occurring under this subsection other than by expiration of term shall be filled in the same manner as the original appointment for the balance of the unexpired term. Of the four members appointed by the Governor under this subsection, two shall be first selectmen, mayors or managers of Connecticut municipalities; one from a municipality with a population of less than fifty thousand, one from a municipality of over fifty thousand population; two shall be public members without official governmental office or status with extensive high-level experience in municipal or corporate finance or business or industry, provided not more than two of such appointees shall be members of the same political party. The chairman of the board under this subsection shall be appointed by the Governor, with the advice and consent of both houses of the General Assembly and shall serve at the pleasure of the Governor. Notwithstanding the provisions of this subsection, the terms of all members of the board of directors who are serving on May 31, 2002, shall expire on said date.

(c) On and after June 1, 2002, the powers of the authority shall be vested in and exercised by a board of directors, which shall consist of eleven directors as follows: Three appointed by the Governor, one of whom shall be a municipal official of a municipality having a population of fifty thousand or less and one of whom shall have extensive, high-level experience in the energy field; two appointed by the president pro tempore of the Senate, one of whom shall be a municipal official of a municipality having a population of more than fifty thousand and one of whom shall have extensive high-level experience in public or corporate finance or business or industry; two appointed by the speaker of the House of Representatives, one of whom shall

be a municipal official of a municipality having a population of more than fifty thousand and one of whom shall have extensive high-level experience in public or corporate finance or business or industry; two appointed by the minority leader of the Senate, one of whom shall be a municipal official of a municipality having a population of fifty thousand or less and one of whom shall have extensive high-level experience in public or corporate finance or business or industry; two appointed by the minority leader of the House of Representatives, one of whom shall be a municipal official of a municipality having a population of fifty thousand or less and one of whom shall have extensive, high-level experience in the environmental field. No director may be a member of the General Assembly. Not more than two of the directors appointed by the Governor shall be members of the same political party. The appointed directors shall serve for terms of four years each, provided, of the directors first appointed for terms beginning on June 1, 2002, (1) two of the directors appointed by the Governor, one of the directors appointed by the president pro tempore of the Senate, one of the directors appointed by the speaker of the House of Representatives, one of the directors appointed by the minority leader of the Senate and one of the directors appointed by the minority leader of the House of Representatives shall serve an initial term of two years and one month, and (2) the other appointed directors shall serve an initial term of four years and one month. The appointment of each director for a term beginning on or after June 1, 2004, shall be made with the advice and consent of both houses of the General Assembly. The Governor shall designate one of the directors to serve as chairperson of the board, with the advice and consent of both houses of the General Assembly. The chairperson of the board shall serve at the pleasure of the Governor. Any appointed director who fails to attend three consecutive meetings of the board or who fails to attend fifty per cent of all meetings of the board held during any calendar year shall be deemed to have resigned from the board. Any vacancy occurring other than by expiration of term shall be filled in the same manner as the original appointment for the balance of the unexpired term. As used in this subsection, "municipal official" means the first selectman, mayor, city or town manager or chief financial officer of a municipality that has entered into a solid waste disposal services contract with the authority and pledged the municipality's full faith and credit for the payment of obligations under such contract.

(d) The chairperson shall, with the approval of the directors, appoint a president of the authority who shall be an employee of the authority and paid a salary prescribed by the directors. The president shall supervise the administrative affairs and technical activities of the authority in accordance with the directives of the board.

(e) Each director shall be entitled to reimbursement for said director's actual and necessary expenses incurred during the performance of said director's official duties.

(f) Directors may engage in private employment, or in a profession or business, subject to any applicable laws, rules and regulations of the state or federal government regarding official ethics or conflict of interest.

(g) Six directors of the authority shall constitute a quorum for the transaction of any business or the exercise of any power of the authority, provided, two directors from municipal government shall be present in order for a quorum to be in attendance. For the transaction of any business or the exercise of any power of the authority, and except as otherwise provided in this chapter,

the authority shall have power to act by a majority of the directors present at any meeting at which a quorum is in attendance. If the legislative body of a municipality that is the site of a facility passes a resolution requesting the Governor to appoint a resident of such municipality to be an ad hoc member, the Governor shall make such appointment upon the next vacancy for the ad hoc members representing such facility. The Governor shall appoint with the advice and consent of the General Assembly ad hoc members to represent each facility operated by the authority provided at least one-half of such members shall be chief elected officials of municipalities, or their designees. Each such facility shall be represented by two such members. The ad hoc members shall be electors from a municipality or municipalities in the area to be served by the facility and shall vote only on matters concerning such facility. The terms of the ad hoc members shall be four years.

[(h) There is established, effective June 1, 2002, a steering committee of the board of directors, consisting of at least three but not more than five directors, who shall be jointly appointed by the Governor, the president pro tempore of the Senate and the speaker of the House of Representatives. Said committee shall consist of at least one director who is a municipal official, as defined in subsection (c) of this section. The steering committee shall forthwith establish a financial restructuring plan for the authority, subject to the approval of the board of directors, and shall implement said plan. The financial restructuring plan shall determine the financial condition of the authority and provide for mitigation of the impact of the Connecticut Resources Recovery Authority-Enron-Connecticut Light and Power Company transaction on municipalities which have entered into solid waste disposal services contracts with the authority. The steering committee shall also review all aspects of the authority's finances and administration, including but not limited to, tipping fees and adjustments to such fees, the annual budget of the authority, any budget transfers, any use of the authority's reserves, all contracts entered into by or on behalf of the authority, including but not limited to, an assessment of the alignment of interests between the authority and the authority's contractors, all financings or restructuring of debts, any sale or other disposition or valuation of assets of the authority, including sales of electricity and steam, any joint ventures and strategic partnerships, and the initiation and resolution of litigation, arbitration and other disputes. The steering committee (1) shall have access to all information, files and records maintained by the authority, (2) may retain consultants and utilize other resources necessary to carry out its responsibilities under this subsection, which have a total cost of not more than five hundred thousand dollars, without the approval of the board of directors, and may draw on accounts of the authority for such costs, and (3) shall submit a report to the board of directors and the General Assembly, in accordance with section 11-4a, on its findings, progress and recommendations for future action by the board of directors in carrying out the purposes of this subsection, not later than December 31, 2002. Said report shall also include a report on any loans made to the authority under section 22a-268d. The steering committee shall terminate on December 31, 2002, unless extended by the board.]

[(i)] (h) The board may delegate to three or more directors such board powers and duties as it may deem necessary and proper in conformity with the provisions of this chapter and its bylaws. At least one of such directors shall be a municipal official, as defined in subsection (c) of this section, and at least one of such directors shall not be a state employee.

[(j)] (i) Appointed directors may not designate a representative to perform in their absence their respective duties under this chapter.

[(k)] (j) The term "director", as used in this section, shall include such persons so designated as provided in this section and this designation shall be deemed temporary only and shall not affect any applicable civil service or retirement rights of any person so designated.

[(l)] (k) The appointing authority for any director may remove such director for inefficiency, neglect of duty or misconduct in office after giving the director a copy of the charges against the director and an opportunity to be heard, in person or by counsel, in the director's defense, upon not less than ten days' notice. If any director shall be so removed, the appointing authority for such director shall file in the office of the Secretary of the State a complete statement of charges made against such director and the appointing authority's findings on such statement of charges, together with a complete record of the proceedings.

[(m)] (l) The authority shall continue as long as it has bonds or other obligations outstanding and until its existence is terminated by law. Upon the termination of the existence of the authority, all its rights and properties shall pass to and be vested in the state of Connecticut.

[(n)] (m) The directors, members and officers of the authority and any person executing the bonds or notes of the authority shall not be liable personally on such bonds or notes or be subject to any personal liability or accountability by reason of the issuance thereof, nor shall any director, member or officer of the authority be personally liable for damage or injury, not wanton or wilful, caused in the performance of such person's duties and within the scope of such person's employment or appointment as such director, member or officer.

[(o)] (n) Notwithstanding the provisions of any other law to the contrary, it shall not constitute a conflict of interest for a trustee, director, partner or officer of any person, firm or corporation, or any individual having a financial interest in a person, firm or corporation, to serve as a director of the authority, provided such trustee, director, partner, officer or individual shall abstain from deliberation, action or vote by the authority in specific respect to such person, firm or corporation.

Sec. 11. Subsection (a) of section 22a-221 of the general statutes is repealed and the following is substituted in lieu thereof (Effective from passage):

(a) The state, any municipality or any municipal or regional authority may make contracts for the exercise of its corporate or municipal powers with respect to the collection, transportation, separation, volume reduction, processing, storage and disposal of its solid wastes for a period not exceeding thirty years and may pledge its full faith and credit for the payment of obligations under such contracts. Said thirty-year limitation shall not apply to the extension of any such contract that was in force as of December 31, 2008, and that was approved by the commissioner pursuant to subsection (a) of section 22a-213.

Sec. 12. Sections 22a-268c to 22a-268f, inclusive, of the general statutes are repealed. (Effective from passage)

Approved July 12, 2013

Exhibit B

CT Solid Waste Management Plan Executive Summary

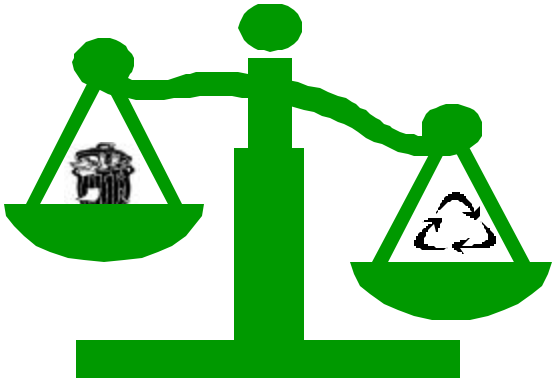
November 30, 2013

STATE OF CONNECTICUT

State Solid Waste Management Plan
Amended December 2006

Executive Summary & Table of Recommended Strategies

Gina McCarthy, Commissioner



Changing the Balance

State of Connecticut
Department of Environmental Protection
79 Elm Street
Hartford, Connecticut 06106-5127
www.ct.gov/dep

Pursuant to Connecticut General Statutes Section 22a-228 and Section 22a-228-1(b) of the Regulations of Connecticut State Agencies (RCSA), the State Solid Waste Management Plan has been amended. Pursuant to RCSA Section 22a-228-1(b)(8), notice of this amendment was provided on December 20, 2006. The effective date of the Amended State Solid Waste Management Plan shall be December 20, 2006.

Gina McCarthy
Commissioner
Connecticut Department of Environmental Protection

Dated: December 20, 2006

CT DEP ADA Publication Statement

The DEP is an affirmative action/equal opportunity employer. In conformance with the ADA, individuals with disabilities who need information in an alternative format, to allow them to benefit and/or participate in the agency's programs and services, should call TDD(860) 424-3000 and make their request to the receptionist. Requests for accommodations to attend meetings and/or educational programs, sponsored by the DEP, must be made at least two weeks prior to the program date.

These requests may be made directly to Marcia Z. Bonitto, ADA Coordinator, via e-mail: Marcia.Bonitto@po.state.ct.us

Executive Summary and Table of Recommended Strategies
Excerpted from
STATE OF CONNECTICUT SOLID WASTE MANAGEMENT PLAN,
AMENDED DECEMBER 2006

This document contains excerpts from the State of Connecticut State Solid Waste Management Plan, Amended December 2006. Included are the **Executive Summary** and the **Table of Recommended Strategies** which lists the objectives and corresponding strategies and outlines for each: the type of action needed; the assigned priority; anticipated new costs; the initiation timeframe; and the lead and/or key partners for implementation.

The entire Plan can be accessed on the CT DEP website at: www.ct.gov/dep The Plan consists of five chapters and eleven appendices. The Plan's contents includes the following:

- **Chapter 1** is the introduction which provides the purpose of the Plan, statutory and regulatory authorities for the Plan, the adoption process, solid waste management plan consistency requirements, the solid waste planning framework, and identifies variables potentially impacting solid waste management in Connecticut.
- **Chapter 2** summarizes Connecticut's current conditions and practices, provides solid waste projections, identifies key factors affecting solid waste management in Connecticut, and identifies key issues that will determine the State's future directions.
- **Chapter 3** presents Connecticut's long range vision to treat solid waste as a valuable resource, including principles and goals that will be used as a guide to the State's efforts in managing solid waste.
- **Chapter 4** presents an outline for action, including specific objectives and strategies for eight critical areas.
- **Chapter 5** outlines implementation approaches to the Plan and begins with a discussion on roles and responsibilities by both the public and private sectors and ends with a comprehensive listing of recommended strategies.

The appendices to this Plan were prepared to provide detailed background information that was considered during the development of the Plan.

The Plan includes eight objectives, with a total of seventy-five strategies. Listed below are the objectives, each with a descriptive narrative.

- **Source Reduction –** Catalyze shifts in consumer, business, product manufacturing, and solid waste processing practices that reduce the amount and toxicity of waste generated in Connecticut.
- **Recycling and Composting –** Move aggressively to strengthen Connecticut's public and private reuse, recycling and composting efforts and infrastructure to increase the quantity and quality of recovered materials and to build resilient, highly efficient and continually improving programs to reduce the amount of solid waste Connecticut disposes, both now

and in the future. Therefore, Connecticut needs to maximize recycling and composting for all types of solid waste generated in the state. Throughout the Plan, recycling includes composting and composting efforts refer only to the composting of source-separated organic material.

- **Management of Solid Waste Requiring Disposal –** Assure that the need for new disposal capacity is minimized, that existing solid waste facilities are used as efficiently as possible, and that the public is fully aware of the potential need for and impacts of disposal options and specific proposals, through a robust public participation process.
- **Management of Special Wastes and Other Types of Solid Waste –** Maximize source reduction, recycling, and beneficial use of special waste and other types of solid waste in a manner that protects human health and the environment; and also assure that special waste and other types of waste that require disposal are disposed in compliance with the State's solid waste management hierarchy in facilities that meet all regulatory standards for protection of human health and safety, natural resources and the environment.
- **Education and Outreach –** Significantly increase awareness and understanding of waste management needs, impacts and the critical social, economic, and environmental issues facing Connecticut, and build support for programs to engage citizens in actions needed to maximize waste reduction and recycling and minimize the need for additional disposal capacity.
- **Program Planning, Evaluation and Measurement –** Enhance local, state and regional planning, measurement and program evaluation practices to drive continual progress towards achieving Connecticut's waste management goals.
- **Permitting and Enforcement -** Ensure that permitting and enforcement decisions promote the goals of the Plan and are made in a manner that is fully protective of human health and the environment; promote continuous improvement of the environmental permit application review and decision making process; achieve the highest level of environmental compliance through predictable, timely, and consistent enforcement and effective compliance assistance where appropriate; and improve communication with municipalities, business, industry, and the public on the regulatory process in order to facilitate and improve compliance with environmental requirements.
- **Funding –** Adopt stable, long-term funding mechanisms that provide sufficient revenue for state, regional and local programs while providing incentives for increased source reduction and recycling.

The State Solid Waste Management Plan as amended provides a comprehensive approach to managing the State's solid waste. All of Connecticut's citizens will play a critical role in achieving the State's vision to treat solid waste as a valuable resource.

EXECUTIVE SUMMARY

Introduction

The Connecticut Department of Environmental Protection (the Department or CT DEP) has amended the State Solid Waste Management Plan in accordance with Section 22a-228 of the Connecticut General Statutes (CGS). It replaces the State Solid Waste Management Plan that was adopted in 1991. CGS Section 22a-229 requires that *…after adoption of a state-wide solid waste management plan pursuant to section 22a-228, any action taken by a person, municipality, or regional authority that is governed by this chapter shall be consistent with such plan.* Since the adoption of the 1991 Plan, solid waste management has changed dramatically from mainly a state and local issue to one that is increasingly a regional, national, and global issue.

This new Plan will now serve as the basis for Connecticut's solid waste management planning and decision making for the period fiscal year 2005 through FY2024. The Plan addresses a wide range of solid wastes, focusing primarily on municipal solid waste (or MSW, what is commonly considered household and commercial trash) and debris resulting from construction and/or demolition activities (C&D waste). Though some other special wastes are addressed, hazardous wastes are not covered. The Plan examines the existing state of solid waste management in Connecticut, identifies the problems that exist and the barriers to solving those problems, sets out a vision and goals and presents strategies to help achieve those goals and realize the vision. Within the immediate five-year period, Connecticut will focus on implementing the higher priority strategies listed in the Plan.

In developing this Plan, the Department worked extensively with the public and the specially created CT DEP Solid Waste Management Plan External Stakeholders Working Group. The External Stakeholders Working group included representatives from municipal and government associations, regional solid waste management authorities, the solid waste management industry, the recycling sector, community and environmental groups, and business and waste generating industries. Implementing the Plan will involve all the citizens of Connecticut to address the solid waste issues facing the state and will require not only changes in personal and business practices, but also legislative changes and increases in funding at the state, regional, and local levels to support new and expanded solid waste management programs.

Vision Statement and Goals

Connecticut's long-range vision for solid waste management is to:

- Significantly transform our system into one based on resource management through collective responsibility for the production, use, and end-of-life management of products and materials in the state;

- Shift from a *throwaway society* towards a system that reduces the generation and toxicity of trash and treats wastes as valuable raw materials and energy resources, rather than as useless garbage or trash; and
- Manage wastes through a more holistic and comprehensive approach than today's system, resulting in the conservation of natural resources and the creation of less waste and less pollution, while supplying valuable raw materials to boost manufacturing economies.

The goals of the State Solid Waste Management Plan are:

- Goal 1: Significantly reduce the amount of Connecticut generated solid waste requiring disposal through increased source reduction, reuse, recycling, and composting.
- Goal 2: Manage the solid waste that ultimately must be disposed in an efficient, equitable, and environmentally protective manner, consistent with the statutory solid waste hierarchy.
- Goal 3: Adopt stable, long-term funding mechanisms that provide sufficient revenue for state, regional, and local programs while providing incentives for increased waste reduction and diversion.

Current Status Of Solid Waste Management

Through State legislation, Connecticut has formally adopted an integrated waste management hierarchy as a guiding framework for solid waste management efforts. Connecticut's system adheres to this hierarchy by emphasizing source reduction, recycling, composting, and energy recovery from solid waste, while relying on landfill disposal as a last resort.

MSW

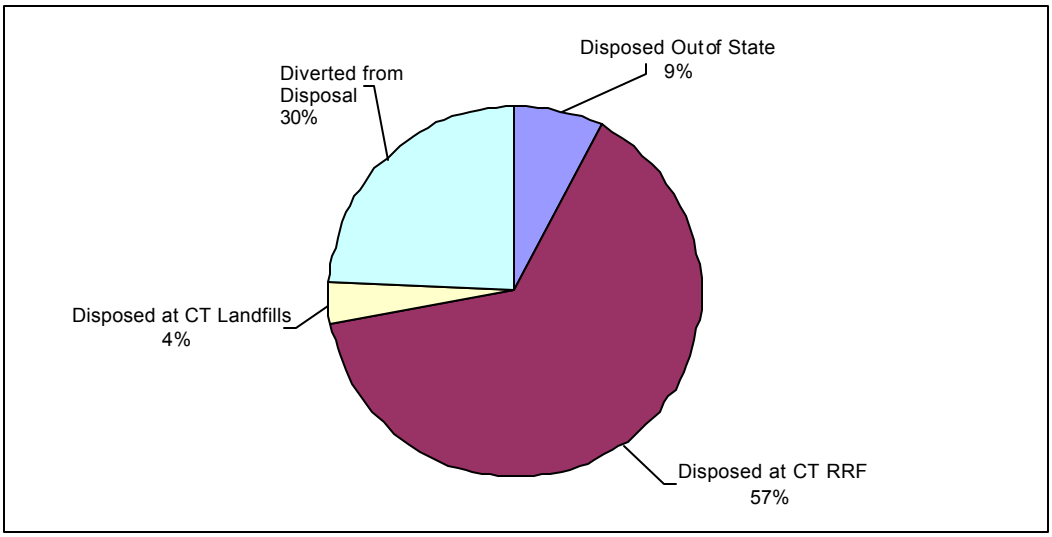
As shown in ES Figure 1, it was projected that in FY2005 approximately thirty percent of the municipal solid waste (MSW) generated was recycled; fifty-seven percent was burned at six regional MSW Resource Recovery Facilities (RRFs); nine percent was disposed out-of-state; and four percent was disposed at in-state landfills. Connecticut is more reliant on waste-to-energy facilities than any other state in the country. This reliance on RRFs results in a significant reduction in the volume of waste ultimately needing disposal at a landfill.

Over the past decade, Connecticut has become more reliant on out-of-state disposal options for MSW (mostly at out-of-state landfills). Since FY1994, out-of-state disposal of Connecticut-generated MSW has increased from approximately 27,000 tons/year to 327,000 tons/year in FY2004. This raises issues regarding inconsistency with the statutory hierarchy, and increased risk due to disposal cost fluctuations and availability.

ES Figure 1

Management of Connecticut MSW, FY 2005; MSW Generated is Estimated at 3,805,000 tons.

(Estimated by R.W. Beck based on FY2003 & FY2004 Data Reported to the CT DEP and Estimates of Non-reported Recyclables)



Through recycling efforts in Connecticut, MSW recycling rates have increased from less than five percent before recycling became mandatory in 1991 to almost thirty percent of the MSW generated in FY2005. This estimate includes non-reported recyclables such as bottle bill material and additional commercial recycling. Composting of yard wastes (leaves and brush) and grass cycling have been successful in Connecticut at both diverting waste from disposal and yielding useful end products. However, composting of other organic materials has been less successful. Consequently, composting of source separated organics remains significantly under-utilized in Connecticut. Although recycling and composting have been successful in Connecticut, recycling rates have stagnated over the last ten years. At the same time, the population and per capita waste generation rates have increased. As a result, if waste reduction and recycling efforts are not reinvigorated and if more waste is not diverted from disposal, Connecticut will face an increasing need for disposal capacity at a time when available land is in shorter supply, construction and operating costs are higher, and the public is less willing to accept additional waste disposal facilities.

RRF Ash Residue

The six MSW RRFs in the State generate an average of approximately 551,000 tons per year of ash residue. Two landfills in the State are permitted to accept and dispose of RRF ash residue. The Connecticut Resources Recovery Authority (CRRA) ash landfill in Hartford is estimated to reach capacity and close in October 2008. The Wheelabrator ash landfill in Putnam is estimated to reach capacity and close by FY2018. This is based on a number of assumptions detailed in the Plan, including the following: no new RRF capacity will be built in Connecticut, all Connecticut RRFs will continue to operate, and the Bristol RRF will start sending its ash residue to the Putnam ash landfill after June 2008, when its current contract with a New York state landfill expires.

Construction and Demolition (C&D) Waste/Oversized MSW

Currently, most of the Connecticut C&D waste/oversized MSW is disposed, with only about seven percent (not including clean fill) reported as being recycled. C&D waste recycling occurs at a much higher level in many other states. Connecticut's low recycling rate, coupled with a severe lack of disposal capacity in Connecticut for C&D related waste, results in most of Connecticut's C&D waste/oversized MSW being disposed of at out-of-state landfills. In FY2004, in-state C&D volume reduction facilities (VRFs) and transfer stations (TSs) reported sending approximately 909,000 tons of Connecticut generated C&D waste/oversized MSW to out-of-state landfills for disposal. All but one of the twenty-four remaining active Connecticut bulky waste landfills are municipally-owned, and most serve only their communities. Many are expected to close soon.

Special Waste

A special waste category of increasing concern is electronic waste. Our reliance on computers and other electronic devices, along with the continuing advances in technology, have created a huge increase in the volume of these materials requiring disposal. Efforts have been undertaken to develop a consistent national approach to this issue, but no consensus has been reached. As a result, recycling of electronic waste in this state has been limited to those few manufacturers willing to take back old products and to those few municipalities and authorities willing to conduct costly collection programs. In addition to electronic wastes, the Plan discusses other types of special waste. These include land clearing debris, household hazardous wastes, animal mortalities, road wastes, contaminated soils, dredge materials, sewage sludge, water treatment residual solids, disaster debris, waste treated wood, waste sharps and waste pharmaceuticals.

Projections for MSW, MSW RRF Ash Residue, and C&D Waste

This Plan sets a target to achieve a fifty-eight percent MSW disposal diversion rate by FY2024. Solid waste planning needs to provide strategies for achieving targets and goals and include contingency plans in the event that targets are not met. To provide some of the information needed to develop this Plan, projections were made for the twenty year period FY2005 through FY2024 to help predict the amount of: (1) Connecticut MSW, C&D waste/oversized MSW, and RRF ash residue generated, disposed, and diverted from disposal; (2) the in-state disposal capacity for those wastes; and (3) the in-state disposal capacity shortfall for those wastes. The projections developed are based on a number of factors including: solid waste data reported to the CT DEP; estimates of data not captured by the reporting system; and the development and use of a regression analysis based on Connecticut's population and gross state product. These analyses resulted in the assumption of a 1.6 percent annual increase for some components of the solid waste stream. The assumptions used in making these projections can be found in Chapter Four – Tables 4-1, 4-2, and

4-3, with a more full discussion in Appendix J. Projections were made for four broad scenarios.

MSW Projections Scenarios

Connecticut's *MSW in-state disposal capacity* is determined by the in-state landfill capacity and the in-state RRF capacity. The *MSW in-state disposal capacity shortfall* is the MSW disposed subtracted from the in-state disposal capacity.

Scenario 1. The current MSW diversion from disposal rate, 30 percent, remains the same and would result in increasing annual in-state disposal capacity shortfalls reaching 1.5 million tons by FY2024.

Scenario 2. The current MSW diversion rate increases to 40 percent (goal prescribed by state statute) by FY2015 and remains at 40 percent through FY2024. A 40 percent MSW disposal diversion rate would still result in increasing annual in-state disposal capacity shortfall for MSW of 931,000 tons by FY2024.

Scenario 3. The current MSW diversion rate increases to 49 percent by FY2024 thereby maintaining a consistent tonnage of MSW requiring disposal from FY2005 through FY2024. A 49 percent MSW disposal diversion rate would only slightly increase the current annual in-state disposal capacity shortfall and would be 471,000 tons by FY2024.

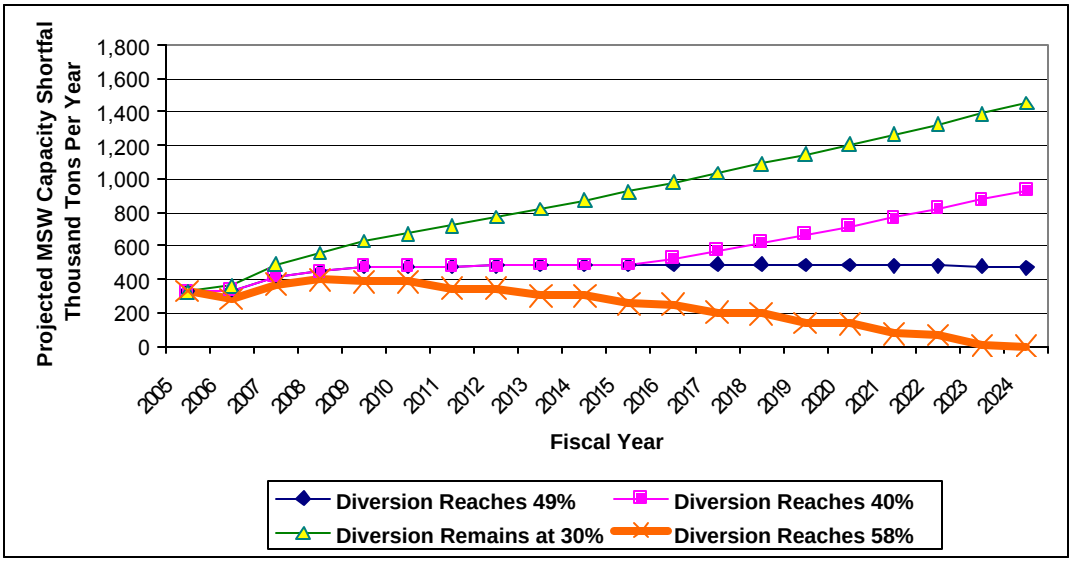
Scenario 4. The Plan's target of a 58 percent MSW disposal diversion rate is achieved by FY2024 and the projected in-state disposal capacity shortfall is eliminated by FY2024.

Unless Connecticut can successfully divert more waste from disposal, the in-state disposal capacity shortfall for MSW will grow as depicted in ES Figure 2 which shows the projections of in-state MSW disposal capacity shortfall under the four scenarios described above.

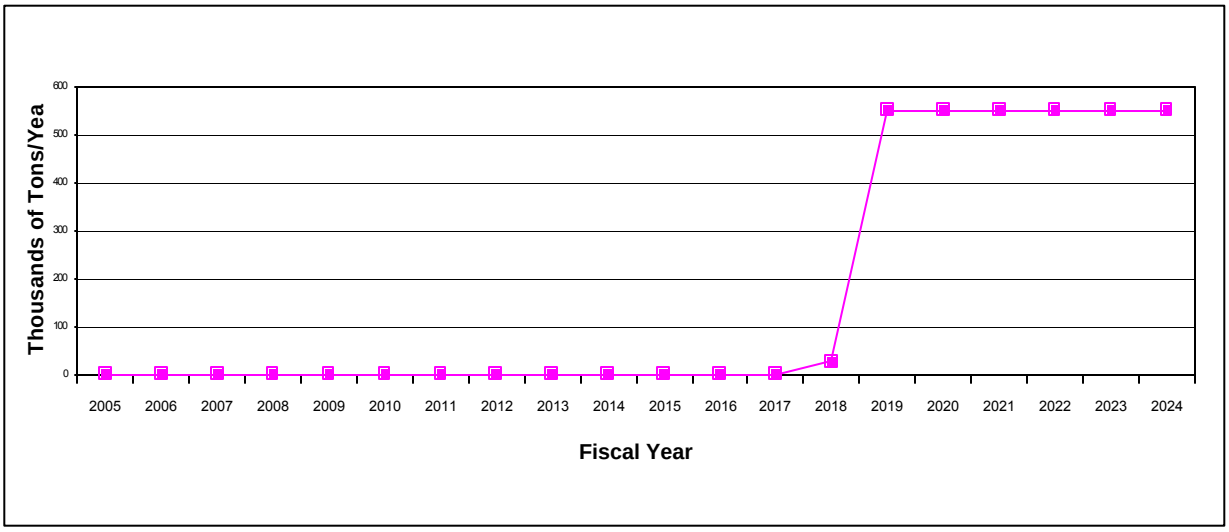
MSW RRF Ash Residue Projection Scenarios

Based on a number of assumptions as detailed in the Plan, it is projected that in-state disposal capacity for MSW RRF ash residue will be sufficient to meet the needs of all the state's RRF ash residue generated through the end of FY2018. Projections of generation of Connecticut MSW RRF ash residue requiring disposal and in-state disposal capacity were made based on the following: no new MSW RRF capacity will be built in-state during the planning period; the amount of MSW processed at Connecticut RRFs remains constant; and the amount of RRF ash residue requiring disposal remains constant. Figure 3 shows the projections of in-state MSW RRF ash residue disposal capacity shortfall for the period FY2005 through FY2024.

ES - Figure 2
Projections of In-State MSW Disposal Capacity Shortfall Under Various Waste Diversion Assumptions for the Period FY2005 through FY2024.



ES - Figure 3
Projections of In-State MSW RRF Ash Residue Disposal Capacity Shortfall for the Period FY2005 through FY2024



C&D waste/oversized MSW Projection Scenarios

Based on the available data regarding the generation of C&D waste/oversized MSW, it is difficult to set a specific goal for reducing the amount of this type of waste requiring disposal. Nonetheless, an effort will be made to maximize the diversion of this waste from disposal. The projections for the amount of C&D waste generated was based on reported data and assumed a 1.6 percent annual increase in the amount of such waste generated. Listed below are three scenarios.

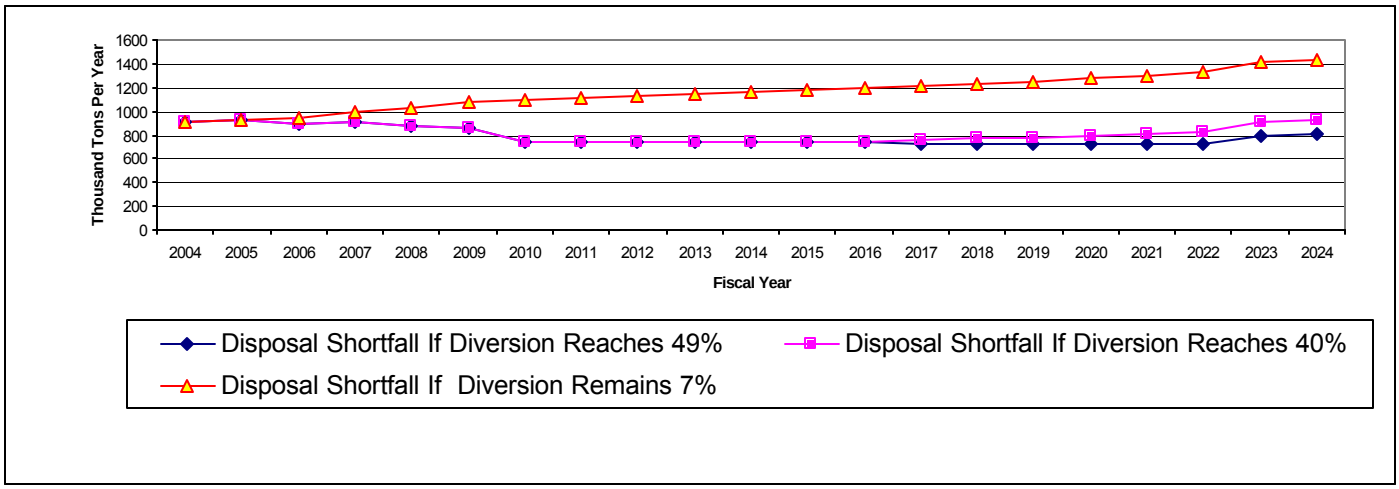
Scenario 1. The current diversion from disposal rate, seven percent, for C&D waste/oversized MSW remains the same through FY2024. This would result in increasing annual in-state disposal capacity shortfalls through FY2024 for C&D waste/oversized MSW and would be 1.4 million tons by FY2024.

Scenario 2. The current C&D waste/oversized MSW disposal diversion rates increases to 40 percent by FY2015 and remains at 40 percent through FY2024. A 40 percent disposal diversion rate by FY2024 is projected to slightly decrease and then increase the level of C&D waste/oversized MSW annual disposal capacity shortfall so that by FY2024 the disposal capacity shortfall would be similar to current levels.

Scenario 3. The current C&D waste/oversized MSW diversion rate increases to 48 percent by FY2024 and would result in a slight decrease in the annual in-state disposal capacity shortfall for this waste by FY2024.

Unless Connecticut can successfully divert more waste from disposal, the in-state disposal capacity shortfall for C&D waste/oversized MSW will grow as depicted in ES Figure 4 which shows the projection for in-state C&D waste/oversized MSW disposal capacity shortfall.

ES Figure 4.
Projections of In-State C&D Waste/Oversized MSW Disposal Capacity Shortfall
Under Various Waste Diversion Assumptions for the Period FY2005 through FY2024.



Key Factors Affecting Solid Waste Management in Connecticut

The context for solid waste management in Connecticut has changed substantially since the last statewide solid waste management plan was adopted in 1991. The following are among the key issues that will shape solid waste management in coming years:

- If Connecticut doesn't substantially increase the rate of MSW disposal diversion, it is projected to have an increasing shortfall of MSW in-state disposal capacity.
- Currently there is increasing out-of-state capacity for solid waste disposal at competitive prices.
- Solid waste is a commodity subject to interstate commerce laws.
- Bonds that financed the construction of the MSW RRFs will be paid off, and municipal contracts to supply MSW to Connecticut's RRF facilities will expire over the next two to fourteen years. Over this same time period, disposal capacity at four of the six MSW RRFs may shift from public to private ownership.
- Recycling and solid waste management services are increasingly privately run and market-driven.
- Connecticut's waste diversion infrastructure is stagnant and State and municipal funding is inadequate to support and achieve increased source reduction, reuse, recycling, and composting.
- Nationally, recycling of non-traditional material streams has grown significantly.
- National and global recycling markets have grown substantially.
- Other states and communities have demonstrated an ability to achieve higher waste diversion rates than Connecticut has achieved to date.
- There is a growing interest in product stewardship and producer responsibility policies.

Major Recommendations

MSW Disposal Diversion Rate

The Plan has established a target of 58 percent MSW disposal diversion by FY2024. To help identify and assess the strategies needed to meet this target rate, the Department will conduct a waste characterization study; continue to monitor the State's disposal diversion rates and conduct a comprehensive analysis of that rate at the mid-point of this planning period, i.e. by FY2016, for the purpose of determining the success to date and future expectations in achieving the desired results; and encourage and promote research, consider and evaluate new technologies, and assess and eliminate institutional barriers in order to establish such activities in-state.

Source Reduction, Recycling, Composting

The recommendations regarding source reduction, recycling, and composting represent the centerpiece of this Plan. After rapid growth in the early to mid 1990s, Connecticut's recycling efforts have become stagnant and are in need of reinvigoration. This Plan sets forth objectives and strategies to be implemented so as to reduce our per capita disposal rate from 0.8 tons/person/year in FY2005 to 0.6 tons/person/year in FY2024. This is to be accomplished by adopting a fifty-eight percent MSW disposal diversion rate by FY2024. This rate is consistent with the Connecticut Climate Change Action Plan 2005 recommendation that called for an increase in recycling and source reduction of municipal solid waste to achieve significant greenhouse gas reductions. While much of the burden of accomplishing this will fall on the Department, a greater amount will necessarily be borne by municipalities and businesses. Significant increases in funding will be needed to support these efforts.

The State needs to take advantage of increasing demand for recycled material, especially in overseas markets, by increasing the amount of marketable material recovered for recycling. The State must also facilitate the development of a more robust recycling business infrastructure in Connecticut for almost all materials including paper, metals, electronics, and compostable organics. In particular, significant results can be achieved through increased efforts to compost source separated commercial and institutional food wastes, as is being done in other states. In order to reduce the amount and toxicity of waste being generated, Connecticut must focus more effort on packaging. The State will continue to work with the Toxics in Packaging Clearinghouse to enforce existing laws and to encourage producers to reduce the amount and toxicity of packaging being used.

Disposal Capacity

There is not enough disposal capacity in-state to handle all the Connecticut solid waste requiring disposal. This is true for the major components of the solid waste stream: MSW and C&D waste. The adopted 1991 State Solid Waste Management Plan and the proposed 1999 Plan were based on the premise that the state should have sufficient in-state capacity for recycling, processing and disposal to manage all Connecticut MSW and ash residue generated by Connecticut resources recovery facilities. This Plan continues to recognize that self-sufficiency in managing our solid waste represents good public policy for Connecticut for many reasons, including the ability to better control costs and other risks related to solid waste disposal. This Plan emphasizes that a significant reduction in the amount of waste disposed must be achieved as the primary means of attaining self-sufficiency.

Public or Private Ownership and Control

Another key issue is whether the RRF capacity in Connecticut and the RRF ash residue landfill capacity in Connecticut will be owned and controlled by public or private entities. Bonds that financed the construction of the RRFs will be paid off

over the next two to fourteen years and contracts for disposal at the RRFs will expire over that same time. Further, the Hartford landfill, where CRRA sends the ash generated at the Hartford RRF, will be closing in two years, leaving one (privately owned) RRF ash residue landfill in Connecticut. These events will lead to a major shift in control of the majority of the MSW and RRF ash residue disposal capacity in the state from public to private entities. Private owners will be free to enter into contracts with out-of-state generators for some of the existing capacity that today is contracted to and/or used by Connecticut's municipalities. While this Plan does not advocate for or against private ownership, it does urge the state's decision-makers to take note of the issue, fully debate it, and make the prudent decisions necessary to ensure that the interests of Connecticut's citizens and businesses are protected.

Planning, Evaluation, and Measurement

This Plan replaces the last Plan adopted by the Department fifteen years ago in 1991. That is clearly too much time between plan revisions. Therefore, one of the recommendations of this Plan is that the Department regularly identify the critical solid waste issues facing the state and make appropriate revisions to this Plan. In order to ensure that these efforts are comprehensive and reflect diverse views, the Department will form a standing Solid Waste Management Advisory Committee, with representation from the public and private sectors. Finally, rather than expecting 169 towns to prepare their own solid waste management plans as envisioned by existing law, the Department should ensure that its planning efforts thoroughly evaluate and reflect municipal accomplishments, needs, and trends. Collecting data is critical to perform these evaluations. To facilitate this, changes must be made to existing municipal reporting requirements so they are less burdensome and more meaningful.

Permitting and Enforcement

During the public process, many urged the Department to streamline its permitting processes, especially for those activities that support the goals of this Plan, such as increased recycling and composting. The Department agrees with these suggestions, and this Plan makes several recommendations for improving the permitting process. Some of the most significant recommendations are as follows:

- make review of the applications for recycling, composting, and other beneficial facilities a high priority for the permit program;
- develop fact sheets, model permits, and other helpful materials for prospective permit applicants;
- form a review team whose primary responsibility will be to review applications for beneficial activities;
- require permitting or some other regulation of waste haulers, consistent with the Governor's Task Force Report recommendations that are carried forward; and
- evaluate opportunities to reduce permitting requirements for the beneficial reuse of certain waste materials.

It is recognized that the Department must make enforcement of solid waste laws a high priority, and the Plan includes recommendations for accomplishing this task. In addition, recognizing that most of the potential for improvement in recycling rates exists in the municipalities, recommendations are made to increase the level of enforcement at the local level, using existing authorities. The Department will work with municipalities to identify barriers to accomplishing this and will partner with municipalities to take appropriate enforcement actions.

Funding

This Plan charts an aggressive course for meeting the challenges of managing Connecticut's solid waste over the twenty year planning period. Action is recommended through the implementation of seventy-five strategies over the next several years to deal with these difficult issues. As with many other important programs, addressing these needs will require significant support in the form of funding at the local, state, and regional level.

One of the most difficult, but clear, challenges that face decision-makers and the citizens of Connecticut is to find the resources for these programs when other critical needs are competing for the same limited public dollars. As the public, legislators, and other officials make decisions on which strategies will be implemented, appropriate sources of funding must be identified. The following are the specific potential funding sources identified in this Plan:

- capture some or all of the unclaimed bottle and can deposits (escheats);
- expand the Solid Waste Assessment to all disposed solid waste, including all MSW, C&D debris, and oversized MSW, whether disposed in-state or out-of-state;
- increase the Solid Waste Assessment beyond the present $1.50 per ton;
- direct enforcement penalties to a special account for distribution to municipalities and regional authorities aimed at recycling; and
- bond funds for infrastructure to support demonstration projects and/or development of publicly controlled recycling facilities.

Without adequate funding, many of the critical needs identified in this Plan will not be met. It is up to all citizens of Connecticut to fully debate these issues and make the decisions necessary to properly manage the solid waste that we generate.

Statutory and Regulatory Changes Needed

Many of the changes needed to meet the goals of this Plan cannot be implemented without action by the legislature to change Connecticut's solid waste statutes, and possibly other areas of the law such as those affecting taxes and revenue. The following are some of the more significant recommendations identified in this Plan that will require statutory and/or regulatory change:

- establish a recycling program for electronics;

- increase funding sources, and increase the authority to pass adequate funding along to municipalities and regional entities;
- prohibit the disposal of unprocessed construction and demolition waste;
- add plastics #1 and #2 and magazines to the list of mandated recyclables;
- create incentives to encourage businesses to create or expand activities that will move the state forward in meeting its waste diversion goals;
- amend the permit program;
- expand the bottle bill to include plastic water bottles, and increase the deposit to ten cents;
- require liners for all new C&D/oversized MSW/bulky waste landfills; and
- comprehensively align and update solid waste management laws.

Critical Issues for Decision Makers

The issues raised in this Plan present significant challenges to Connecticut's citizens, businesses, and government leaders. Many critical decisions must be made over the next several years in order to successfully meet those challenges. The most critical issues or decisions, and those who will need to help address them, are outlined below:

State Legislators

- Find ways to help fund the actions outlined in this Plan, and support those needing additional resources including state agencies, regional authorities, and municipalities.
- Evaluate the role of CRRA given the changing conditions in the state with regards to the MSW RRFs and the changing and complex nature of managing the solid waste stream.
- Expand authority allowing state agencies, regional authorities, and municipalities to more effectively manage and regulate solid wastes.
- Help define what role government entities should play in directly managing and/or controlling the solid waste management infrastructure.
- Expand recycling mandates.
- Establish incentives to encourage expansion and creation of new recycling and composting infrastructure.
- Continue to support environmentally preferable purchasing by state government, including Connecticut's state colleges and universities.

Department of Environmental Protection

- Serve as a model for other governmental entities, businesses, and citizens to enhance source reduction, composting, recycling, and buying environmentally preferable products.
- Maximize resources to support and maintain solid waste education, assistance, recycling, permitting, and enforcement.
- Establish a standing Solid Waste Management Advisory Committee.
- Establish permitting of beneficial activities as a high priority for the Agency.
- Continually monitor solid waste issues nationally, regionally, and locally and help guide Connecticut to manage its solid waste in response to those issues in a manner that best protects the environment and human health.

Other State Agencies

- Provide support to research, develop, and market recycling processes and products.
- Adopt purchasing practices that create less waste and buy environmentally preferable products.
- Increase source reduction and recycling efforts in agency operations.

Local Officials and Regional Waste Authorities

- Continue to play an active role in the proper and efficient management of solid waste in their communities.
- Expand recycling/source reduction programs and efforts.
- Increase enforcement of local recycling ordinances.
- Enact or amend ordinances to reflect new State programs.
- Change purchasing practices to create less waste and purchase environmentally preferable products.

Businesses

- Provide cost effective and efficient solid waste management opportunities.
- Increase efforts to recycle and source reduce the solid waste generated.
- Establish new businesses to expand recycling and composting infrastructure.
- Change purchasing practices to create less waste and buy environmentally preferable products.
- Adopt a product stewardship ethic.

Citizens

- Change practices to create less waste.
- Purchase environmentally preferable products.
- Increase recycling efforts.
- Compost food waste and other organics.

Summary

The efforts made over the next five to ten years will largely determine the success or failure of the State in meeting the challenges set out in this Plan. Connecticut's existing approach to solid waste management has served its citizens well. However, the solid waste field has continued to evolve to the point where new approaches and greater effort will be needed to meet the challenges. Future discussions and actions will determine the State's success in significantly reducing our per capita disposal rate, reliance on Resource Recovery Facilities, the potential need for new disposal facilities, the role of landfills, and how much Connecticut will pay for these programs. Most importantly, they will determine whether or not Connecticut's citizens and businesses will make a greater commitment to source reduction, recycling, and composting. This Plan is only a starting point. The on-going, hard work of a diverse set of stakeholders will be needed for Connecticut to achieve its Solid Waste Management Vision.

Table of Recommended Strategies

Excerpted from
STATE OF CONNECTICUT SOLID WASTE MANAGEMENT PLAN,
AMENDED DECEMBER 2006

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Table of Recommended Strategies

This Plan proposes numerous strategies for achieving the State's long-term solid waste management goals. For planning purposes, as well as the prudent use of resources, it is essential that priorities among the Plan's strategies be established. The relative importance of each strategy needs to be assessed given that resources will be insufficient to undertake all strategies simultaneously or to the fullest possible extent. In addition, strategies need to be mapped chronologically so that all parties involved have a sense of when they are to be undertaken. These priorities were established based on consideration of the following criteria:

- The importance of the strategy in bringing Connecticut closer to its solid waste vision and goals;
- The ease of implementation and institutional feasibility of the strategy;
- The costs and cost-effectiveness of the strategy relative to the resources available; and
- The extent to which other strategies are dependent upon the strategy.

Table 5-1 presents an annotated list of recommended strategies for solid waste management in Connecticut. The Table identifies for each of the seventy-five strategies, the following: the type of action needed; the assigned priority; new costs; initiation time frame; and the lead and/or key partners for implementation. Of the total number of strategies, forty-five are high priority; twenty-two are medium priority; and eight are low priority. The CT DEP will, in conjunction with the Agency Solid Waste Management Advisory Committee, be preparing an operational work plan that will target those high priority strategies and will further refine associated implementation costs. Many of the high priority strategies are focused on attaining a much higher diversion rate for MSW disposal. Diversion includes reducing MSW at the source, recycling or composting. As discussed in the Plan, the greatest opportunity for increasing diversion rates is to develop new programs for materials that have very low diversion rates at present, while enhancing, improving and maintaining existing source reduction, composting and recycling programs.

Based on available information and best professional judgment, cost estimates have been prepared for those high priority strategies found in Table 5-1. Assuming that the focus of the efforts will be directed towards:

- Enhancing and improving the existing municipal recycling programs;
- Targeting certain waste streams, such as: the recycling of electronics, mixed paper, and commercial C&D wastes; and the composting of commercial food waste.
- Promoting and developing options for Pay as you Throw (PAYT) programs or unit pricing throughout Connecticut for MSW;
- Enhancing and improving the state's solid waste management database system;
- Conducting a waste characterization study; and

- Improving permitting and enforcement activities.

Program costs under each of these efforts may include staffing and education, collection and processing infrastructure and other related costs. Much of the responsibility for implementing these efforts will involve multiple partners, including the CT DEP and other state agencies, regional waste authorities, municipalities, private haulers, processors, environmental groups, and private citizens. It is expected that in the first 12 to 18 months, the need for new resources necessary for administration, planning and coordination, and start-up activities would be evenly divided between state and regional/municipal partners. From year two forward, resource allocations would favor regional/municipal partners in ratios of 3 to 1, to as much as 5 to 1. The estimated costs for the first five years of implementation, targeting high priority strategies, are estimated to be approximately 28 million dollars ranging from 4.5 million dollars the first year to about 7 million dollars in the peak second and third years. As programs become established, some programs are expected to become self-sustaining through user fees and, in addition, the annual costs level off again in the 4.5 million dollar range.

Of the estimated costs, a combination of funding mechanisms may be appropriate and could include: an on-going general fund line item appropriation; bonding; and fee based programs. As indicated throughout the Plan, a large portion of the work will be undertaken at the regional and municipal level and the allocation of resources would necessarily follow this level of effort. Refinement of these cost estimates will need to follow the development of more detailed action plans and will require a great deal of additional discussion with stakeholders. The State Solid Waste Management Plan provides the foundation for the work that must be done to best manage our solid waste in a social, economic and environmentally responsible manner.

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
Objective 1	**Source Reduction**					
1-1	Continue to implement the CT DEP's Pollution Prevention Plan that establishes goals and identifies strategies to reduce the quantity and toxicity of wastes discharged to the land, air, and waters of the state.	Administrative	Medium	Staff = $	Existing	DEP
1-2	Educate consumers and businesses about the effects of their purchasing choices and behaviors on waste generation, and provide education and incentives to help change purchasing and behavioral practices to reduce the amount and toxicity of waste produced.	Administrative	High	Staff = $$ Other = $$	Short term	DEP
1-3	Continue to support regional and national efforts to change manufacturer practices to produce products that generate less waste and less toxic waste.	Administrative	Medium	Staff = $	Existing	DEP
1-4	Continue to promote environmentally preferable purchasing ("EPP") standards in state and local government; encourage state agencies and municipalities to become members of EPA's WasteWise Program; and support green design standards and encourage their adoption by Connecticut local governments and institutions.	Administrative	High	Staff = $	Existing	DAS/ DEP & municipalities
1-5	Provide funding to promote reuse and publicize product reuse opportunities.	Legislative, Administrative	Medium	Other = $	Short term	TBD
1-6	Promote through such activities as technical assistance, start-up funding, and/or other incentives, the implementation of effective pay-as-you-throw (PAYT) pricing systems by municipalities and haulers for managing solid waste from residents and small businesses to achieve waste reduction.	Administrative	High	Staff = $$ Other = $$	Mid term	TBD/ Municipalities & Regional

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
1-7	Seek partnerships, provide funding, and coordinate a model source reduction program to reduce the amount and toxicity of solid waste generated in at least one Connecticut community.	Administrative	Low- Medium	Staff = $ Other = TBD	Mid term	DEP/ Municipalities and others TBD
1-8	Continue to enforce Connecticut's Toxics in Packaging Act and other toxic reduction programs and efforts. Continue to work in conjunction with the Toxics in Packaging Clearing House and other member states to assess compliance rates with toxics in packaging laws.	Administrative	Medium	Minimal	Existing	DEP/ Regional
Objective 2	**Recycling and Composting**					
2-1	Update Connecticut's beverage container deposit system by increasing the deposit amount and expanding coverage to at least plastic water bottles.	Legislative	High	Staff = $ Other = $$$	Short term	DEP/ Private sector
2-2	Add plastics PET #1 and HDPE #2 and magazines to the list of State mandated recyclables.	Legislative	High	Staff = $ Other = $$	Short term	DEP/ Municipal & private sector
2-3	Continue to support Environmentally Preferable Purchasing (EPP) at CT DAS and promote and ensure state agencies and political subdivision utilization of EPP standards. CT DEP and CT DAS will evaluate the relevant statutes to ensure their completeness and effectiveness in actual State purchasing practices.	Administrative	High	Minimal	Short term	DAS/ DEP & municipal
2-4	Through the Agency's Solid Waste Management Advisory Committee identify incentives for municipalities and haulers to implement effective PAYT pricing systems for managing solid waste from residents and small businesses to achieve waste reduction. (See 6.3)	Administrative	High	Minimal	Mid term	DEP/ Multi-stakeholder committee

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
2-5	Increase technical assistance, education, outreach, and enforcement with regard to the business and industry sectors (especially the small businesses) and institutions to decrease their waste disposal rates by increasing recycling and source reduction. Promote EPP, including recycled content products, by Connecticut's businesses, industries, and institutions.	Administrative, Regulatory	High	Staff = $$ Other = $$	Short term	DEP/ Municipal, regional and others TBD
2-6	Continue the CT DEP's Municipal Recycling Honor Roll Awards Program and the Green Circle Awards Program to recognize and support exemplary source reduction and recycling practices and promote technology transfer.	Administrative	Medium	Minimal	Existing	DEP
2-7	CT DEP, in collaboration with regional authorities and the hauling industry, will identify incentives for haulers to increase the amount of material recovered for recycling.	Administrative	Medium	Staff = minimal Other = $ - $$	Mid term	DEP/ Private, Regional
2-8	Develop the infrastructure necessary to increase the amount of paper that is recycled. Create incentives and funding for increased paper recycling and for source reducing the amount of waste paper generated.	Administrative	Medium	Staff = $ Other = $	Mid term	TBD/ Regional, Private
2-9	Support the continued recycling of non-mandated recyclables.	Administrative	Low	Minimal	Existing	Municipal & Regional
2-10	CT DEP, the Agency's Solid Waste Management Advisory Committee and other State Agencies will work with recycling business representatives to facilitate the development, expansion, and creation of markets for recycled materials.	Administrative	Low – Medium	Staff = $ Other = $$	Mid term	DEP/ other state agencies TBD
2-11	Build local, regional, and state capacity for implementing State recycling policies, regional planning and program implementation, and recycling information sharing.	Administrative	High	Staff = $$$	Short term	TBD/ DEP, Municipal, Regional, & others

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
2-12	CT DEP and regional recycling entities will work to build partnerships with groups that can assist with and support the State's recycling efforts. Potential partners include regional recycling programs, municipalities, CRRA, trade associations, non-governmental organizations, universities and others.	Administrative	Medium	Staff = $	Mid term	DEP/ Regional & other stakeholders
2-13	CT DEP will designate a "State Source Reduction and Recycling Coordinator" to coordinate and implement the strategies described in this section and other sections of the Plan to increase source reduction, recycling, and composting.	Administrative	High	Staff = $	Short term	DEP
2-14	Identify the internal barriers and solutions to streamlining the permitting process for source separated organic material recycling, especially for those institutional, commercial, and industrial operations that process food scraps, soiled paper and waxed cardboard.	Administrative	High	Staff = $	Mid term	DEP/ Private
2-15	The Agency's Solid Waste Management Advisory Committee will be requested to discuss options that could stimulate organics recycling, especially food scraps, soiled paper, and waxed cardboard from the institutional, commercial and industrial sectors.	Administrative	High	Minimal	Short term	DEP/ Stakeholders
2-16	Include compost and compostable materials in a statewide or regional on-line materials exchange to link generators of source separated organic material with processors and compost users.	Administrative	Low	Staff = $ Other = $	Mid term	TBD/ Private
2-17	Encourage the marketing of compost products for such uses as erosion control, potting soil blends, topsoil blends, playing field mediums, etc.	Administrative	Low	Minimal	Mid term/ existing	TBD/ Stakeholders
2-18	Promote home composting and grasscycling.	Administrative	Medium	Other = $-$$	Mid term	DEP/ Municipal

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
Objective 3	**Management of Solid Waste Requiring Disposal**					
3-1	Minimize the need for additional capacity for disposal of MSW, MSW RRF ash residue and C&D waste through aggressive implementation of the source reduction, recycling, composting, and other initiatives in this Plan. This Plan establishes a target of achieving a 58 percent MSW disposal diversion rate by FY2024.	All types	High	$$$	Short term	All partners
3-2	The State will monitor waste generation and capacity on a regular basis, and with input from the Agency's Solid Waste Management Advisory Committee, evaluate the need for additional MSW, MSW RRF ash residue and C&D waste disposal capacity.	Administrative	High	Staff = $	Mid term	DEP
3-3	The Department will seek legislative authorization to require any applicant for new RRF or landfill capacity, at the time any application is submitted to the CT DEP, to create a fund to be accessed by the host municipality to: (1) fund a local advisory committee and (2) hire appropriate expertise to assist the host municipality in reviewing the application and taking part in the application process. The local advisory committee should include elected officials and residents from both the host community and contiguous communities.	Legislative, Administrative	High	Staff = $ Other = $$	Short term	DEP/ Applicants and stakeholders
3-4	Require C&D waste to be processed to the greatest extent practicable prior to its disposal at any solid waste facility.	Legislative, Administrative	High	Staff = $ Other = $$$	Short term	DEP/ Private sector
3-5	Research and track new solid waste management technologies that have the potential to reduce environmental impacts and maximize benefits.	Administrative	Low	Minimal	Long term	TBD

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
Objective 4	**Management of Special Waste and Other Types of Waste**					
4-1	The Agency Solid Waste Management Advisory Committee will be requested to discuss and identify opportunities to reuse and recycle building related C&D waste.	Administrative	High	Staff = $	Short term	DEP/ Private
4-2	Revise the statutory and regulatory definitions of solid wastes and solid waste categories to more accurately reflect the character and management of these wastes.	Legislative, Regulatory	Medium	Staff = $	Mid term	DEP
4-3	Manage building related C&D waste that cannot be reduced, reused, recycled, or composted, in a manner that ensures protection of land, air, and water resources and the public health, in compliance with the state hierarchy for managing solid waste.	Administrative, Regulatory	High	Staff = $ Other = $$$	Mid term	DEP/ Private & other stakeholders
4-4	Support reuse and recycling of highway/road C&D waste, and dispose of that portion that cannot be reduced, reused, recycled, or composted, in a manner that ensures protection of land, air, and water resources and the public health in compliance with the state hierarchy for managing solid waste.	Administrative	Medium	Minimal	Existing	DEP/ DOT, Municipal
4-5	Increase the recycling, composting, and beneficial use of land clearing debris.	Administrative	Medium	Staff = $ Other = $$	Mid term	DEP/ Private, Municipal, private sector
4-6	Increase the reuse and recycling of oversized MSW.	Administrative	Low	TBD	Long term	DEP/ Regional, and other partners
4-7	Manage oversized MSW that cannot be reused or recycled in a manner that ensures protection of land, air, and water resources and the public health in compliance with the state hierarchy for managing solid waste.	Administrative, Regulatory	High	Staff = $ Other = $$$	Mid term	TBD
4-8	Seek legislation that provides for recycling of electronic wastes based on a producer responsibility model.	Legislative	High	Staff = $ Other = TBD	Short term	DEP/ private stakeholders

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

(3) Lead will be responsible for initiating action; Key Partners may be responsible for implementation

Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
4-9	Enhance the statewide Household Hazardous Waste Program.	Administrative	Low	Staff = min. Other = $$S	Long term	DEP/ municipal
4-10	CT DEP will continue to monitor and research management options for other types of special wastes that have not been adequately addressed to date, or as problems and the need arises, and as resources allow. Types of wastes that need to be addressed include: animal mortalities; road wastes; dredge material from Long Island Sound; contaminated soils; sewage sludge; water treatment residual solids; preservative treated wood; sharps and waste pharmaceuticals; disaster debris; and other materials as appropriate.	Administrative	Low - high	TBD	Short term – Long term	DEP/ Others
Objective 5	**Education and Outreach**					
5-1	Undertake education and outreach actions using minimal additional resources. Such actions could include: coordinating existing resources and sharing information; enhancing the CT DEP website; promoting awareness through recognition programs; integrating solid waste issues with other environmental issues; ongoing outreach to media; and encouraging municipalities to provide solid waste and recycling information to residents and businesses.	Administrative	High	Staff = min. Other = $	Short term	DEP/ Municipal and others TBD
5-2	Undertake education and outreach actions using additional resources. These actions can include: providing comprehensive assistance to regional and local outreach programs; developing partnerships; and assessing and modifying outreach programs on a two year basis.	Administrative	High	Staff = $ Other = $$	Mid term	DEP/ Municipal and others TBD

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

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Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
5-3	Undertake education and outreach actions using expanded resources. These actions can include: researching and developing effective outreach approaches; disseminating new educational and outreach materials; developing an independent recycling web site that acts as a clearinghouse and listserve for municipal and regional recycling coordinators; and developing education and technical assistance for targeted sectors.	Administrative	High	Staff = $$ Other = $$$	Long term	DEP/ Municipal and others TBD
Objective 6	**Program Planning, Evaluation, and Measurement**					
6-1	Establish per capita waste disposal minimization goals for MSW and C&D/oversized MSW.	Administrative	High	Minimal	Short term	DEP
6-2	Minimize the reporting burden for municipalities and others by only requiring the collection of data necessary to support the goals of the Plan and provide the information needed for on-going solid waste management planning and evaluation.	Administrative, Regulatory	High	Staff = $ Other = $$	Mid term	DEP/ Municipal
6-3	Establish a standing Agency Solid Waste Management Advisory Committee of affected stakeholders to help implement the new State Solid Waste Management Plan, revise the Plan, identify emerging issues, and find solutions.	Administrative	High	Staff = $	Short term	DEP
6-4	Implement an iterative planning process for the State's Solid Waste Management Plan to allow revisions on a more frequent and as needed basis, following a management system model of Plan/Do/Check/Act. A strong on-going stakeholder process, local and regional planning, and an improved methodology for measuring success will inform the planning cycle.	Administrative	High	Staff = $	Short term	DEP/ Stakeholders

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

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Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
6-5	Evaluate and make recommendations for changes to underlying legal authorities to improve state, regional, and local solid waste planning and coordination. Develop system performance benchmarks relevant at both the state and local levels aimed at achieving a unified solid waste management vision. Explore opportunities to fund planning activities at the state, regional, and local level and develop incentives for full participation.	Administrative	High	Staff = $$ Other = $$	Mid term	DEP/ Stakeholders
6-6	Provide training and informational materials to municipal officials, regional and local waste management and recycling staff regarding best practices and strategies for strengthening solid waste and recycling programs. Encourage communities and regional recycling programs to share their best practices and strategies. Investigate the possibility of established a municipal solid waste/recycling mentor program.	Administrative	High	Staff = $ Other = $	Short term	DEP/ Municipal
6-7	The CT DEP will conduct a solid waste characterization study.	Administrative	High	Other = $$	Short term	DEP/Stakeholders
Objective 7	**Permitting and Enforcement**					
7-1	CT DEP will make the permitting of solid waste facilities that increase waste diversion from disposal a priority.	Administrative	High	Minimal	Short term	DEP
7-2	CT DEP will designate a permitting team whose responsibility is to review all solid waste diversion applications and to make determinations in a timely manner.	Administrative	High	Minimal	Short term	DEP
7-3	CT DEP will facilitate the permitting process by developing model permits and fact sheets for applicants and interested parties, so that the process and the applicant's obligations are well defined and readily comprehensible.	Administrative	Medium	Staff = $ - $$	Mid term	DEP
7-4	CT DEP will establish target time frames for acting on solid waste diversion and beneficial use applications.	Administrative	Low	Minimal	Mid term	DEP

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

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Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
7-5	CT DEP will conduct a comprehensive assessment of the state statutes and regulations as they relate to solid waste management and to the implementation of the State Solid Waste Management Plan. It its review, the CT DEP should take into account broader environmental concerns, such as air and water issues.	Administrative, Legislative, Regulatory	High	Staff= $ Other = 0	Short term	DEP
7-6	CT DEP will streamline the beneficial use process, with consideration given to an exemption from permitting for certain types of materials.	Administrative, Legislative, Regulatory	High	Staff = $	Short term	DEP/ Stakeholders
7-7	CT DEP will establish a streamlined method of regulating waste haulers in order to incorporate reporting and other substantive requirements, along with a simple means of assessing the solid waste fee. Any action taken by the CT DEP will be consistent with the Governor's Task Force Report recommendations that are carried forward.	Legislative, Regulatory	High	Staff = $ Other = $$	Short term	DEP/ Stakeholders
7-8	CT DEP will seek authority to establish categories of demonstration projects that would not require traditional permitting.	Legislative, Regulatory	Medium	Staff = $	Mid term	DEP
7-9	CT DEP will continue to identify activities appropriate for approval by general permit, and devote staff resources to this effort.	Administrative	Medium	Staff = $	Existing	DEP
7-10	CT DEP will develop a procedure to allow the modification of existing permit approvals in order to facilitate improved or modified business operations and enhanced protection of the environment that are needed due to evolving technologies, markets conditions, and environmental concerns.	Administrative, Regulatory	Medium	Staff = $	Mid term	DEP

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

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Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
7-11	CT DEP will seek amendments to CGS Section 22a-208a(d) to allow municipal transfer stations to accept and do minimal separation of residentially generated construction and demolition waste without requiring full permit modifications and fees.	Legislative, Regulatory	Medium	Staff = $	Short term	DEP
7-12	CT DEP will establish criteria for C&D waste Volume Reduction Facilities to help ensure that more of this waste stream is diverted from disposal.	Administrative	Medium	TBD	Mid term	DEP
7-13	CT DEP will seek and encourage public input at the appropriate steps with regard to the development of General Permits for certain activities and Beneficial Use General Permits.	Other	High	Minimal	Short term	DEP
7-14	CT DEP will consider host community agreements as part of the re-writing of the solid waste regulations. Until such time regulations are adopted, host community agreements shall be encouraged on a case-by-case basis.	Administrative, Regulatory	High	Minimal	Short term	DEP
7-15	CT DEP will continue to evaluate the environmental impacts of the alternatives for solid waste disposal and will examine its authority to require an applicant for new capacity and disposal to provide detailed information on such impacts.	Administrative	High	Minimal	Short term	DEP/private sector
7-16	CT DEP will increase its compliance outreach efforts to develop a more comprehensive and mutually supportive network of communications with land use, public works, and other municipal officials who are directly involved in solid waste activities. CT DEP will take appropriate actions to ensure compliance.	Administrative	High	Staff = $-$$	Short term	DEP/ Municipal and others
7-17	CT DEP will take enforcement actions against recycling law violators as necessary to ensure compliance.	Administrative	High	Staff = $ Other = $$	Existing	DEP/ Municipal and others
7-18	CT DEP will evaluate incentives that would encourage municipalities to take on enforcement responsibilities they are already authorized to do.	Administrative	High	Staff = $	Short term	DEP/ Municipal

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

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Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
7-19	CT DEP will establish civil penalty regulations for violations of recycling laws.	Regulatory	Medium	Staff = $	Short term	DEP
7-20	CT DEP will evaluate additional tools for taking enforcement actions against violators of the solid waste statutes, regulations, and permits.	Administrative	Medium	TBD	Mid term	DEP/ Stakeholders
7-21	CT DEP will ensure that RRF's and other solid waste facilities including landfills and transfer stations comply with CGS Section 22a-220c(b) which requires solid waste facilities periodically to inspect loads delivered to them for significant quantities of recyclables and report such violation back to the municipalities.	Administrative	High	Staff = $$	Mid term	DEP/ Municipal, Authorities, & Private sector
Objective 8	**Funding**					
8-1	Adopt a comprehensive, long term, integrated solid waste management funding system to ensure that adequate revenue is available to implement the strategies and achieve the goals of this Plan. The Agency's Solid Waste Management Advisory Committee will assume a major role in identifying appropriate funding mechanisms.	Legislative	High	$$$	Short term	DEP/ OPM, Stakeholders
8-1(1)	Expand the current $1.50 fee on waste processed at Connecticut RRFs to all disposed solid waste, including all MSW, C&D debris, and oversized MSW, whether disposed in-state or out-of-state.					
8-1(2)	Capture some portion of the unclaimed bottle and can deposits (escheats) to fund needed solid waste source reduction and recycling/composting programs at the state, regional, and local levels.					
8-1(3)	Direct penalty monies from solid waste enforcement actions to municipal and regional recycling and other diversion programs.					

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

(2) Existing; Short term = 2006-2008; Mid term = 2008-2010; Long term after 2010

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Table 5-1
Annotated List of Recommended Strategies for Solid Waste Management in Connecticut

Strategy Number	Recommended Strategy	Type of Action	Priority	New Costs (1)	Initiation Time Frame (2)	Responsibility Lead/ Key Partners (3)
8-1(4)	Increase the Solid Waste Assessment beyond the present $1.50 per ton.					
8-1(5)	Use state bond funds for needed infrastructure projects such as publicly controlled composting facilities and recycling facilities.					
8-2	CT DEP will initiate discussion with the Connecticut General Assembly regarding options for funding, including directing a significant portion of any new funds to municipal and regional programs.	Legislative	High	Other = $$$	Short term	DEP
8-3	CT DEP will work with the CT Department of Economic Development and Community Development to identify the types of economic assistance that are needed and could be provided to businesses, especially recycling, composting or other businesses that directly support the goals of the Plan.	Administrative	High	Staff = $	Short term	DEP, State agency

(1) Costs estimates include start up & on-going implementation: $ = ~ 1Fte or < $100,000; $$ = 2-5 Ftes or $100,000 to $500,000; $$$ = >5 ftes or > $500,000; Other costs include capital costs, grants, consulting fees, etc

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Exhibit C

5-Year and 10-Year Authority Operating Forecast

November 30, 2013

The Connecticut Resources Recovery Authority

Forecast

FY 2014 – FY 2018

Connecticut Resources Recovery Authority
Forecast
FY 2014 – FY 2018

A. Introduction

Underpinning the protocol to the forecasting process and assumptions is the State Solid Waste Management Plan. As part of an ongoing forecasting process the Connecticut Resources Recovery Authority ("CRRA") creates a rolling five year forecast for continuing operations. CRRA chooses to forecast on a rolling five year basis due to the unique nature of the market and the industry to allow for recognition of changes due to a host of forecast drivers including State and regional economic activity, regulatory changes, fuel and energy prices, alternative capacity development, hauler mergers and acquisitions, new technology advancements and other changes.

The common baseline projections presented herein cover the five fiscal years June 30, 2014 through June 30, 2018. As the Cash Flow Projection and Operating Forecasts are inherently interdependent, CRRA has proceeded to develop a common baseline suitable for both purposes. Use of the fiscal year aligns the Cash Flow Projection with current and historical audited financial statements and adopted budgets. Use of a five year forecast period provides a more complete picture of the life cycle of capital improvements regularly required to keep CRRA's major plant and facilities operational as well as a minimum period needed to plan, design and engineer a more permanent replacement of the solid waste disposal capacity available through CRRA.

The major premises underlying the common baseline is that CRRA continues to operate its existing facilities at full capacity throughout the forecast period, and that CRRA landfills including associated reserves, current and long term liabilities are transferred to the State pursuant to Public Act 13-184. The common baseline is an existing conditions projection that adheres to all existing major contractual and legal requirements and past practice, unless otherwise stated in the assumptions. These existing conditions include what is known as the "Opt Out" level of the Tip Fee developed pursuant to Municipal Solid Waste Management Service Agreements between CRRA and 51 municipalities and multiple haulers.

CRRA has provided forecasts for the CRRA mission responsibilities in three distinct but interrelated divisions: the Authority (see Tab 2), Property Division (see Tab 3), and the Connecticut Solid Waste System Division ("CSWS") (see Tab 4). Note that as required by statute and regulations, a projection of expenses for the thirty year post-closure period has been developed for each landfill and is updated annually. CRRA anticipates that the State of Connecticut will assume the liabilities for these landfills and accordingly has not shown a projection for the Landfill Division.

The SouthWest Division Municipal Service Agreements ("MSA") and contract with the Bridgeport facility operator are expiring at the end of Fiscal Year 2014 and therefore future projections have not been developed for this Division. Future projections will be a function of ongoing discussion with the municipalities and haulers in that region. The Southeast Project operates with a separate Board of Directors, executive director, and staff and CRRA's participation in this project is primarily limited to service as a conduit to the Trustee for bonds and for providing budgetary, accounting, operational, contracting for ash disposal, and financial advice. A projection for CRRA administrative expenses related to the Southeast Project is included in the Authority Budget through 2017 when the existing Project terms first MSA extension expires with the Towns.

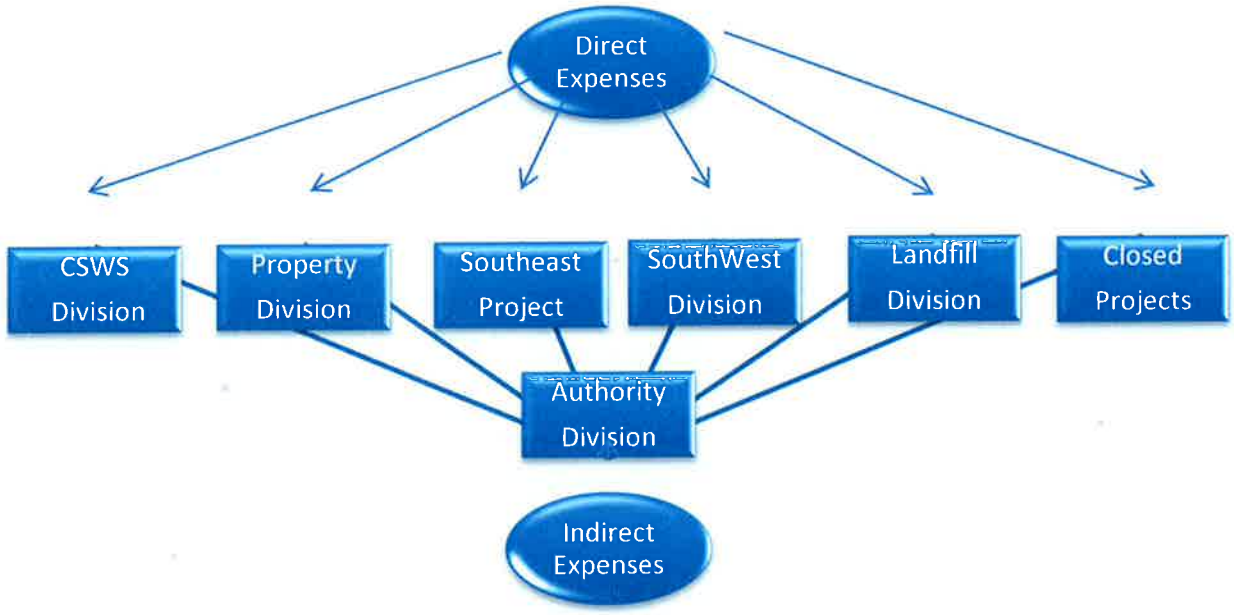
CRRA manages ongoing residual activities related to its closed and expired Projects and CRRA administrative costs are charged directly to the specific entities Post Project Reserve. These include the Bridgeport Project, the Wallingford Project, and the Mid-Connecticut Project (closed in Fiscal Year 2013). Each of the closed Projects no longer generate revenue but have funded reserves designated to cover residual liabilities related to the operations of those Projects. These potential liabilities have been previously identified and are monitored periodically. Any reserved funds that are deemed surplus are planned to be refunded to the appropriate municipalities.

B. Forecasting Process

CRRA has established an accounting structure that follows the contractual and legal structure arrangements (primarily hauler contracts and MSAs) of each of its Projects and Divisions. Each Project/Division forecast is developed under the auspices of a standalone

operation. Accordingly, each Project/Division's revenues and expenses are forecasted separately. In Fiscal Year 2014 CRRA will manage four operating Divisions, one operating Project, the Authority Division, and three closed Projects. In order to properly reflect the operating cost of each Project and Division, CRRA's practice is to directly charge operating expenses to Projects and Divisions when such expenses are dedicated solely to a single activity. Expenses remaining after direct charges reside in the Authority Division. The Authority Division is then allocated to the other Projects and Divisions based on an allocation methodology. Chart I depicts the flow of CRRA's expenses.

Chart I



CRRA operates the CSWS on a "Net Cost of Operation" basis and forecasts the particulars of these operations so that the revenues are balanced with the expenses. This balance is obtained through summing the expenses for CSWS and then subtracting non-tip fee revenues from the expense summation. The non-tip fee revenues consist of electric revenues, sale of recovered materials (recycling), interest earnings, and revenues from Spot and Contract Tons. Once these non-tip fee revenues have been subtracted from the expense summation, the remaining expense is divided by the projected Municipal Solid Waste ("MSW") deliveries to derive a tip fee. The expenses for the year are estimated through a bottom up process where each cost center reviews its anticipated activity for the upcoming year(s) and provides an estimate for their department's future expenditures and revenues. Included in this process is a collaborative cost development effort involving the contract plant operator who helps project the future expenses based on CRRA developed criteria. Once this information is assimilated into the appropriate Project/Division, management reviews the information for potential synergies and determines if all of CRRA's reserves are funded to the correct level. Chart II is an example of the calculation.

Chart II

Total Expenses
Less:
Electric Revenue
Sale of Recovered and Recycled Materials
Interest Income
Revenue from Spot and Contract Tons
Subtotal Remaining Expenses (Net Cost)
Divided by:
Budgeted MSA Tonnage
Derives:
Fiscal Year Tip Fee Pricing

THE AUTHORITY OPERATING FORECAST

EXPENDITURE ALLOCATION

Description	ADOPTED FY14	PROJECTED FY15	PROJECTED FY16	PROJECTED FY17	PROJECTED FY18
Personnel Services	$ 2,206,500	$ 2,134,000	$ 2,206,000	$ 2,276,000	$ 2,347,000
Non-Personnel Services	$ 1,650,500	$ 1,716,000	$ 1,757,500	$ 1,769,000	$ 1,804,000
Total Expenditures	$ 3,857,000	$ 3,850,000	$ 3,963,500	$ 4,045,000	$ 4,151,000

REVENUE REQUIREMENTS ALLOCATION

Description	ADOPTED FY14	PROJECTED FY15	PROJECTED FY16	PROJECTED FY17	PROJECTED FY18
Mid-Connecticut (A)	$ 264,000	$ 136,000	$ 2,000	n/a	n/a
Southeast Project (B)	$ 132,000	$ 141,000	$ 145,000	$ 113,000	n/a
Southwest Division (C)	$ 574,000	n/a	n/a	n/a	n/a
Landfill Division (D)	$ 396,000	n/a	n/a	n/a	n/a
Property Division	$ 354,000	$ 781,000	$ 835,000	$ 627,000	$ 561,000
CSWS (E)	$ 2,136,000	$ 2,791,000	$ 2,980,500	$ 3,304,000	$ 3,589,000
Interest & Other Income	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Total Allocations	$ 3,857,000	$ 3,850,000	$ 3,963,500	$ 4,045,000	$ 4,151,000
Balance	$ -	$ -	$ -	$ -	$ -

(A) Project ended on 11/15/2012.

(B) Project to end on 02/17/2017.

(C) Project to end on 6/30/ 2014.

(D) Division expected to be assumed by the State of Connecticut per PA13-184 by 6/30/2014.

(E) System commenced on 11/16/2012.

n/a = Not Applicable

Key Assumptions

1 Assumes expense increase at the rate of inflation which is estimated to be 2.2% annually.

2 Assumes 6 budgeted full time personnel reductions in FY 15 (1 in the Authority Division and 5 that are directly expensed in the other Divisions)

3 Assumes compensation expenses increase by 4% annually.

4 Assumes the Authority performs an upgrade to its computers and corresponding technology in FY15 and FY16 . Total cost of 50k.

CRRA - PROPERTY DIVISION FORECAST

REVENUE & EXPENDITURE SUMMARY

DESCRIPTION	ADOPTED FY14	PROJECTED FY15	PROJECTED FY16	PROJECTED FY17	PROJECTED FY18
South Central Facility Capacity	$ 239,000	$ 239,000	$ 239,000	$ 239,000	$ -
Jets	$ 5,823,000	$ 6,865,000	$ 6,377,000	$ 6,368,000	$ 6,368,000
Lease Income	$ 425,000	$ 433,000	$ 442,000	$ 451,000	$ 460,000
Education	$ 235,000	$ -	$ -	$ -	$ -
Total Revenues	$ 6,722,000	$ 7,537,000	$ 7,058,000	$ 7,058,000	$ 6,828,000

EXPENDITURE DETAILS

DESCRIPTION	ADOPTED FY14	PROJECTED FY15	PROJECTED FY16	PROJECTED FY17	PROJECTED FY18
Telecommunications	$ 2,500	$ 3,000	$ 3,000	$ 3,000	$ 3,000
Mileage Reimbursement	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000
Legal	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Insurance Consulting/Brokerage Service	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Insurance Premium	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Other Consulting Services	$ 200,000	$ 100,000	$ 50,000	$ 50,000	$ 50,000
Contribution to Facilities Capital Refurbishment Reserve	$ 300,000	$ 30,000	$ 100,000	$ 100,000	$ 100,000
Indirect Labor & Overhead - Administration	$ 354,000	$ 781,000	$ 835,000	$ 627,000	$ 561,000
Direct Salaries/Labor & Benefits - Administration	$ 31,000	$ 31,000	$ 33,000	$ 33,000	$ 35,000
Direct Salaries/Labor & Benefits - Operational	$ 25,000	$ 22,000	$ 23,000	$ 24,000	$ 24,000
Contribution to Solid Waste Future Development Reserve	$ 688,000	$ -	$ -	$ -	$ -
Contribution to Severance Reserve	$ 430,000	$ -	$ -	$ -	$ -
Subtotal 211 Murphy Road Operations Center, Net	$ 94,000	$ 95,000	$ 96,000	$ 97,000	$ 98,000
Subtotal 1410 Honey Spot Road	$ 95,000	$ 96,000	$ 97,000	$ 98,000	$ 99,000
Subtotal 171 Murphy Road	$ 45,000	$ 46,000	$ 46,000	$ 46,000	$ 46,000
Education	$ 278,000	$ 96,500	$ 96,500	$ 96,500	$ 96,500
South Central Facility Operating Charges	$ 220,400	$ 224,200	$ 228,000	$ 231,800	$ -
Jets Operating Charges	$ 3,129,000	$ 3,126,000	$ 2,935,000	$ 2,942,000	$ 2,946,000
Total Expenditures	$ 5,922,000	$ 4,681,000	$ 4,572,000	$ 4,379,000	$ 4,089,000
Operating Balance	$ 800,000	$ 2,856,000	$ 2,486,000	$ 2,679,000	$ 2,739,000
Transfer to the CSWS	$ 800,000	$ 2,856,000	$ 2,486,000	$ 2,679,000	$ 2,739,000
Balance	$ -	$ -	$ -	$ -	$ -

Key Assumptions

1 Assumes expense increase at the rate of inflation which is estimated to be 2.2% annually.
2 Assumes continuation of Jets trading order and upon maturity of the order the sale of the assets will produce sufficient net revenue to produce level of income.
3 Assumes a 50% reduction in the net cost of providing education services.
4 Assumes that all operating surpluses are transferred to the CSWS Division.

Connecticut Solid Waste System
FORECAST

The Forecast for Connecticut Solid Waste System ("CSWS") like the annual budget, is based on a net cost of operation methodology where the final calculation determines the tip fee. The tip fee is the amount necessary to generate revenues needed to recover the net costs after recognizing all other revenue sources such as electric revenues.

Capital Expenditures have been developed predicated on a five year time horizon and presume the continuing operation of the South Meadows Facilities. Annually the budget and forecast are reviewed to assess current technological advances, competitive market conditions and ongoing capital and operational costs. The attached forecast is predicated upon the assumption that the CSWS will be managed and capitalized to continue operations over the next 5 years. If a longer time frame is required for the continued operation of the South Meadows Facility then the Capital Expenditure program will need to be realigned to reflect this significant assumption change.

The contractual arrangements with the MSW suppliers incorporate an opt-out price provision which permits unilateral withdrawal from delivery obligations if the CSWS tip fee exceeds that opt-out price. It is intended to protect the Towns and haulers for unsupportable fee increases or if the tip fee yields a price in excess of reasonable alternatives. At that point the Towns and haulers are in the position to continue with CRRA or opt to an alternative disposal provider.

The chart shown in the accompanying CSWS Forecast indicates the need for closure of a gap between the calculated net cost of operation tip-fee and the opt-out price .

The gap ranges from $4.1 million FY 16 to $2.2 million in FY 18.

Table I below identifies opportunities for mitigating the gap.

Table I
CSWS
Gap Mitigation Options

I.	**Electric Revenues**	**Value**
	Effect $.01/KWH change	$4,170,000
	A. Wholesale Day Ahead Market Price Increase	
	B. Bilateral Purchase Agreement with State of Connecticut	
	C. Convert part of electric sales to a fixed firm commitment	unknown
	D. Improvement in Renewable Energy Credit's	
	E. Virtual Net Metering	
II.	**Tip Fee Revenues**	
	A. Increase tip fee beyond opt-out price (each $1/ton)	$ 442,000
	B. Replace spot revenues with higher value municipal/ commercial firm contract tons	unknown
	C. Increase in spot prices (each $1/ton)	$ 91,000
	D. Increase in Contract Tonnage Pricing (each $1/ton)	$ 110,000
	E. Use of FY13 CSWS surplus	$ 988,000

III. Other Revenue's

A. Elimination of $10/Ton Recycling Rebate	$ 415,000
B. Partial Reduction in Recycling Rebate	unknown
C. State bonding of turbine overhaul costs ($3.7 annual for FY 15 and FY 16)	$7.4 million
D. Hartford Landfill Post Closure Reserve Funds	unknown

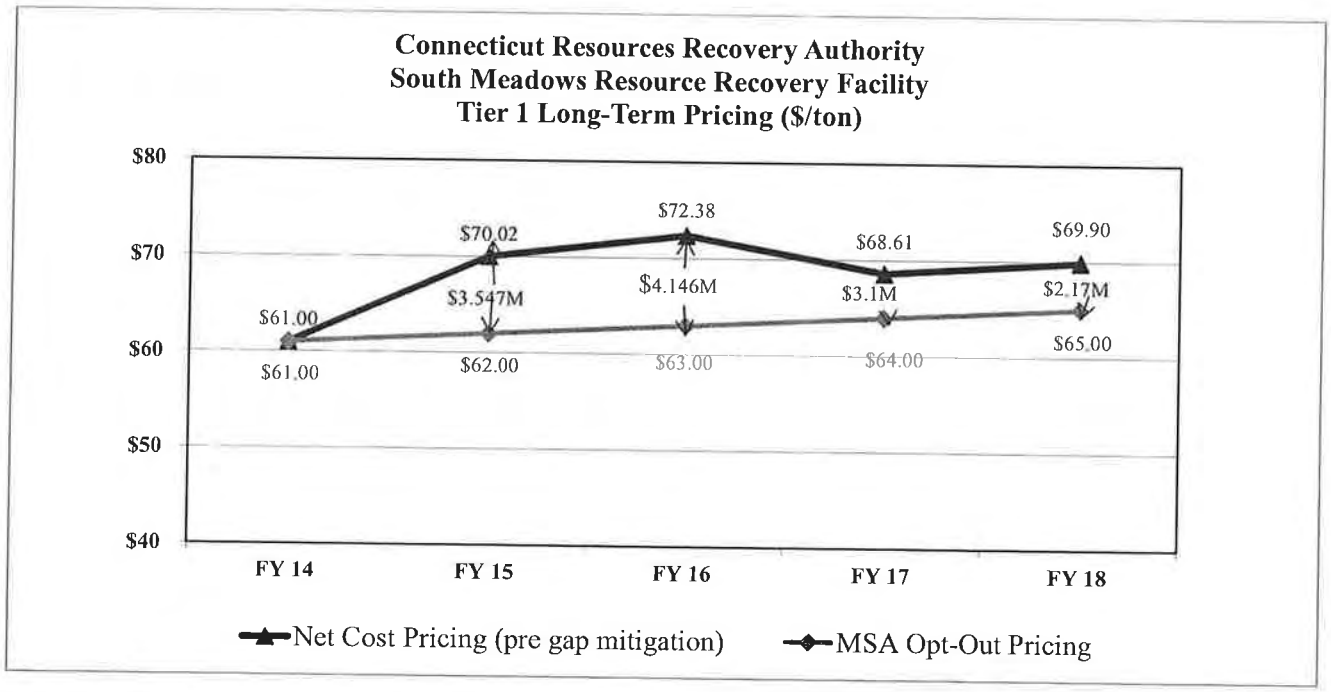
IV. Operating Expenditures

A. Eliminate City of Hartford Pilot	$ 2,200,000
B. Reduce City of Hartford Pilot	unknown
C. Eliminate MSW Contract Enforcement Program	$ 175,000
D. Reduction in Legal Expenditures by 10%	$ 100,000
E. Elimination of Solid Waste Assessment	$ 1,022,000

V. Other Initiatives

A. Sale of miscellaneous property and land	
1. Collins Building (171 Murphy Road)	$ 827,000
2. Stratford Facility and land (1410 Honeyspot Road)	$6.6 million
B. Elimination of Property Division Facilities Capital Reserve and Use Funds for CSWS	$ 300,000
C. Direct State Support	unknown
D. Longer Term Financing of Capital Expenditures	unknown

CRRA - CONNECTICUT SOLID WASTE SYSTEM (CSWS)
FORECAST FISCAL YEAR 2014 THROUGH FISCAL YEAR 2018



Key Tip Fee Assumptions

1. Assumes total municipal and hauler tonnage deliveries of 442,000 @ tiered rates.
2. Assumes contract deliveries of 175,000 tons at individually contracted rate.
3. Assumes spot deliveries of 91,000 tons at market rates.
4. Includes the transfer from the Property Division of $800k in FY14, $2.856M in FY15, $2.4867M in FY16, $2.679M in FY17, and $2.739M in FY18.
5. FY15 through FY18 includes the extension of 40,000 tons of contract waste set to expire in FY14.
6. Reflects diversion of 9,000 tons (4,000 to Wallingford WTE and 5,000 to lowest price alternative assumed to be $75.50/ton)for FY14 through FY17 and all of the diverted tons to the lowest alternative location in FY18.
7. Reflects the burning of processed residue.
8. FY15 through FY18 reflects NAES's full operating budget (reduced by a one-time $750k in FY14). After FY 14 non-labor expenses are maintained at a continuous level and labor is increase by 4% year over year.
9. Total estimated kWh sales of 417M kilowatts, based on 612 kWh/ton of RDF processed.
10. Assumes available electricity to be sold in the day ahead market at a weighted average rate of $0.0461 per kWh for FY14, $0.0516 per kWh for FY15, $0.0495 per kWh for FY16, $0.0481 per kWh for FY17, and $0.0471 per kWh for FY18.
11. Reflects annual RRF capacity Payments of $1.34M.
12. FY 14 reflects Rec II payments of $200,000.
13. FY 15 through FY 18 reflects Rec II payments of $160,000.
14. The Capital Reserve is developed as a 5 year rolling capital reserve.
15. Reflects capital reserve contributions of $5.9M in FY14, $13M in FY15, $12M in FY16, $9M in FY17,and $8M in FY18 .
16. Legal expenses included contributions to Legal reserve of $500k in FY14 thru FY16 and $750k in FY17 and FY18. In addition the operating account has $500k budgeted for FY14 and FY15 and $250k budgeted for FY16. After FY16 all CSWS legal expenses will be funded from the Legal Reserve.
17. Reflects a PILOT to the City of Hartford of $2.2M for each year.
18. Assumes recycling deliveries in accordance with municipal contracts.
19. Assumes $10 per ton recycling rebate in each year.
20. Assumes the reimbursement of the Hartford Landfill Post Closure Reserve borrowings will come from asset monetization or that the State will acquire the landfill assets and assume all liabilities negating the need for reimbursement.
21. Assumes a contribution of $250k to the CSWS Risk Fund annually.
22. Assumes an annual State of Connecticut solid waste assessment payment of $1.022M.
23. Assumes CPI increases by 2.2%.

SOUTH MEADOWS SYSTEM - FIVE YEAR CAPITAL PLAN

FY14 - FY18 Capital Improvement Plan ($000's)

WASTE PROCESSING, POWER BLOCK, ROLLING STOCK, TRANSFER STATIONS

CAPITAL EXPENDITURES RESERVE	FY14 Proposed	FY15 Projected	FY16 Projected	FY17 Proposed	FY18 Projected
Reserve Balance as of July 1st	**$ 3,200**	**$ 1,000**	**$ 1,435**	**$ 1,430**	**$ 1,660**
Waste Processing Facility (WPF)	$ 1,330	$ 1,775	$ 1,065	$ 845	$ 675
Power Block (PBF)	$ 6,244	$ 10,750	$ 10,260	$ 7,175	$ 6,275
Rolling Stock (RS)	$ 500	$ -	$ 640	$ 710	$ 760
Transfer Stations (TS)	$ 35	$ 40	$ 40	$ 40	$ 40
TOTAL WPF/PBF/RS/TS	**$ 8,109**	**$ 12,565**	**$ 12,005**	**$ 8,770**	**$ 7,750**
Contributions to Capital Reserve	$ 5,909	$ 13,000	$ 12,000	$ 9,000	$ 8,000
Estimated Reserve Balance	$ 1,000	$ 1,435	$ 1,430	$ 1,660	$ 1,910

The Connecticut Resources Recovery Authority

Forecast

FY 2014 – FY 2024

A. Background

The above stated forecast, prepared for CRRA's fiscal years 2014 through 2018, determines the estimated net-cost pricing that CRRA's customers would pay absent any significant change in CRRA's current business model. For the purposes of this section, it is referred to as the "Existing Conditions Forecast". Under the Existing Conditions Forecast, the estimated net-cost pricing exceeds the opt-out price established in CRRA's customer contracts. The difference between the opt-out price and estimated net-cost pricing represents the deficit CRRA will need to close through the adoption of certain "Gap Mitigation Options" previously identified.

Those Gap Mitigation Options were considered in the feedback process with the CRRA Board of Directors, and with the Resource Recovery Task Force as contemplated by State statute. As a result of this process, the Existing Conditions Forecast was extended through CRRA's fiscal year ending June 30, 2024 and alternative mitigation options were considered and are now reflected in an updated and extended forecast. For the purposes of this section, this is referred to as the "Ten Year Forecast".

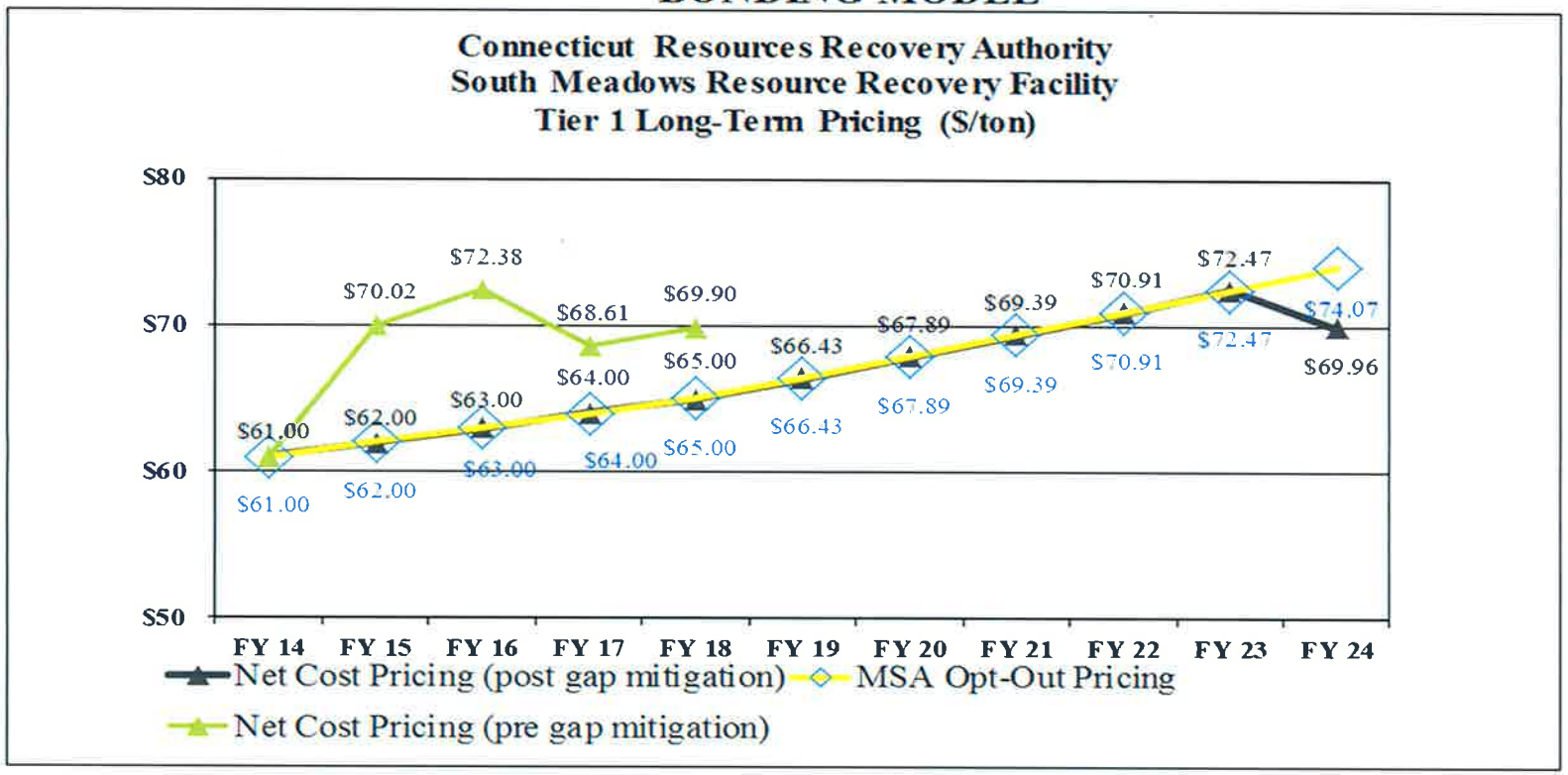
The Ten Year Forecast reflects a financially viable CRRA for the ten plus years ending June 30, 2024 as the mitigation options incorporated within the Ten year Forecast permit the tip fee to remain at or below the established opt-out price. During this 10 year period, the State's MSW may continue to be managed consistent with the State's Solid Waste Management Plan, such plan may be reevaluated by policy makers, new technology chosen, and CRRA will be available to continue to implement certain aspects of the Solid Waste Management Plan as envisioned by State statute and discussed in the body of the Transition Plan.

The following summarizes the changes reflected in CRRA's Ten Year Forecast. Unless otherwise noted, all assumptions reflected in the Existing Conditions Forecast remain unchanged and were continued into the Ten Year Forecast:

- The Ten Year Forecast now includes 11 years ending June 30, 2024.
- The Ten Year Forecast period accommodates a 10 year bond issue which is assumed to be in place by July 1, 2014.
- The bond is sized to close the $12.96 million deficit identified in the Existing Conditions Forecast considering:
    - the debt service that will be incurred;
    - reserves that that are presently available for the major maintenance program;
    - additional revenues that can be foreseen in the price for spot and contract waste; and
    - cost savings measures that will be imposed early in the forecast;
- The resulting bond size is $17.5 million for a 10 year term and 3.5% interest.
- Additional reserves being made available totaling $3.0 million.
- The cost savings measures that are reflected in the Ten Year Forecast are as follows:
    - A 5 year salary freeze. The Existing Conditions Forecast had incorporated 4% annual increases in compensation which accumulate and contribute to the projected deficits.
    - A reduction in the Hartford PILOT of $700,000 (from $2.2 million to $1.5 million). The $1.5 million reflects what CRRA believes is 100% of the true property tax that would be derived from the plant on the assessed value basis.
    - A permanent undefined $200,000 reduction in the Non Personnel Services budget.
- A $5 increase in price for spot and contract waste is achieved in FY 2015 which increases proportionate to the opt-out price. In addition, 30,000 tons of spot waste is projected to convert to Tier 1 contract waste by FY 2019.

- The above points take into consideration the forecasting elements CRRA knows and can control best. This leaves the price CRRA receives for its electric generation as the remaining, less predictable, variable.
- For the first 5 years of the Ten Year Forecast, CRRA has kept (unchanged) its Existing Conditions Forecast of electric sales prices. The previously identified deficit in these years is addressed by reducing the capital reserve contributions that are driving the deficit. This approach draws down on bond proceeds.
- For the remainder of the Ten Year Forecast, CRRA is using additional electric sales price forecast data provided by its independent energy consulting firm, LaCapra Associates. See Exhibit N for additional information regarding LaCapra Associates capabilities and qualifications.

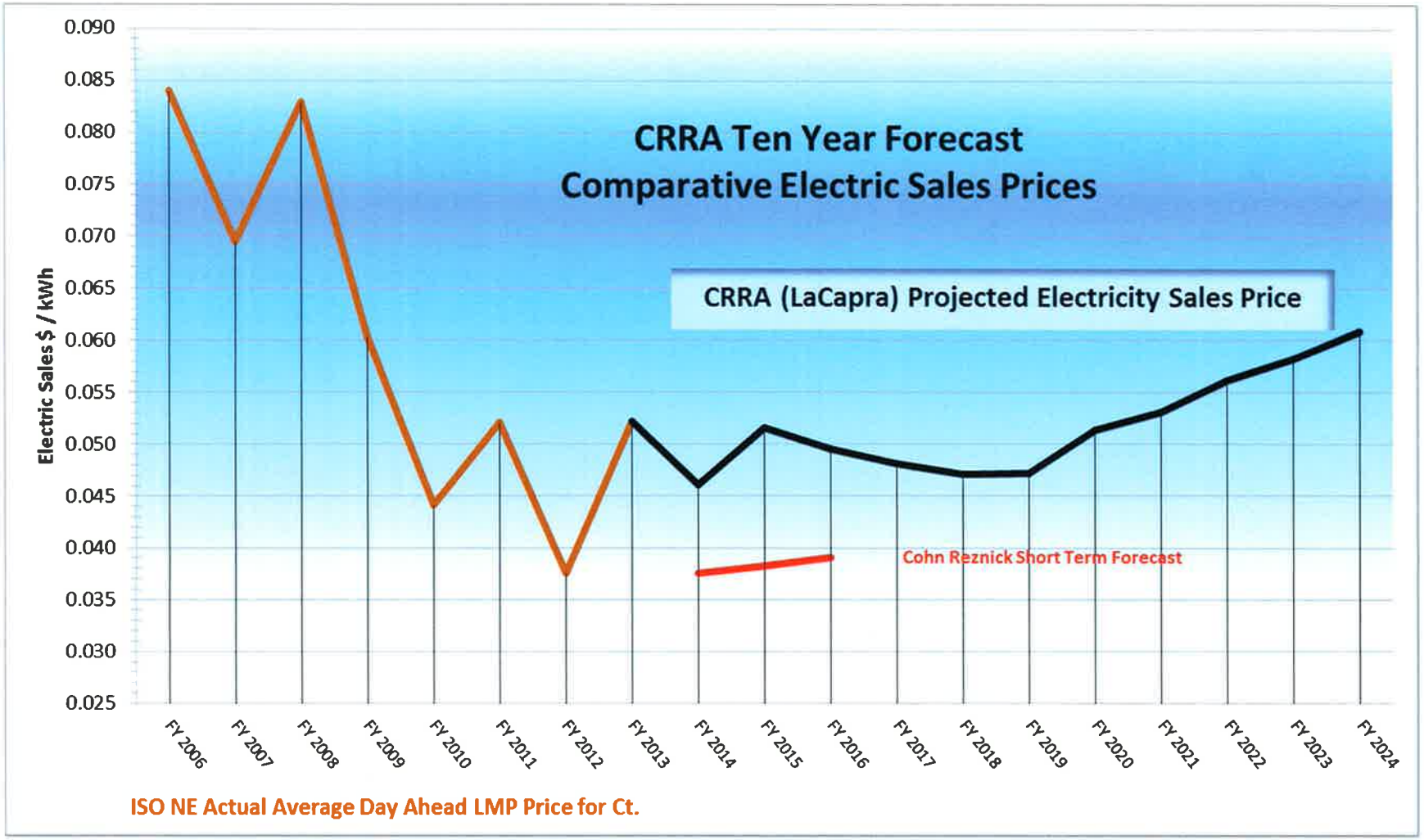
CRRA - CONNECTICUT SOLID WASTE SYSTEM (CSWS)
FORECAST FISCAL YEAR 2014 THROUGH FISCAL YEAR 2024
BONDING MODEL



Changes to Key Tip Fee Assumptions

All forecast assumptions listed in the Existing Conditions Forecast for CSWS apply to this 10 year forecast except as modified below:

1. Assumes a $17.5M bonding in FY 15 with a 10 year level payment of $2,104M annually
2. Assumes a one-time transfer of $3.0M from other CRRA reserves and or operating accounts to the Capital Expenditure Reserve in FY15
3. Assumes salaries are frozen through FY18 and increase at a 2.2% rate thereafter
4. Hartford PILOT is reduced to $1.5M annually.
5. A permanent $200,000 expense reduction is applied in FY15
6. Non-MSA tonnage increased by $5 per ton in FY15 and increase by the change in the opt-out price thereafter
7. Assumes 30,000 tons of spot waste is converted to tier rate waste in FY19
8. Transfer from Property Division in FY 18 reduced from $2.73M to $954,000. Transfers cease after FY18.
9. Electric rates assumed at consultant's projected price levels



ISO NE Actual Average Day Ahead LMP Price for Ct.

Exhibit D

Solid Waste Disposal Market Assessment

November 30, 2013

Solid Waste Disposal Market Assessment

Prepared for:

Connecticut Resources Recovery Authority

CONNECTICUT RESOURCES RECOVERY AUTHORITY

CONNECTICUT'S RECYCLING LEADER

Prepared by:

GBB

SOLID WASTE MANAGEMENT CONSULTANTS

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November 5, 2013

Printed on recycled paper

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Table of Contents

Tables

Figures

1. Introduction

In 2013, State legislation (Public Act No. 13-285, Substitute Senate Bill No. 1081, An Act Concerning Recycling and Jobs) was enacted requiring the Connecticut Resources Recovery Authority (CRRA) to prepare a Transition Plan to evaluate the future role of CRRA and its facilities. The CRRA is in the process of responding to the variety of business challenges generated as a result of the Transition Planning effort and associated CRRA management planning. This report serves to assist CRRA by presenting an evaluation of the solid waste disposal market's potential response to the loss of publicly owned resource recovery facilities (RRF) in the northeastern U.S. The report used the evaluation of conditions at other facilities throughout the region to generate conclusions about the impacts to the Connecticut disposal market should publicly owned RRFs close.

In developing this report, GBB's specific tasks were to:

- Identify publicly owned RRFs in the Northeastern/Mid-Atlantic region (Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Maryland and Virginia).
- Evaluate the market conditions supporting the RRFs, e.g. flow control, market participation.
- Evaluate the waste disposal market condition in the regions around the RRFs.
- Provide an assessment of market competitiveness in the regions around the RRFs with and without landfill availability.
- Produce an economic market assessment report, in conjunction with others, that addresses the impacts of eliminating publicly owned RRFs.

In developing this report, GBB's methodology was as follows:

- Identify publicly owned RRFs in the Northeastern/Mid-Atlantic region (Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Ohio, Maryland and Virginia).
- For each facility, determine:
  - The permitted capacity and typical throughput
  - The sources of waste that flow to the facility, and the mechanism through which they flow (e.g. flow control, public residential collection, short term contracts)
  - The tipping fees levied for each customer group and contract/agreement type
  - The approximate wasteshed, or region from which the facility draws waste
  - Tipping fees at other disposal facilities within or nearby the wasteshed
- Evaluate each facility to assess what may happen if the facility were to close – where the waste may flow to, and how the economics of disposal may change for the communities affected by this change. GBB utilized the data collected on tipping fees at other disposal facilities within or nearby the respective wasteshed during this effort.

2. Facilities and Market Conditions Supporting RRFs

The facilities assessed in this report are only those in the region included in the study that are publicly owned. Out of the 42 RRFs in the region, 13 are publicly owned.

Table 1 RRFs in Study Region

State	RRFs	Publicly Owned RRFs
CT	6	2
MA	7	0
MD	3	2
NJ	5	1
NY	10	3
OH	0	0
PA	6	3
VA	5	2
Total	**42**	**13**

For each facility shown in Figure 1, GBB evaluated the waste disposal market condition in the region around the RRF.

Figure 1 Map of Publicly Owned RRFs

Information about the publicly owned RRFs was collected through analysis of facility annual reports, City or County planning documents, industry reports and conference presentations on waste to energy facilities, (confidential) inquiries to City solid waste and facility managers, and published gate fees. The publicly owned RRFs in this region receive waste through a variety of agreement and source types:

- Flow control
- Public residential collection
- Interlocal agreements with nearby communities
- Residential contracts/franchise agreements with private haulers
- Commercial contracts/franchise agreements with private haulers
- Short Term contracts with public and private entities
- Long Term contracts with public and private entities
- Other guarantees

2.1 Massachusetts

There are no publicly owned RRFs in the State of Massachusetts.

2.2 Maryland

2.2.1 Montgomery County Resource Recovery Facility – Dickerson, MD

- **Owner:** Northeast Maryland Waste Disposal Authority (NMWDA)
- **Operator:** Covanta Energy of Montgomery County
- **Facility Capacity and Throughput:** 1800 TPD Design / 1466 TPD Actual

The Montgomery County RRF sources waste from residential and commercial entities within Montgomery County – through pre-payment of disposal fees via county service fees paid with property taxes and contract with NMWDA, and through competitive tip fees at the County's Transfer Station.

Table 2 Montgomery County RRF Waste Sources

Waste Source		Tipping Fees
Residential Contract	55% - County has collection districts for residential waste	No tip fee charges to resident waste - residents pay for solid waste services through property taxes
Other Guarantees	45% - Waste comes through tip fee - competitive for area. Commercial establishments pay system benefit charge	$56 per ton (2013) for commercial and private hauler waste originating in county

All residences and commercial establishments in the County are assessed a systems benefit charge, which pays for a portion of the solid waste system. Residents of the unincorporated County are assessed an additional disposal fee as a line item on their tax bill. The haulers contracted to collect residential waste deliver waste to the facility at no charge. Commercial

haulers pay a competitive tip fee, encouraging haulers to deliver to the RRF instead of hauling to another facility outside the County.

The Authority has contracts with Mirant Americas Energy Marketing, PEPCO, and PJM Interconnection for its energy sales. The Authority receives Renewable Energy Credits for the sale of electricity (WTE is considered a producer of renewable energy in the State of Maryland).

2.2.2 Harford WTE Facility - Joppa, MD

- **Owner:** Northeast Maryland Waste Disposal Authority
- **Operator:** Energy Recovery Operations, Inc.
- **Facility Capacity and Throughput:** 360 TPD Design / 328 TPD Actual

The Harford WTE facility sources its waste from Harford County haulers, including the towns of Aberdeen, Joppa, and Belair, by sustaining competitive tip fees.

Table 3 Harford WTE Facility Waste Sources

Waste Source		Tipping Fees
Other Guarantees	100% - All haulers in the county come to the facility through its tip fee and location	$68 for in-county waste only; $158 for special waste (tires, documents)

The facility's current steam customer is the U.S. Army's Aberdeen Proving Ground; therefore, plans for expansion or modification are in part dependent on the Army's steam needs. The base began planning to construct its own facility in 2011 without Authority or County involvement. The Army owns the facility and is leasing it to the County through March of 2016. The County plans to have waste directed to Baltimore County's landfill, and has an agreement to that effect.

The County pays the Authority annually to cover the debt service for the facility. The Authority pays a management fee plus incentives to the operator. The facility accepts up to 5,000 tons of tires, and offers secure document destruction services.

2.3 Connecticut

2.3.1 Wheelabrator Lisbon - Lisbon, CT

- **Owner:** Eastern Connecticut Resources Recovery Authority
- **Operator:** Wheelabrator Lisbon, Inc.
- **Facility Capacity and Throughput:** 500 TPD Design / 509 TPD Actual

Wheelabrator Lisbon sources its waste from interlocal agreements with ECRRA (Middletown) and Lisbon (a host community agreement), out-of-state waste and special wastes. The facility serves the cities of Middletown and Lisbon, and 26 other towns in northeastern and other parts of Connecticut.

Table 4 Wheelabrator Lisbon Waste Sources

Waste Source		Tipping Fees
Interlocal Agreements	13% - Agreement with ECRRA (Middletown) and Lisbon - host community agreement	$67.03 for ECRRA - Middletown is the only member of the Authority; City of Lisbon pays no tip fee
Short-Term Contract	12% - Out of state waste and special waste	N/A
Long-Term Contract	75% - One to five-year contracts with private haulers bringing waste from Putnam, Colchester, and other towns	$64.66 for 26 towns in Northeastern CT; $65 for transfer stations in Middletown, Stratford, Newtown, Ridgefield

In its agreement with Wheelabrator for the operation of the facility, ECRRA has a minimum waste guarantee of 32,850 tons. The agreement has been modified by amendment, the City of Middletown is responsible for delivering 6,718 tons, and Wheelabrator is to make up the remaining 26,132 tons, which it pays to bring to the facility. Lisbon is the host community and can deliver up to 2,050 tons per year at no cost, and receives a $0.50 in royalty fees per ton of waste brought to the facility (approximately $250,000 per year).

The waste from the 26 towns in Connecticut is committed to this facility in three and five-year contracts, and tip fees are kept competitive for the area. A large portion of the Housatonic Resource Recovery Facility's waste has come to the facility in the past, though much of this waste has been redirected to the Wheelabrator Bridgeport facility since 2010, causing this facility to make up that tonnage from other sources. ECRRA has started to evaluate possible future facility and system changes, including expanding to add a third boiler line, and/or contracting to build a rail spur and a "bale to rail" facility, which could transfer in baled waste from other areas of the state to be combusted during seasons when waste generation in the 26 towns is low.

Electricity from the facility is sold to Connecticut Power & Light.

2.4 New York

2.4.1 Oswego County Energy Recovery Facility - Fulton, NY

- **Owner:** Oswego County
- **Operator:** Oswego County
- **Facility Capacity and Throughput:** 200 TPD Design / 168 TPD Actual

Oswego County ERF sources its waste through flow control legislation that directs all waste in the County to the facility, as well as the public residential collection in the town of Fulton. The facility serves Oswego County.

Table 5 Oswego County ERF Waste Sources

Waste Source		Tipping Fees
Flow Control	89% - Flow control legislation for whole county - relatively competitive tip fee for all in-county waste	$58 for in-county waste; $100 for special waste (document destruction, pharmaceuticals, industrial waste)
Public Residential	11% - Town of Fulton has municipal collection	$58 for in-county waste

Oswego County has had well-enforced flow control since 2008, both for waste and recyclables, and only accepts waste from within Oswego County (except special wastes, which may be brought in from outside the county). Private haulers collect waste and bring it to the ERF, and collect recyclables and deliver them to county facilities, from which they are transferred to a Waste Management MRF in Liverpool, NY. The facility's tip fees are competitive to other public facilities in the region (the Town of Fulton's landfill has a commercial rate of $52 per ton), though not to all privately owned facilities (the Seneca Meadows landfill 48 miles away charges tip fees as low as $18 to $20 per ton).

2.4.2 Dutchess County Resource Recovery Facility - Covanta Hudson Valley - Poughkeepsie, NY

- **Owner:** Dutchess County Resource Recovery Agency
- **Operator:** Covanta Hudson Valley Renewable Energy
- **Facility Capacity and Throughput:** 510 TPD Design / 471 TPD Actual

Covanta Hudson Valley sources its waste through an interlocal agreement with the City of Poughkeepsie, and through long-term contracts with private haulers. The facility also receives spot waste from private haulers. The facility serves Dutchess County.

Table 6 Dutchess County RRF Waste Sources

Waste Source		Tipping Fees
Interlocal Agreements	8% - City of Poughkeepsie	$79 for City of Poughkeepsie
Long Term Contract	92% - Royal Carting and other private haulers; Private haulers are licensed by County - Condition of license	$73.75 for Royal Carting - dominant hauler - receives 8% discount on tip fee in return for committing 115,000 tons of waste to the facility; $80 for various private haulers; Spot market varies - transfer station waste from NY, NJ, CT

Over the past five years, the facility has seen decreases in tonnage due to cheaper disposal facilities in the area, and is reliant on a few private haulers for the majority of the facility's waste. The hauler primarily responsible for this waste is given a discounted tip fee reliant on a put or pay contract to deliver 115,000 tons annually.

In the region, Ulster County pays nearly $10 less for waste transport and disposal. It has been subsidized by the Dutchess County Resource Recovery Agency to cover revenue shortfalls caused by tip fees that were lowered to be competitive with the region. This led to discussions about closing the facility after the end of its current operating contract in 2014. As the deficit was reduced from $4 million in 2012 to $2 million in 2013, Ulster County has stated that it will make efforts to eliminate this shortfall and modify the operating contract at the end of its term, so that it is more beneficial for the County (the current agreement has been criticized as being one sided in favor of the operator).

2.4.3 Covanta MacArthur Renewable Energy - Ronkonkoma (Islip), NY

- **Owner:** Islip Resource Recovery Authority
- **Operator:** Covanta Renewable Energy, Inc.
- **Facility Capacity and Throughput:** 485 TPD Design / 480 TPD Actual

Covanta MacArthur sources its waste from public and private haulers that perform residential and commercial collection in Islip's collection district. The facility also has a large amount of capacity made available to Covanta commercial customers, and commercial and spot market waste in the region. The facility serves the Town of Islip.

Table 7 Covanta MacArthur Waste Sources

Waste Source		Tipping Fees
Public Residential	5% - Seven collection districts including Dept. of Public Works and the Islip Airport	No tipping fees charged for residential waste - solid waste functions paid for by residents through special solid waste tax, which also covers collection
Residential Contract/Franchise	80% - 65 collection districts. Town of Islip 21% commercial, 76% residential	$85 for all commercial waste
Long-Term Contract	9% - Covanta Accounts	Variable spot market fee for waste from Covanta Westchester Kisco Transfer Station
Other Guarantees	6% - Condition of license to haul. Commercial waste from businesses and restaurants	$85 for all commercial waste

The Islip Resource Recovery Authority (IRRA) is an enterprise fund, and has the RRF, a MRF, a yard waste composting facility, a clean fill, and a closed landfill. Commercial waste collected in Islip must be taken to the RRF as a condition of their hauling license. The Town pays the tip fee for franchised refuse haulers and directly remits the fee to the IRRA. The IRRA directs some fees back to the Town to pay for administrative costs and to help fund activities of the other facilities. The facility's electricity production has been low in the past five or so years due to the impact of APC equipment added, and the fact that MSW tons have declined in Islip in both the residential and commercial sectors since 2008. To offset the loss of tonnage, the Authority entered into an agreement with Covanta stating that

Covanta would take additional waste from its Westchester transfer station, and the Authority would share in the revenues from this waste. In 2012, the revenue for tipping fees increased by 5% when compared to 2011, due to Hurricane Sandy, which impacted the collection of clean debris and yard waste. The facility's price for electricity in 2012 was $0.0572. In Q2 2013, Covanta's MacArthur service fee contract was extended by 15 years to 2030.

2.5 New Jersey

2.5.1 Union County Resource Recovery Facility – Rahway, NJ

- **Owner:** Union County Utilities Authority
- **Operator:** Covanta Energy of Union County
- **Facility Capacity and Throughput:** 1440 TPD Design / 1502 TPD Actual

The Union County RRF sources its waste through municipal collections in Union County and through private haulers serving Union and nearby communities. The facility serves 21 communities in Union County, and communities in Passaic, Hudson, Somerset, and Bergen Counties.

Table 8 Union County RRF Waste Sources

Waste Source		Tipping Fees
Public Residential	32% - Agreement with 14 localities within County - all have municipal collection	$68.05 for Union County municipalities with flow control ($2.50 is administrative charge)
Interlocal Agreements	26% - Agreement with seven localities and County - in these localities, there is residential collection by subscription	$97.48 for long-term contracts with seven towns (includes $31.93/ton EIC charge)
Long-Term Contract	42% - Other contracts of various duration with private haulers service Passaic, Somerset, and Bergen Counties	$72 -$84 for various haulers from NY State, mostly with manufacturing/industrial wastes and documents

In 1998, when flow control was struck down in New Jersey, the 14 localities in Union County that have municipal collection signed agreements with the County directing their waste to the RRF. They pay a tip fee and an administrative charge, which goes to the Authority. Seven localities have residential collection through private haulers, whose contracts state that all waste from these towns will flow to the RRF. These towns pay an additional environmental investment charge (EIC), which is dedicated to paying the Authority's debt service for the RRF. This agreement runs through 2023. Covanta is paying approximately two-thirds of the facility debt, under its lease agreement with the Authority. Under the Authority's agreement with Covanta, the Authority sends its waste to the facility, and it entered into voluntary agreements with the 21 localities in its jurisdiction. Covanta also agreed to offer unused capacity to the open market.

2.6 Pennsylvania

2.6.1 Susquehanna Resource Management Complex (formerly Harrisburg Resource Recovery Facility) – Harrisburg, PA

- **Owner:** Lancaster County Solid Waste Management Authority
- **Operator:** Covanta Energy
- **Facility Capacity and Throughput:** 800 TPD Design / 768 TPD Actual

The Susquehanna Resource Management Complex (SRMC) sources its waste from public residential collections, interlocal agreements and long-term contracts with surrounding counties; and short-term contracts, primarily with the private sector. The facility serves the City of Harrisburg and the remainder of Dauphin County, as well as haulers and municipalities in other nearby counties.

Table 9 Harrisburg WTE Waste Sources

Waste Source		Tipping Fees
Public Residential	13% - City of Harrisburg	$190 for City of Harrisburg
Interlocal Agreements	44% - Dauphin County	$72.60 for Dauphin County - Authority remits $4.90/ton back to County
Short Term Contract	27% - Currently uncommitted waste	$21.50 for various spot market waste; $75 for special waste
Long Term Contract	16% - Perry, Schuylkill, Northumberland, and Cumberland Counties	$39.06 for Perry, Schuylkill, Northumberland, and Cumberland Counties

In the fall of 2011, the City of Harrisburg declared bankruptcy, leading to arranging for the purchase of the facility by the Lancaster County Solid Waste Management Authority (LCSWMA). LCSWMA elected to purchase this facility instead of adding a third line to its RRF in Marietta. The facility has exceptionally high debt service, due to its history and upgrades while under ownership by the City of Harrisburg. Its agreements with the City of Harrisburg are set by contract for five years, to start at $190 per ton through 2019, and then raised to $195 per ton. Under the agreement of sale, Dauphin County designates LCSWMA to manage municipal waste generated in the county for the next 20 years and guarantees minimum revenues per year; Highspire Borough and Swatara Township, which currently take their trash to York County, would use the SRMC when their contracts expire in 2016. Dauphin County has agreed to a graduated fee for trash haulers. It would be increased by $2.91 per ton, starting in January 2014. Electricity generated at the facility will be purchased by the State Department of General Services, with a 2013 price of $0.04022 per Kwh. Some conditions of the sale:

- The Harrisburg Authority permanently transfers ownership of the SRMC to LCSWMA, which includes ownership of all real estate, buildings, structures, utilities and improvements.
- The Harrisburg Authority transfers the balance of the post-closure funds for the SRMC and the ash landfills to LCSWMA.
- The Harrisburg Authority transfers to LCSWMA $8 million from their bond indenture funds, to be used as part of the SRMC acquisition price.

- LCSWMA will pay a total acquisition price of $130,736,365:
  - $24 million subordinate loan
  - $8 million from The Harrisburg Authority indenture funds
  - $98 million asset purchase price (subject to change due to interest rate changes)
- LCSWMA will not assume any previous debt or liability from The Harrisburg Authority.
- LCSWMA and The Harrisburg Authority will enter into an Operating Agreement in which LCSWMA will assume the conditions of the SRMC's environmental permits from the PA Department of Environmental Protection, until the permits are reissued in LCSWMA's name.
- LCSWMA will cover the cost of transportation and disposal of all ash generated at the RRF for the first 54 months of operation, after which Dauphin County will assume the cost of those responsibilities.

Combined, the 20-year waste delivery agreements with Dauphin County and the City of Harrisburg, plus the electric contract, guarantees 82 percent of revenues for the project, according to LCSWMA leadership. The LCSWMA plans to maintain and upgrade the facility, to further improve efficiency.

2.6.2 Lancaster County Resource Recovery Facility – Marietta, PA

- **Owner:** Lancaster County Solid Waste Management Authority
- **Operator:** Covanta Energy of Lancaster County
- **Facility Capacity and Throughput:** 1200 TPD Design / 1012 TPD Actual

The Lancaster County RRF sources waste through long term contracts with private haulers, and through short-term contracts for special wastes and residual waste. The facility serves communities and customers in Lancaster County.

Table 10 Lancaster County RRF Waste Sources

Waste Source		Tipping Fees
Short-Term Contract	25% - Mix of contracts for residual and special waste	$190 for residual waste
Long-Term Contract	75% - Contracts with County private haulers - five-year renewable contracts	$62.80 for some haulers with five-year contracts; 2013 tip fee for Dauphin County not to exceed $77.09

MSW constituted about 67% of total tonnage delivered to the authority in 2012 and accounted for 51% of total revenues and 75% of tipping fees or $26.2 million. Special waste (~70,000 tons annually), including pharmaceuticals, dewatered wastewater sludge, industrial byproducts, documents, and controlled substances accounted for 25% of tipping fees. In 2012, 97% of MSW delivered was pursuant to contracts, which were recently renewed and now extend to December 2017. The county's six largest haulers accounted for approximately 65% of MSW deliveries in 2012. The balance of waste tonnage, 35%, is special waste delivered under contract with various waste generators and transporters.

Tip fees charged by the authority in 2012 remained below the contractually permitted maximum of $78.20, which declines to $73.20 with the 2012 renewal and extension of hauler contracts. Management ensured the delivery of MSW and construction and demolition waste into the system through short-term contracts with haulers, minimizing short-term competitive pressure. Historically, the authority's tip fee for MSW was $$73 per ton. The hauler contracts provide for a flat quarterly rebate of $10.20 per ton, which reduces the fee to a net $62.80 per ton of MSW, which is paid to the contracting haulers for tonnage received. The presence of hauler contracts, attractive fees, and special waste strategies enable the Authority to remain competitive. The county's solid waste management plan makes it difficult for waste to flow outside of the county and transporting waste outside state lines is uneconomical. There are no other public landfills or waste-to-energy plants in the county.

As LCSWMA has purchased the Harrisburg WTE facility, past concerns regarding the need for capacity have been resolved, and LCSWMA is not planning to build a third line at the Marietta facility at this time. Lancaster County, as a public entity, has been able to enforce flow control in the past, but since flow control was struck down in the region, LCSWMA has negotiated with all private haulers.

2.6.3 York County Resource Recovery Center – York, PA

- **Owner:** York County Solid Waste & Refuse Authority
- **Operator:** Covanta Energy
- **Facility Capacity and Throughput:** 1344 TPD Design / 1134 TPD Actual

The York County RRC sources waste through agreements with communities in the County (under flow control) and outside of the County (through interlocal agreements). The facility also has long-term contracts with private haulers, and short-term contracts and spot waste from the private sector. The facility serves York County and the surrounding areas.

Table 11 York County RRC Waste Sources

Waste Source		Tipping Fees
Flow Control	69% - County directive in conjunction with long-term price stable contracts through 2014	$59 for York County municipality contracts
Interlocal Agreements	4% - Agreements with four localities at$67.76/ton	$67.76 for three out-of-county municipalities - $11.76 covers additional administrative costs - blended rate
Short-Term Contract	17% - Spot market	$37 for spot market (though varies between $18 and $56)
Long-Term Contract	10% - Contract with Waste Management and other private firms for as needed waste	$32 for Waste Management contract

In 2006, the facility delayed a planned expansion indefinitely due to escalating costs that would not be supported by a downturn in waste generation. In 2012, the Authority performed an evaluation of the facility to determine what investments would be required to

ensure that the facility is operating efficiently. The Authority studied possible methods for the beneficial reuse of ash generated at the RRC, and bottom ash is now processed to produce an aggregate for use in roadbeds and at landfills. In 2012, the tipping fee at the facility increased by $3 per ton from $56 per ton to $59 per ton, the first time the Authority has increased the cost for waste disposal in 20 years.

2.7 Ohio

There are no publicly owned RRFs in the State of Ohio.

2.8 Virginia

2.8.1 Hampton/NASA Refuse-Fired Steam Generator Facility – Hampton, VA

- **Owner:** NASA and City of Hampton
- **Operator:** City of Hampton
- **Facility Capacity and Throughput:** 240 TPD Design / 191 TPD Actual

The Hampton/NASA Steam facility sources its waste from residential and commercial customers in the Cities of Hampton and Poquoson, and from two Navy bases in Virginia.

Table 12 Hampton/NASA Waste Sources

Waste Source		Tipping Fees
Public Residential	60% - City of Hampton	$18.18 for internal fee - residential waste from Hampton
Short-Term Contract	25% - Commercial waste from Hampton and surrounding areas - Includes document destruction	$35 for commercial haulers from Hampton area; $34 for special waste - document destruction
Long--Term Contract	15% - Military bases	$24 for military bases in area

The facility has a stable steam customer, and the fact that it is providing steam to an industrial user instead of producing electricity has helped the facility to keep tip fees competitive to the region. Due to the competitive tip fees and the location of the facility, it is able to get more waste than it can process, and is in the process of investigating additional and alternative technologies that can be co-located with the steam plant.

2.8.2 Harrisonburg Resource Recovery Facility - Harrisonburg , VA

- **Owner:** City of Harrisonburg
- **Operator:** City of Harrisonburg
- **Facility Capacity and Throughput:** 200 TPD Design / 149 TPD Actual

The Harrisonburg RRF serves the City of Harrisonburg and Rockingham County, and sources flow-controlled residential waste and commercial contracts.

Table 13 Harrisonburg Waste Sources

Waste Source		Tipping Fees
Flow Control	61% - County directs waste stream to facility	Gate Rate is $69 per ton; Contract rates N/A
Public Residential	17% - Residential waste from Harrisonburg, publicly collected	
Commercial Contract/Franchise	22% - Multi-family and commercial accounts in City of Harrisonburg	

The facility is small, serving James Madison University as a steam customer. The stable steam contract and the small size of the facility support its capacity and help to keep tip fees competitive. This facility does not compete with large landfills: there is only one landfill in the area, which is owned by the County, and is not competing for waste with the RRF. The City of Harrisonburg hauls a large portion of its waste to the County landfill, at $20 per ton for residential waste, and $27.40 per ton for commercial waste.

3. Potential Impacts of Eliminating Publicly-Owned RRFs

When considering the impacts on the local disposal market that would result if the RRFs in Section 2 were to close, the facilities can be divided into two categories – regions with landfill availability, and those without.

3.1 Regions with Landfill Availability

Maryland

Maryland does have landfills, but it is a net exporter of MSW. In 2011, Maryland exported 1.7 million tons of MSW, and imported 53,599 tons. Due to economic considerations and the desire to conserve disposal capacity in county-owned landfills, most counties in Maryland transport some of their solid waste out of state for recycling or disposal. If the publicly owned RRFs were to close, this may result in increased export of waste, as the desire to retain disposal capacity inside the county would remain. The excess capacity requiring disposal would not be small, 1800 tons per day minimum, the majority of which would likely be exported. This may put pressure on communities to raise tipping fees at landfills in Maryland, in order to continue to save capacity for future use. In Montgomery County, residential haulers are not charged a tipping fee at the RRF, as disposal fees are pre-paid by County residents. The NMWDA also receives Renewable Energy Credits for the sale of electricity (WTE is considered a producer of renewable energy in the State of Maryland), and closure would result in a reduction in the amount of renewable energy generation in the state.

Closure of the Harford County facility may not have as notable an impact on disposal in Maryland. Its tip fees are competitive with other nearby facilities, and 300-350 tons per day can be absorbed into the marketplace without a significant change in pricing. The military, the facility's steam customer, has already made clear that it is capable of developing its own facility and the Harford facility will close in 2016, with waste transferred to an out-of-county landfill.

New York

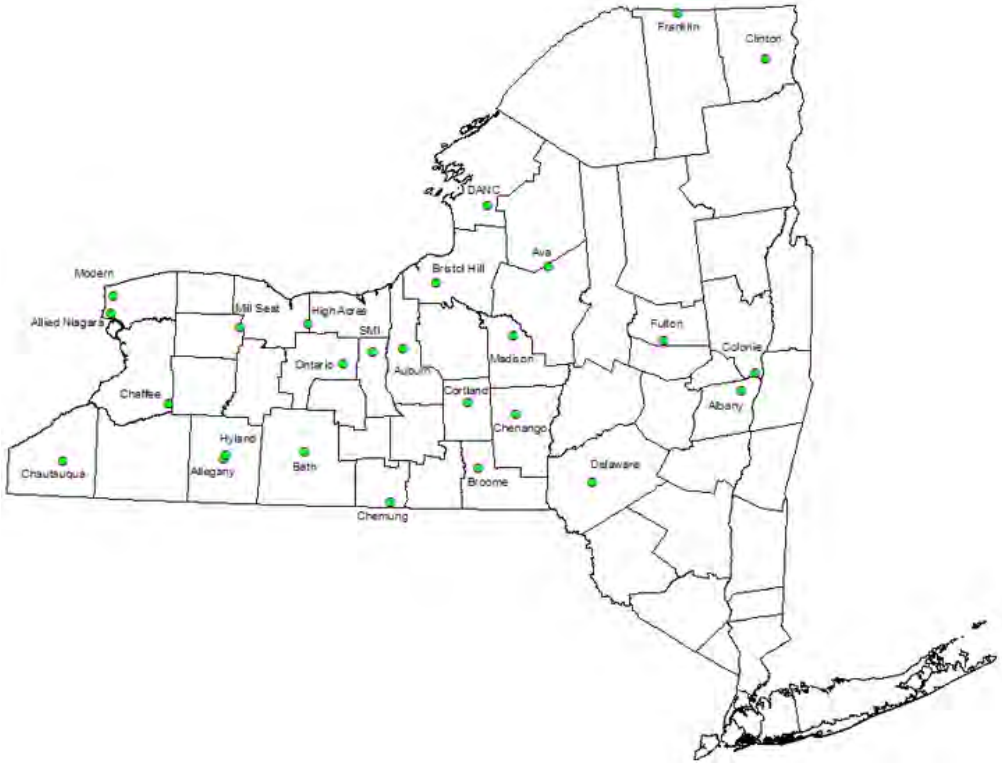

Figure 2 New York Active MSW Landfills[1]

[1] New York Department of Environmental Conservation, 2013.

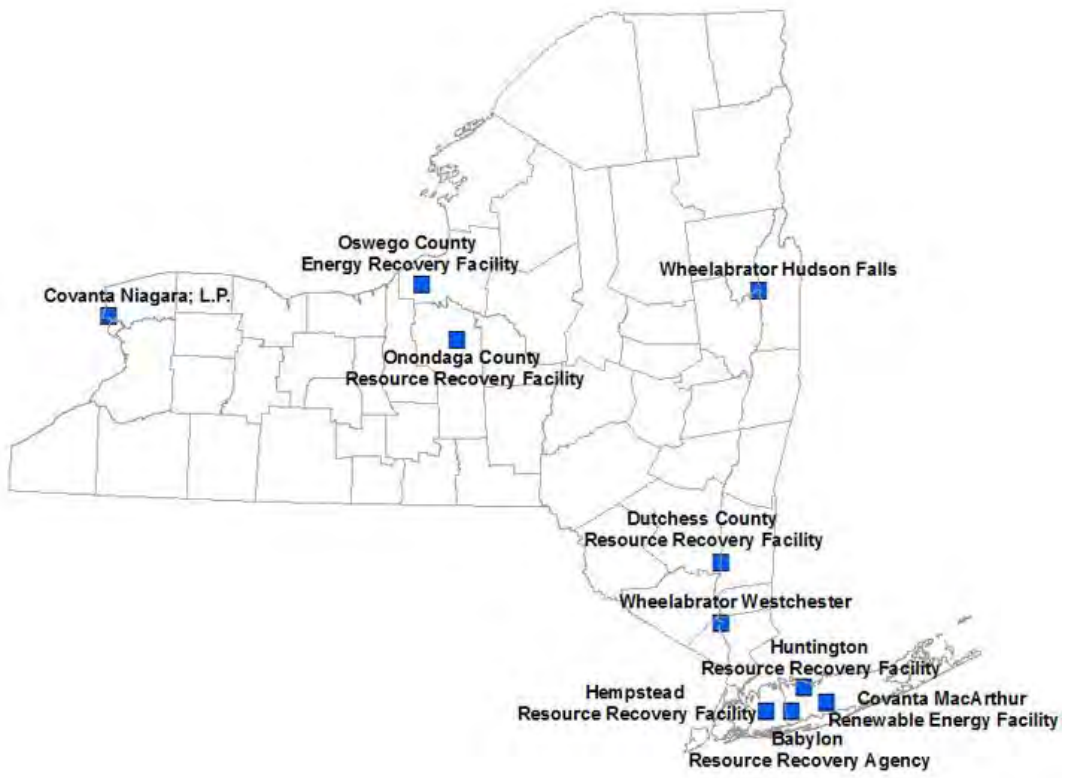

Figure 3 New York Active RRFs[2]

As shown in Figure 2, New York has 26 landfills, many of significant size, as well as several privately owned RRFs. The location of these facilities relative to the publicly owned RRFs will have an impact on how the marketplace would or would not change if a publicly owned RRF were to close. However, New York also exports over 4.5 million tons of waste annually, delivering 1.1 million tons to Ohio in 2011 – due both to a dearth in statewide capacity, and competitive pricing at large landfills in Ohio, and rail access.

The Oswego County facility's tip fees are competitive to other public facilities in the region; though not to all privately owned facilities (the Seneca Meadows landfill is nearby and charges a lower tip fee). The fact that it is approximately an hour's drive to the large High Acres and Seneca Meadows landfills suggest that waste from Oswego County could be absorbed into this local market without causing much of an impact to the cost of disposal at these facilities. The cost of disposal for Oswego County has the potential to decrease if this were to happen – the County charges nearly $60 at the RRF, while the Seneca Meadows landfill charges tip fees as low as $18 to $20 per ton.

Covanta Hudson Valley has seen decreases in tonnage due to cheaper disposal facilities in the area, and is reliant on a few private haulers for the majority of the facility's waste. In the region, Ulster County pays nearly $10 less for waste transport and disposal. The facility is located such that it could haul waste down to privately owned RRFs, or haul waste north to the Albany area, and be met by a market for disposal that may be less expensive than what Dutchess County currently pays.

[2] New York Department of Environmental Conservation, 2013.

New Jersey

Although New Jersey has landfills, it is located such that many New Jersey communities can transfer waste out of state, by rail, truck, and barge. New Jersey exports waste, delivering 1.2 million tons to Ohio in 2011. Like New York, it is a net exporter, but still has an active landfill market, and transfer stations for privately owned RRFs.

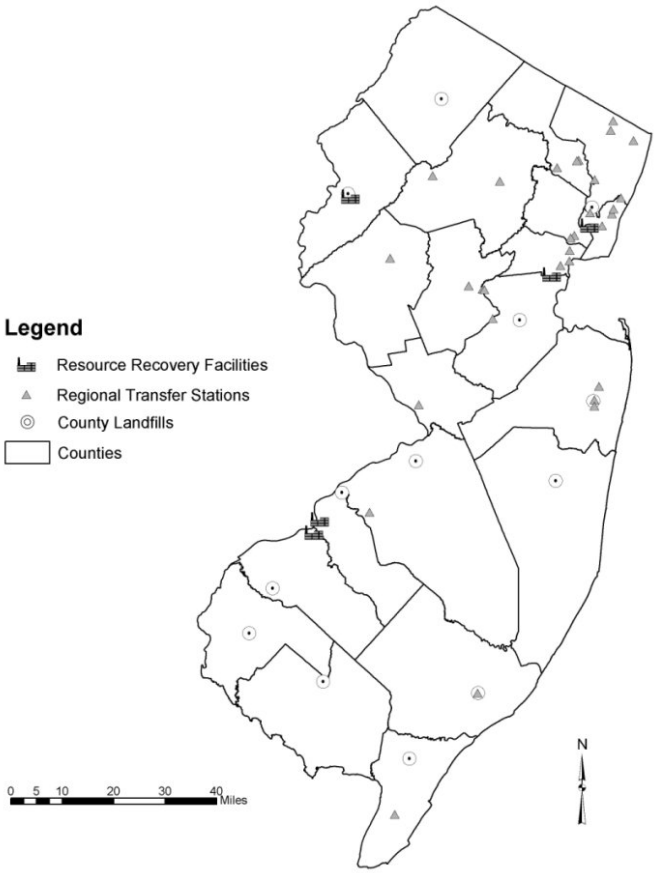

Figure 4 New Jersey Solid Waste Disposal Facilities[3]

The Union County RRF accepts waste from a large geographic range – including from out of state, and at nearly 1500 tons per day, is large enough that closure of the facility may put economic pressure on communities in Union, Passaic, Hudson, Somerset, and Bergen Counties. As Covanta has been able to successfully market unused capacity on the open market, and the facility receives more waste than its design capacity, this further suggests that the local and regional market would be impacted by the loss of this facility.

Pennsylvania

As shown in Figure 5, Pennsylvania has landfills, and accepts waste from outside of the state.

[3] New Jersey Department of Environmental Protections, 2010.

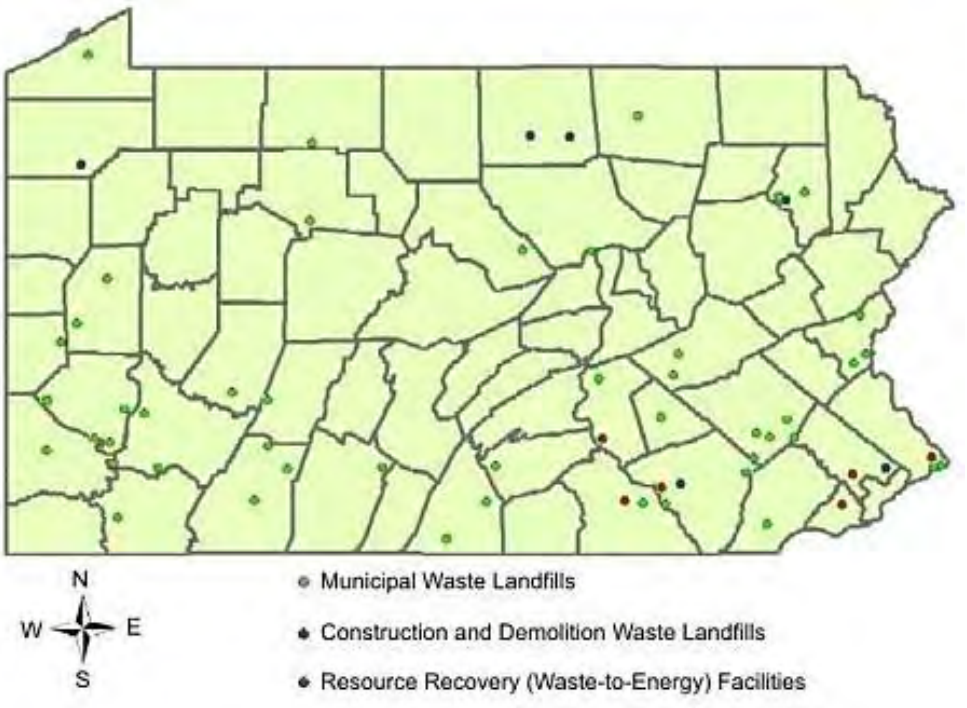

Figure 5 Pennsylvania Disposal Facilities[4]

The dispersed Pennsylvania landfill market (with a number of large facilities) means that for the majority of RRFs, the local market does include competition with landfills, and landfills are within reasonable transport distance to many communities.

As the SRMC sources almost 40 percent of its waste from uncommitted sources, the other 300 or so tons per day from municipalities could be managed through other facilities. The City of Harrisburg has incredibly high tip fees due to the debt payments on this facility, and is not competitive with the surrounding market. The Lancaster RRF has pricing that is competitive with the local market, and it has negotiated with haulers to keep waste at the facility, which operates below capacity since flow control was removed in the region. This indicates that haulers choosing to contract with the Lancaster RRF have other, only slightly more expensive disposal options in the region, and closure of the facility would not result in significant economic pressure to the municipalities in Dauphin and Lancaster Counties. Closure of both facilities, however, may remove a large enough amount of capacity to raise pressure on costs. The Lancaster facility manages a large amount of special wastes, which would need capacity at other facilities, potentially requiring increased transportation costs for material that already has high disposal costs.

The York RRF is also operating at below capacity, and obtains almost 30 percent of its waste through the spot market and a contract with Waste Management, Inc. Although an expansion was planned in the mid-2000s, the facility is no longer considering this type of modification, and instead, needs to find ways for the facility to operate more efficiently given its current throughput. Waste from this facility could be absorbed into the regional market.

[4] Pennsylvania DEP, 2013.

Virginia

Virginia has large landfills that import waste from many states, due to their low tipping fees and available capacity. Both of the publicly owned RRFs in Virginia are small, and their waste could be absorbed into Virginia's large landfill market at a lower disposal cost, though this would also require increased transportation costs. Both of the communities that host the RRFs, however, rely on these facilities for more than just disposal – both facilities generate steam for institutional users, including a university and a military base. These customers would be required to find alternate sources of steam, should the RRFs close. These are customers that value having a reliable, publicly owned steam source.

3.2 Regions without Landfill Availability

Connecticut

Wheelabrator Lisbon is operating at (or slightly above capacity). Requiring the majority of its 500 tons per day to be exported would likely increase the cost of disposal for ECRRA and the towns it serves in northeastern Connecticut. In addition to introducing additional transportation (and potentially disposal) costs, the City of Lisbon would likely lose the benefit it receives from the facility in its host community agreement.

Based on data from the Connecticut DEEP for fiscal year 2011, approximately 64 percent or about 2.1 million tons of the MSW generated in Connecticut was combusted at the six RRFs in the state. About 63,000 tons of waste from outside the state was also combusted at those facilities (approximately 175 tons per day). Approximately one percent of MSW was landfilled directly in the State of Connecticut, 10 percent was transported and disposed in out-of-state disposal facilities, and 25 percent was recycled. If recycling does not increase and the publicly owned facilities in the state were to close, the privately owned facilities would be able to absorb up to 63,000 tons from within the state, but all waste in excess of that amount would likely be exported. In recent studies, the state's Legislative Program Review and Investigations Committee found that without the use of out-of-state disposal facilities, Connecticut's disposal system would not be sufficient to process the waste generated in the state for the next 20 years[5]. The Program Review Committee found that:

> "The long-term trend in market competitiveness is unclear because the disposal market in Connecticut appears to rely on the nearest out-of-state disposal sites and the short-term spot market to provide competition to the only two operators of RRF disposal services in Connecticut."

In addition to the increased cost of disposal if the Lisbon or the Mid-Connecticut facility were to close, Connecticut's economy would also be affected. According to a February 2013 study[6], the total statewide economic contribution of all six waste to energy facilities in Connecticut is $428 million, and 381 workers are employed at the six RRFs in the state. Considering the indirect impacts of eliminating that economic activity, there could be more than an estimated $651 million in total output added to that value if the garbage hauling

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[5] Transfer of Ownership of Mid-Connecticut Resources Recovery Facility from CRRA to the State of Connecticut. Carrie Vibert, Director, Legislative Program Review and Investigations Committee to Members of the Program Review Committee. May 5, 2011.

[6] Statewide Economic Benefits of Connecticut's Waste to Energy Sector, Governmental Advisory Associates, Inc. (GAA). Westport CT. February 2013.

and transfer station jobs and infrastructure that support the six RRFs are included in the analysis. Closure of one or two of the six facilities would result in economic loss of a significant increment of this total.

New York – Long Island

The Long Island Landfill Law, ECL 27-0704, placed additional requirements and restrictions that dictate each new landfill or expansion can only accept material that is the product of resource recovery, incineration, or composting and untreatable waste. Covanta MacArthur is located in an area that does not have nearby landfills, but does have privately owned RRFs, and has the Covanta Westchester Kisco Transfer Station through which waste could be transferred upstate or out of state. If private haulers in Islip, contracted by the Town to deliver waste to the facility are required to haul to a different location, the Town may be required to alter its fee structure and method of payment to haulers.

4. Conclusions

The facilities listed in Section 2 provide local, long-term, and in most cases, cost-competitive disposal services to their host communities. The advantage gained from a planning perspective is clear-those communities that can rely on a local RRF for disposal do not need to shoulder the administrative burden of re-procuring disposal from private facilities every five or ten years, and those that have either legislative or economic flow control measures do not need to fall subject to pricing variations experienced in the disposal market. After the facilities have paid off bonds, they may have the opportunity to reduce tip fees to their member communities, and they may be able to use steam from the facilities to offset steam purchases from other sources at public facilities and institutions. There are a variety of supporting factors that have helped the facilities in Section 2 to sustain operation and keep waste deliveries, including:

- Flow control
  - Legislative Flow Control
  - Economic Flow Control
- Long-term contracts
  - With public entities
  - With private haulers
  - With facility operator
- Competitive tip fees
- Stable electricity and steam customers
  - Electric Utilities
  - Institutions/military
- Renewable Energy
- Rail access
- Special waste and other waste streams
- Consistent (and adequate) regional waste generation
- Limited landfill (or other regional disposal) availability

When publicly owned facilities do not demonstrate one (or likely multiple) of these strong supporting factors, it may become difficult for them to economically serve their municipal customer base (e.g. Harford County, MD closing due to its host military base wanting to produce its own steam). If closure is considered a potential option for an RRF, the role that the facility plays in guiding waste management practices needs to be considered. The February 2013 GAA report for the State of Connecticut also notes:

> "In the future, aside from serving as engines of jobs throughout the state, waste-to-energy plants are hubs around which alternative energy and recycling eco-parks might be developed. These eco-parks could stimulate further economic activity, given the close proximity of power, and encourage experimentation with new waste to power conversion and recycling technologies.
>
> [In Connecticut] The WTE sector contributes to the state's day to day functioning in three major areas:
>
> 1) it is the chief method of disposal for most residential and commercial waste;

> 2) it is the state's largest recycler of municipal post-consumer metals by a factor of two; and
>
> 3) it serves as power generator, providing baseline electric power to [state] residents and beyond.
>
> The revenues, employment, and labor earnings obtained from these activities constitute the direct economic benefits of waste to energy…these activities also generate indirect impacts (value of inputs purchased in the first and second round of spending by the WTE sector and in subsequent rounds of spending by supporting industries) as well as induced impacts (value of goods and services purchased by all workers whose earnings are affected by the direct and indirect WTE spending)."

If each of the facilities presented in Section 2 were to consider closure, the direct economic impact of the facility, the indirect impacts associated with operation, and the role the RRF plays as an energy producer, recycler, and basis for reliable disposal would need to be extensively analyzed.

In the State of Connecticut, loss of publicly-controlled disposal due to a closure of one or both of the publicly-owned RRFs would result in a loss of what is a cost-based price ceiling on disposal. Not only would disposal become more expensive for waste that would need to be transferred for disposal outside of the state, after existing contracts were completed, in-state disposal is also likely to become more expensive. If either the South Meadows or Lisbon facility were to close, and the remaining facility were to become privately operated, the result would be much the same. Eliminating the publicly-controlled competition leaves only two firms in the marketplace, both who have interests outside the state, and have little incentive to keep disposal costs to Connecticut municipalities near to current levels.

Exhibit E

Out-of-State Disposal Market Assessment

November 30, 2013

Out-of-State Waste Disposal Market Assessment

Prepared for:

Connecticut Resources Recovery Authority

CONNECTICUT RESOURCES RECOVERY AUTHORITY

CONNECTICUT'S RECYCLING LEADER

Prepared by:

GBB

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November 5, 2013

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Table of Contents

Tables

Attachments

1. Introduction

In 2013, State legislation (Public Act No. 13-285, Substitute Senate Bill No. 1081, An Act Concerning Recycling and Jobs) was enacted requiring the Connecticut Resources Recovery Authority (CRRA) to prepare a Transition Plan to evaluate the future role of CRRA and its facilities. CRRA is seeking to identify options in the waste disposal market to dispose of the waste it is currently managing for its customers. Therefore, CRRA desires to establish an understanding of the Northeast (consists of New England states, New York (including Long Island), New Jersey, Pennsylvania, Ohio, Maryland and Virginia) waste disposal markets. Gershman, Brickner & Bratton (GBB) understands that the CRRA needs to be in a position to respond to changes in disposal market dynamics while continuing to provide solid waste disposal services to its customers.

2. Waste Assessment Background

2.1 Background

The purpose of this report is to present an assessment of out-of-state waste disposal costs in states where the waste from Connecticut could reasonably be delivered by truck. This report represents and updates a previous assessment done by GBB in 2011. The assessment is based on the disposal facility being able to accept between 250,000 to 500,000 tons per year (TPY) of solid waste.

The assessment is also based on expected contract agreements (as opposed to spot pricing) with the disposal facilities for 5 to 10 year periods based on a set quantity of waste (such as 500 tons per day). Spot market pricing is typically used with smaller waste quantities (such as 50 to 100 tons per day) at facilities operating below permitted capacity where the disposal facility can accept that amount to meet capacity.

This report presents an assessment of transportation and disposal (T&D) costs for waste disposal out-of-state. All the tables and cost estimates provided herein are T&D only costs. However, in order for waste to be disposed outside of Connecticut, there will be costs incurred to transfer the waste from collection trucks to transfer trailers. We estimate these costs to be an additional $10/ton. Therefore, the reader should understand that the total estimated cost to dispose of waste out-of-state will include the T&D costs presented in thie report plus and additional $10/ton.

2.2 Waste Disposal Market Assessment

The focus of this market assessment is on disposal facilities that would accept municipal solid waste (MSW) collected in central Connecticut and transferred by long-haul transfer trailers to various disposal facility locations. A list of the facilities where GBB sought to obtain information is presented as Attachment 1. This list is similar to the list of facilities considered in GBB's previous report submitted to CRRA in 2011. Typically these facilities consist of privately owned and operated landfills and publicly or privately operated WTE facilities. Consideration was generally given to landfills and WTE facilities that could accept about 700,000 to 800,000 tons of solid waste. This amount is based on delivering 150,000 TPY (500 tons per day) over a five-year period. The waste disposal market assessment was conducted in a confidential manner.

The information presented in Table 1 presents site names, locations and addresses; calculations for transportation cost; and tipping fee information. The basis of the tipping fees varied depending on whether GBB was able to obtain the information directly from the site or used published information.

Many waste disposal market assessments rely on published tariffs or gate rates. These are rates that generally do not require a contract or commitment of a specific volume of waste. The gate rates are usually substantially higher than what can be obtained through a contract price and are often as much as twice the possible contract rates. For this waste disposal market assessment, to the extent possible, GBB attempted to obtain pricing that reflects a five to 10-year contract term for tonnages of 500,000 TPY, to reflect the possibility of having to access more than one facility. All costs are presented in a dollar per ton ($/ton) format.

Many of the large solid waste disposal companies including Covanta, Wheelabrator, Waste Management and Republic would not comment on capacity available at specific facilities, but suggested they had capacity available within their network of facilities. In some cases, representatives from these companies did not provide tipping fee information for contract rates. When contract pricing was not provided, gate rates were requested by calling the facilities.

In addition to disposal cost estimates, GBB also calculated and presented transportation costs. It was assumed that solid waste would be transported via roads in a transfer trailer from CRRA's transfer stations or the South Meadows Facility to the disposal site. Transportation costs were also based on the following assumptions:

1. The T&D pricing shown in this assessment excludes the cost of transfer station operation and loading of waste for out-of-state transport. This activity is estimated at an additional $10 per ton.
2. The point of origin of the waste would be the South Meadows Facility on Reserve Road in Hartford. The time required for transfer trailer drivers to check in and have their trailers loaded is 40 minutes.
3. The time required for transfer trailer drivers to check in at the disposal site and unload their trailers is 40 minutes.
4. The quantity of waste for transfer trailers is 22 tons per load.
5. Diesel fuel cost is $4.00 per gallon and trucks would get an average of 5.5 miles per gallon.
6. The rate to operate the truck was estimated to be about $59.00 per hour. This rate considers driver wages and capital and maintenance costs for the trucking equipment.
7. The mileage and travel times were determined using Google Maps.
8. The practice of backhauling materials to reduce transportation cost was not considered.

The one-way travel times shown in Attachment 1 vary from 30 minutes for locations in Connecticut to more than eight hours for locations in Virginia and Ohio. The travel distances vary from 26 miles to more than 400 miles. It is noted that the amount of equipment needed to transport waste to the locations close to central Connecticut is significantly less than for transporting waste to more distant locations in Ohio or Virginia. For example, a truck traveling to Ohio would only be one turn every two days. For shorter distances and travel times, trucks could make several turns per day. These calculations do not differentiate the advantages and disadvantages between locations that are closer or more distant from central Connecticut.

Section 3 presents a brief description of solid waste management facilities in Connecticut, and Section 4 presents information GBB collected on disposal sites in eight states.

3. Connecticut

Based on data from the Connecticut Department of Energy and Environmental Protection (DEEP) for fiscal year 2011, approximately 64 percent or about 2.1 million tons of the MSW generated in Connecticut was combusted at the six WTE facilities in the state. About 63,000 tons of waste from outside the state was also combusted at those facilities. Approximately one percent of MSW was landfilled directly in Connecticut, 10 percent was transported and disposed in out-of-state disposal facilities, and 25 percent was recycled.

Connecticut is a net exporter of solid waste, and exports a majority of the MSW that is not combusted at WTE facilities in the state. According to the Connecticut DEEP, a total of about 318,000 tons of MSW was disposed out of state in fiscal year 2011, while about 60,700 tons of out-of-state waste was imported. As stated above, most of the imported waste was combusted at the WTE facilities. The Northeast Waste Management Officials' Association (NEWMOA) published waste flow information on imports and exports from eight Northeastern States (including Connecticut) in its report, "Municipal Solid Waste (MSW) Interstate Flow in 2010" dated January 30, 2013. Based on the information presented in that report, Connecticut exported about 209,000 tons and imported 70,000 tons in 2010.

Two of the six WTE facilities are part of the CRRA system (Southeastern Connecticut Resource Recovery Facility and South Meadows Facility). The two other WTE facilities are the Bridgeport Resource Recovery Facility in Bridgeport, CT and Wheelabrator Lisbon, Inc. The tipping fees for the Bristol, Preston and Wallingford were obtained from published information[1]. Calls to request tipping fees were placed to Wheelabrator Technologies, Inc. (Wheelabrator). The disposal cost listed in Table 3-1 for the Lisbon Facility is based on published information.[2]

Table 3-1
Connecticut WTE Facilities

Facility	Location	Disposal Cost ($/ton)	Transport Cost ($/ton)	Transport + Disposal ($/ton)
Covanta Bristol Resource Recovery Facility	Bristol	$65	$8	$73
Covanta Resource Recovery Facility Preston	Preston	$65	$10	$75
Covanta Resource Recovery Facility Wallingford	Wallingford	$65	$9	$74
Wheelabrator Bridgeport	Bridgeport	$59	$13	$72
Lisbon Wheelabrator, Inc.	Lisbon	$65	$11	$76

There is no information provided in Table 3-1 on MSW landfills because there is limited MSW landfill disposal capacity in Connecticut. GBB understand the State's solid waste

[1] Berenyi, Eileen B, "Municipal Waste to Energy in the United States – 2012-2013" Yearbook and Directory, Ninth Edition. Government Advisory Associates, Inc. Insert publishing year.

[2] CRRA website: http://www.crra/org/pages/proj_fees/htm; accessed August 28, 2013

management plan primarily considered continued use of WTE facilities to manage the MSW generated in Connecticut and does not anticipate significant expansions in MSW landfill capacity. It is therefore concluded that CRRA cannot rely on in-state MSW landfills for its long-term disposal needs.

4. Out of State Disposal Facilities

The alternative to disposing of waste at WTE facilities in Connecticut is to transport waste out-of-state. GBB has considered facilities in seven states with disposal facilities where waste could be transported by truck for disposal. The facilities identified below and the related T&D costs for them is intended to provide CRRA with an overview of the range of costs for potential out-of-state waste disposal. Some of the facilities for which information is presented do not have available capacity to receive CRRA's waste. The information for some of these facilities, particularly those facilities in states close to Connecticut, is presented to show they were part of the assessment of possibilities. All costs presented are T&D only – they do not include the cost of construction and/or operation of a transfer station where waste is loaded into trucks for T&D.

4.1 Massachusetts

There are seven MSW WTE facilities in Massachusetts. New WTE facilities and expansions of these existing facilities are currently unlikely, as the 2010 Massachusetts Solid Waste Management Plan indicates a moratorium has been placed on WTE facility expansions.

Massachusetts is a net exporter of solid waste. Based on the 2013 NEWMOA report for data collected for calendar year 2010, Massachusetts exported 568,000 tons and imported 396,000 tons of MSW.

Telephone calls were made to Covanta and Wheelabrator to determine if there is capacity available at the facilities they own and/or operate. Given the small size of the eco/Springfield and eco/Pittsfield facilities, they were not contacted. Neither Covanta nor Wheelabrator responded to GBB requests for information. The tipping fee information presented below was obtained from published data. Table 4-1 provides a summary of the T&D cost information for the WTE market in Massachusetts.

Table 4-1
Massachusetts WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Haverhill Resource Recovery Facility	Haverhill	$67	$22	$89
SEMASS Resource Recovery Facility	West Wareham	$77	$23	$100
Wheelabrator Millbury Inc.	Millbury	$70	$14	$84
Wheelabrator North Andover Inc.	North Andover	$70	$22	$92
Wheelabrator Saugus, J.V.	Saugus	$71	$21	$92

Similar to other New England states, there is limited MSW landfill disposal capacity in Massachusetts. Consistent with the previous study done by GBB, three landfills were considered as potential disposal facilities. These were the Fall River Landfill, Taunton Landfill and Fitchburg/Westminster Landfill. There were no new landfills identified during our review

process. GBB understands that Republic Industries will use the remaining capacity at the Fall River Landfill primarily for waste from the City of Fall River, MA. Connecticut Valley Sanitary Waste Disposal, Inc. owns a landfill in Chicopee, MA, but at this time no gate rate quotes were available, though CRRA would need to obtain additional administrative approvals to access this facility. Telephone calls placed to Waste Management, Inc. (WMI) to obtain information on capacity and tipping fees for the Taunton, Southbridge, and Fitchburg/Westminster Landfills. No contract pricing information is being presented for these sites because WMI did not provide any information after repeated requests. The gate rate at these landfills was reported by scale-house personnel to be more than $90.00 per ton.

4.2 New York

New York (the state) is a net exporter of solid waste. The 2010 report "Beyond Waste: A Sustainable Materials Management Strategy for New York State" indicates that New York exports 6.0 million TPY while importing 1.3 million TPY. Waste disposal within the State is primarily by landfilling (43 percent) while WTE accounts for 18 percent. New York exports 39 percent of its waste. The 2001 NEWMOA report figures are consistent with the 2010 *Beyond Waste* report.

There are 10 WTE facilities in New York with a combined capacity of over 4 million TPY. Four of the 10 WTE facilities are located on Long Island. New York's largest WTE facilities are owned and/or operated by Covanta or Wheelabrator. Both companies were contacted for available capacity at the WTE facilities, and company representatives did not respond. The tipping fees for three WTE facilities are presented in Table 4-2 are based on published information.

Table 4-2
New York WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Niagara Falls Resource Recovery Facility	Niagara Falls	$43 Published rate for tonnage from Western NY	$64	$107
Wheelabrator Westchester Company, L.P.	Peekskill	$71	$20	$91
Hempstead Resource Recovery Facility	Hempstead	$85	$23	$108

As of January 2011, there were 27 municipal solid waste landfills in New York with a combined capacity of over 220 million tons. GBB contacted the owners and/or operators of three of the larger MSW landfills to determine available capacity and tipping fees. The information for these sites is presented in Table 4-3. The tipping fee reported for Seneca Meadows was quoted by a sales representative from the facility, who also indicated they had capacity available for a five-year contract. According to information obtained from the New York State Department of Environmental Conservation, the remaining permitted capacity at Seneca Meadows was about 31.5 million cubic yards as of January 2011. The tipping fees for the other two facilities are gate rates reported by scale house personnel because GBB did not get a response from facility sales representatives. According to the

NYSDEC information, both of these two landfills had more than 25 million tons of permitted capacity as of January 2011.

Table 4-3
New York State Landfill Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
IESI-Seneca Meadows, Inc.	Seneca Falls	$25	$48	$73
High Acres	Fairport	$50	$53	$103
Modern Landfill	Lewiston	$55	$66	$121

4.3 New Jersey

New Jersey has 13 active regional solid waste landfills and five WTE facilities. None of the New Jersey landfills would likely accept out-of-state waste in significant quantities. New Jersey is a net exporter of solid waste. Based on the 2010 NEWMOA report, New Jersey exported 2.5 million tons and imported 597,000 tons. About 586,000 tons or 98 percent of the imported solid waste was imported from New York City.

There are five active WTE facilities in New Jersey with a combined capacity of 6,300 TPD. The Warren Energy Resource Company and the Wheelabrator Gloucester Company, L.P. are reasonably small WTE facilities (less than 600 TPD). Information for the three other larger WTE facilities is presented in Table 4-4.

Table 4-4
New Jersey WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Essex County Resource Recovery Facility	Newark	$66	$24	$90
Union County Resource Recovery Facility	Rahway	$70	$27	$97
Camden Resource Energy Recovery Facility	Camden	$65	$37	$102

All three of these resource recovery facilities reported a daily intake at or near the permitted capacity in 2010.

4.4 Pennsylvania

Pennsylvania has 46 active landfills and six WTE facilities that manage over 20 million TPY of MSW. Pennsylvania has historically been one of the nation's leading waste importing states. The Congressional Research Service's *Interstate Shipment of Municipal Solid Waste 2007 Update* lists Pennsylvania as the number one waste importing state at almost eight million TPY.

Two of the six Pennsylvania WTE facilities are unlikely to have excess capacity, including the Lancaster County Resource Recovery Facility and the York Resource Recovery Center. Although it could not be confirmed with Covanta and/or Wheelabrator, the other three facilities may have capacity. Information on the three facilities is summarized in Table 4-5.

Table 4-5
Pennsylvania WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Delaware Valley Resource Recovery Facility	Chester	$64	$39	$103
Wheelabrator Falls, Inc.	Morrisville	$68	$33	$101
Covanta Plymouth Renewable Energy LP.	Conshohocken	$63	$37	$100

Pennsylvania has historically had privately owned and operated landfills with a significant available capacity. Several of the permitted landfills in the eastern portion of the state each have permitted capacities of 10,000 TPD.

Three private landfill owners were contacted to obtain representative contract pricing, and the results are summarized in Table 4-6. These landfills all have daily permitted capacities of more than 5,500 tons. As shown, contract pricing is only shown for the Keystone Landfill. The personnel contacted from the other sites did not respond.

Table 4-6
Pennsylvania Landfill Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Keystone Sanitary Landfill	Dunmore	$38	$33	$71
Alliance Landfill	Taylor	$74 (Gate Rate)	$34	$108
Conestoga Landfill	Morgantown	$71 (Gate Rate)	$49	$120

All three of these landfills are located in northeastern Pennsylvania and they generally compete for the same waste streams. It is reasonable to expect that all three would give similar contract disposal rates if CRRA would pursue this matter further with them.

4.5 Ohio

Ohio does not have any operating WTE facilities but has substantial landfill capacity with approximately 45 landfills. Ohio is a net importer of solid waste. The Congressional Research Service's *Interstate Shipment of Municipal Solid Waste 2007 Update* lists Ohio as the 10thhighest waste importing state, at almost 1.7 million TPY.

GBB contacted several landfills in Ohio for preliminary contract disposal pricing. The results of the survey are summarized in Table 4-7. As shown, the T&D costs for these three sites are all more than $116 per ton. These high costs are primarily caused by high transportation cost. Further consideration could be given to disposal at the Tunnel Hill Reclamation and American Landfill sites based on rail transportation

Table 4-7 Ohio Landfill Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
American Landfill Inc.	Waynesburg	$30	$86	$116
Beech Hollow Landfill	Wellston	$33	$103	$136
Tunnell Hill Reclamation Landfill	New Lexington	$27	$99	$126

4.6 Maryland

Maryland has 24 permitted landfills and three WTE facilities and is a net exporter of solid waste. The Congressional Research Service*'s Interstate Shipment of Municipal Solid Waste 2007 Update* has Maryland exporting over 2 million TPY while importing less than 300,000 TPY. Most landfills in Maryland do not accept out-of-region waste and it is not expected that Maryland landfills would be an option for CRRA as a solid waste disposal market.

The use of WTE in Maryland has increased over the past few years with three new or expanded WTE facilities planned. The Maryland legislature has acted to support WTE by classifying WTE facilities as Tier 1 renewables under the state's Renewable Portfolio Standard.

One of the three existing WTE facilities in Maryland, the Harford Waste-to-Energy Facility, is not a likely disposal market for CRRA solid waste due to the small design capacity of that facility. T&D costs for the other two WTE facilities are summarized in Table 4-8.

Table 4-8
Maryland WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Montgomery County Resource Recovery Facility	Dickerson	$56	$62	$118
Baltimore Refuse Energy Systems Company (BRESCO)	Baltimore	$45	$52	$97

It is unlikely that the Montgomery County facility could be accessed; local policy does not support importing waste to this publicly owned facility. At BRESCO, at least one-third of its

capacity has generally been available to the open market. Additionally, BRESCO has considered adding another 750 TPD module (approximately 240,000 TPY) to its facility. In order to proceed with this potential addition, a reliable long-term supply of waste is needed. Pricing for this capacity was not provided by BRESCO.

Another potential consideration is to consider a WTE being planned by Energy Answers (EA) in the Baltimore metropolitan area. EA is currently pursuing the development of a WTE that would process about 2,000 tons per day of MSW with the objective of generating at least 1,500 tons per day of RDF. GBB understands that EA is looking to secure waste to support the operation of this proposed WTE facility. EA has stated publicly that a disposal fee on the order of $40.00 per ton would be charged. Access to this facility for MSW deliveries could be made by truck or rail transport.

4.7 Virginia

Virginia has 55 active MSW landfills and five WTE facilities. Virginia is one of the nation's leading waste importing states, second only to Pennsylvania. The Virginia Department of Environmental Quality report, "Solid Waste Managed in Virginia During Calendar Year 2012" shows that Virginia imported 5.4 million tons in 2012.

Two of the five WTE facilities are considered small based on a design capacity of less than 250 TPD. Tipping fees and transportation costs for the three other WTE facilities are summarized in Table 4-9.

Table 4-9
Virginia WTE Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Covanta Alexandria Resource Recovery Facility	Alexandria	$43 Spot Market Price	$59	$102
I-95 Covanta Energy-Resource Recovery Facility	Lorton	$36 VA County Rate	$60	$96
Wheelabrator Portsmouth, Inc.	Portsmouth	$36 Rate for Commercial Haulers	$87	$123

There are several large landfills in Virginia that receive imported waste by truck and rail shipment. Tipping fees and transportation costs from three of these landfills are presented in Table 4-10.

Table 4-10
Virginia Landfill Market

Facility	Location	Disposal Cost $/ton	Transport Cost $/ton	Transport + Disposal $/ton
Atlantic Waste Disposal, Inc.	Waverly (South of Richmond)	$25	$81	$106
King and Queen Sanitary Landfill	Plymouth (Central Virginia)	$58	$77	$135
Charles City County Landfill	Charles City (Near Richmond)	$25	$77	$102

As shown above in Table 4-10, the transportation and disposal (T&D) costs are more than $100.00 per ton for the Virginia landfills. While the disposal costs for two of the three landfills is relatively low, the transportations costs for all of these sites is high due to the long distances and travel times to reach them.

5. Disposal Options Assessment

Transportation and disposal costs were calculated for 36 disposal facilities in seven states. These states included Maryland, Massachusetts, New Jersey, New York, Ohio, Pennsylvania and Virginia. This information is presented in alphabetical order by State on Attachment 1. The information presented consists of the facility type, name and location; transportation distances for road travel and travel times from the South Meadows Facility in Hartford, CT to the disposal facility location; transportation cost calculations; tipping fee information for disposal and relevant comments about the basis for the tipping fee at each facility; the calculated T&D cost as the sum of the transportation cost and tipping fee; the permitted daily design capacity for each facility; and the reported daily tonnage reported based on 2010 or more current available information.

A ranking and summary of the estimated T&D costs from lowest to highest for all 36 sites is presented on Attachment 2. The T&D costs range from $71.14 per ton at the Keystone Landfill located in Dunmore, PA, which is about 189 miles from Hartford to $137.54 at the Fitchburg/Westminster Landfill in Westminster, MA located about 84 miles from Hartford. The five facilities with the lowest T&D costs ranged from $71.14 to $89.76 per ton. The facilities with the two lowest costs are the Keystone Landfill and Seneca Meadows Landfill. These landfills appear to have capacity available for CRRA's waste. The next three lowest facilities are WTE facilities that are running at or near capacity based on information from 2010.

5.1 Out-of State Landfills

It is noted that the costs presented for four of the landfills shown in Attachments 1 and 2 are based on gate rates because commercial rates were not provided to GBB by the owners/operators. Two of these landfill sites (High Acres Landfill and Modern Landfill) are located in western New York. The High Acres Landfill appears to have capacity to accept CRRA's waste and Modern Landfill is reporting to be near its daily acceptance limitation. If CRRA was able to negotiate a rate of $30.00 per ton for disposal, which is comparable to $25.00 per ton at Seneca Meadows, the calculated disposal rate would be $82.78 per ton. In the case of the two landfills in Pennsylvania that only reported gate rates (Alliance Sanitary Landfill and Conestoga Landfill), the gate rates are $74.00 and $71.54 per ton respectively. These rates compare to $38.00 per ton at the Keystone Landfill, which is in the same general geographical area as the other two landfills in Pennsylvania. If CRRA could negotiate a $40.00 per ton tipping fees at these landfills, the T&D cost would be $74.00 and $89.14 per ton at Alliance Sanitary Landfill and Conestoga Landfill, respectively. With the comparable rates stated above, the T&D costs for the four landfills fall into the cost range for the five disposal facilities with the lowest costs. It is generally concluded that the cost for transportation and disposal of waste in landfills outside of Connecticut ranges from about $70.00 to $90.00 per ton.

5.2 Out-of-State WTE Facilities

As shown in Attachment 2, there are three WTE facilities in the list of the five facilities with the lowest calculated T&D costs. These costs range from $83.49 per ton at the Wheelabrator/Milbury facility in Worchester, MA to $89.05 per ton at Haverhill RRF in Haverhill, MA. Also as shown in Attachment 2, all of these WTE facilities are showing to be operating at design capacity based information reported for calendar year 2010 and have virtually no available capacity to receive 500 tons per day from CRRA. In fact a review of all of the estimated tonnage from 2010 and the design capacity at most of WTE facilities listed

on Attachments 1 and 2 shows none of them, with the exception of the WTE in Montgomery County, MD, have 500 tons per day of capacity. In the event that the option to deliver waste to WTE facilities is pursued, portions of the waste would likely need to be distributed to several locations. Based on the 2010 data, the Wheelabrator-Milbury WTE has about 200 tons per day of capacity at a T&D cost of $83.49 per ton. The next three WTE facilities according to lowest T&D cost are Wheelabrator Westchester in Peekskill, NY, Wheelabrator in Saugus, MA, and Wheelabrator in Andover, MA. Each of these facilities appears to have about 300 tons per days of capacity at a cost of about $92 per ton. It is concluded that CRRA would need to deliver waste to two or more of these WTE facilities to dispose of 500 tons per day.

6. Summary and Conclusions

In the Northeast, three of the states in the survey (Pennsylvania, Ohio and Virginia) are net importing states due to the available disposal capacity and low disposal pricing. The remaining four states (New York, New Jersey, Massachusetts and Maryland) are net exporting states.

Based on the information provided in this report, the T&D pricing for out-of-state landfills was in the $70 to $90 per ton range. There are six landfills where the waste could be taken. Three of these are located in Pennsylvania and three are in New York. The range in T&D pricing for WTE facilities generally ranged from $83.00 to $100 per ton. The facilities with lower costs and available capacity were located in New York and Massachusetts.

The T&D pricing determined for states such as Virginia and Ohio was generally in the range of $100 to 130 per ton. The transportation costs to several of these facilities was calculated to be on the order $80.00 per ton. With transportation costs at that level, consideration should be given to using rail transportation. During the course of making inquiries to obtain information for this assessment, several of the people contacted mentioned the possibility of using rail. GBB is aware of at least 5 landfills in Ohio and Virginia that have the infrastructure to receive waste by rail.

The information contained is presented for CRRA to use as a guide and general assessment of the solid waste disposal market in the Northeast. Disposal markets are often dynamic and in actual contract negotiations, pricing may be higher or lower than this survey may indicate.

Attachment 1

Transportation and Disposal Cost Calculations for Connecticut Resource Recovery Authority

ATTACHMENT 1

Transportation and Disposal Cost Calculations for Connecticut Resource Recovery Authority

Transportation and Disposal from: Reserve Road, Hartford, Connecticut		Facility Type	Location		Information from Google Maps		Transportation Costs			Estimated Disposal Rate				
State	Disposal Facility	Type	City	State	One Way Road Mile	One-way travel time (Hours)	Transportation Time ($$ per ton)	Fuel Cost ($$ per ton)	TOTAL Transportation Cost ($$Per ton)	Tipping Fee at Disposal Facilit	Comments	Total T & D Cost ($$ Per Ton)	Facility Design Capacity or permitted tonnage (Tons per day)	Reported tonnage in 2010 (tons per day)
Maryland	Wheelabrator Baltimore LP	WTE	Baltimore	MD	304	4.9	$29.62	$20.10	$51.99	$45.29	Rate for Baltimore Co thru NMSWA	$97.28	2,250	1,853
Maryland	Montgomery County RRF	WTE	Dickerson	MD	361	6	$35.47	$23.87	$61.61	$56.00	Commercial and Private Rate	$117.61	1,800	1,466
Maryland	Quarantine Road Landfill	Landfill	Baltimore	MD	361	6	$35.47	$23.87	$61.61	$70.00	Gate Rate per Scale House	$131.61	NA	360
Massachusetts	Wheelabrator Millbury Inc.	WTE/RRF	Millbury/Worcester	MA	63	1	$8.87	$4.17	$13.49	$70.00	Spot Market tipping fee	$83.49	1,500	1,306
Massachusetts	Haverhill Resource Recovery Facility	WTE/RRF	Haverhill	MA	120	1.9	$13.66	$7.93	$22.05	$67.00	North Andover Communities thru 2015	$89.05	1,650	1,586
Massachusetts	Wheelabrator Saugus, J.V.	WTE/RRF	Saugus	MA	110	1.8	$13.12	$7.27	$20.85	$71.00	Long Term Municipal Contracts - Spot is higher	$91.85	1,500	1,118
Massachusetts	Wheelabrator North Andover Inc.	WTE/RRF	North Andover	MA	118	1.9	$13.66	$7.80	$21.91	$70.00	$64 in 2011 Spot Market	$91.91	1,500	1,239
Massachusetts	SEMASS Resource Recovery Facility	WTE/RRF	West Wareham	MA	128	2	$14.19	$8.46	$23.11	$77.50	Spot Market tipping fee	$100.61	3,000	2,879
Massachusetts	Taunton Landfill	Landfill	Taunton	MA	112	1.75	$12.86	$7.40	$20.72	$90.00	Gate Rate from Scale House	$110.72	685	287
Massachusetts	West Minster/Fitchburg Landfill	Landfill	Westminster	MA	84	1.5	$11.53	$5.55	$17.54	$120.00	Gate Rate from Scale House	$137.54	1,425	761
New Jersey	Essex County RRF	WTE/RRF	Newark	NJ	123	2.1	$14.72	$8.13	$23.76	$66.00	Long Term Rate to Port Authority	$89.76	2,277	2,545
New Jersey	Union County RRF	WTE/RRF	Westfield	NJ	138	2.5	$16.85	$9.12	$26.88	$70.00	Rate For Private Haulers from NY State	$96.88	1,440	1,502
New Jersey	Warren County RRF	WTE/RRF	Oxford	NJ	176	3	$19.51	$11.64	$32.06	$69.00	Spot Market	$101.06	450	465
New Jersey	Camden County RRF	WTE/RRF	Camden	NJ	208	3.5	$22.17	$13.75	$36.83	$65.00	Rate for Camden Co. & Commercial	$101.83	1,050	854
New Jersey	Gloucester RRF	WTE/RRF	Westville	NJ	207	3.5	$22.17	$13.69	$36.77	$72.00	Rate set in 2010	$108.77	575	521
New York	Seneca Meadows	Landfill	Waterloo	NY	294	4.5	$27.49	$19.44	$48.07	$25.00	Reported by Rocky at IESI on 19 Sept 2013	$73.07	6,211	6,200
New York	Wheelabrator Westchester	WTE	Peekskill	NY	98	1.75	$12.86	$6.48	$20.47	$71.00		$91.47	2,250	1,906
New York	High Acres	Landfill	Fairport	NY	325	5	$30.15	$21.49	$52.78	$50.00	Gate Rate from Scale House: Sales did not respond	$102.78	3,400	1,850
New York	Covanta Energy of Niagara Falls	WTE	Niagara Falls	NY	408	6.1	$36.00	$26.98	$64.12	$43.00	$37 to $43 for local tons	$107.12	2,500	2,095
New York	Hempstead RRF - Covanta	WTE	Westbury	NY	119	2.1	$14.72	$7.87	$23.73	$85.00	Rate for NYC & Suffolk Comm TS	$108.73	2,671	2,639
New York	Modern Corporation	Landfill	Lewiston	NY	417	6.25	$36.80	$27.57	$65.51	$55.00	Gate Rate from Scale House: Sales did not respond	$120.51	2,612	2,600
Ohio	American Landfill	Landfill	Waynesburg	OH	551	8.5	$48.78	$36.43	$86.34	$30.00	Information from Scale House	$116.34	15,000	2,700
Ohio	Tunnel Hill Reclamation	Landfill	New Lexington	OH	619	10	$56.76	$40.93	$98.82	$27.00	$23 - $27 from 2011 Study	$125.82	8,000	2,700
Ohio	Rumpke Beech Hollow	Landfill	Wellston	OH	664	10.25	$58.09	$43.90	$103.12	$33.00	$29 - $33 for out-of-state	$136.12	4,000	1,360
Pennsylvania	Keystone Landfill	Landfill	Dunmore	PA	189	3	$19.51	$12.50	$33.14	$38.00	$36 per ton in 2014 with $0.75 per year increase	$71.14	7,500	NA
Pennsylvania	Covanta Plymouth Renewable	WTE	Conshohocken	PA	213	3.5	$22.17	$14.08	$37.39	$63.00	Residential waste fee for particpating municipalities	$100.39	1,200	1,111
Pennsylvania	Wheelabrator Falls	WTE	Morrisville	PA	178	3.1	$20.04	$11.77	$32.95	$68.00	Average Tip Fee in 2011	$100.95	1,500	1,398
Pennsylvania	Delaware Valley RRF	WTE	Chester	PA	225	3.7	$23.23	$14.88	$39.25	$64.00	Commercial Waste at County TS	$103.25	2,688	3,340
Pennsylvania	Alliance Sanitary Landfill	Landfill	Taylor	PA	198	3.1	$20.04	$13.09	$34.27	$74.00	Gate Rate per Scale House	$108.27	5,500	na
Pennsylvania	Conestoga	Landfill	Morgantown	PA	282	4.75	$28.82	$18.64	$48.60	$71.54	Gate Rate per Scale House	$120.14	10,000	NA
Virginia	I-95 RRF	WTE	Lorton	VA	359	5.8	$34.41	$23.74	$60.42	$36.00	Prince William Rate - $40/ton for Wash DC	$96.42	3,000	NA
Virginia	Charles City County	Landfill	Charles City	VA	464	7.5	$43.45	$30.68	$76.40	$25.00	$25 to 30 per ton quoted	$101.40	5,000	1,506
Virginia	Covanta Alexandria	WTE	Alexandria	VA	350	5.7	$33.88	$23.14	$59.29	$43.00	Spot Market per MWE-US - $55/ton Commercial haulers	$102.29	975	901
Virginia	Atlantic - Waverly	Landfill	Waverly	VA	492	8	$46.11	$32.53	$80.92	$25.00	$25 to 30 per ton quoted. This site was recommended by WMI Sales Rep as the preferred site in VA	$105.92	10,000	4,570
Virginia	Wheelabrator Portsmouth	WTE	Portsmouth	VA	542	8.5	$48.78	$35.83	$86.88	$36.00	Rate for Contract Commercial	$122.88	2,000	1,652
Virginia	King & Queen County	Landfill	Little Plymouth	VA	452	7.75	$44.78	$29.88	$76.94	$57.75	Reported as the gate rate	$134.69	NA	2,128

Attachment 2

Transportation and Disposal Costs for Selected Sites

ATTACHMENT 2

Transportation and Disposal Costs for Selected Sites

Transportation and Disposal from: Reserve Road, Hartford, Connecticut		Facility Type	Location		Information from Google Maps		Estimated T & D Rate		
State	Disposal Facility	Type	City	State	One Way Road Mile	One-way travel time (Hours)	Cost ($ Per Ton)	Facility Design Capacity or permitted tonnage (Tons per day)	Estimated Daily Tonnage
Pennsylvania	Keystone Landfill	Landfill	Dunmore	PA	189	3	$71.14	7,500	NA
New York	Seneca Meadows	Landfill	Waterloo	NY	294	4.5	$73.07	6,211	6,200
Massachusetts	Wheelabrator Millbury Inc.	WTE/RRF	Millbury/Worcester	MA	63	1	$83.49	1,500	1,306
Massachusetts	Haverhill Resource Recovery Facility	WTE/RRF	Haverhill	MA	120	1.9	$89.05	1,650	1,586
New Jersey	Essex County RRF	WTE/RRF	Newark	NJ	123	2.1	$89.76	2,277	2,545
New York	Wheelabrator Westchester	WTE	Peekskill	NY	98	1.75	$91.47	2,250	1,906
Massachusetts	Wheelabrator Saugus, J.V.	WTE/RRF	Saugus	MA	110	1.8	$91.85	1,500	1,118
Massachusetts	Wheelabrator North Andover Inc.	WTE/RRF	North Andover	MA	118	1.9	$91.91	1,500	1,239
Virginia	I-95 RRF	WTE	Lorton	VA	359	5.8	$96.42	3,000	NA
New Jersey	Union County RRF	WTE/RRF	Westfield	NJ	138	2.5	$96.88	1,440	1,502
Maryland	Wheelabrator Baltimore LP	WTE	Baltimore	MD	304	4.9	$97.28	2,250	1,853
Pennsylvania	Covanta Plymouth Renewable	WTE	Conshohocken	PA	213	3.5	$100.39	1,200	1,111
Massachusetts	SEMASS Resource Recovery Facility	WTE/RRF	West Wareham	MA	128	2	$100.61	3,000	2,879
Pennsylvania	Wheelabrator Falls	WTE	Morrisville	PA	178	3.1	$100.95	1,500	1,398
New Jersey	Warren County RRF	WTE/RRF	Oxford	NJ	176	3	$101.06	450	465
Virginia	Charles City County	Landfill	Charles City	VA	464	7.5	$101.40	5,000	1,506
New Jersey	Camden County RRF	WTE/RRF	Camden	NJ	208	3.5	$101.83	1,050	854
Virginia	Covanta Alexandria	WTE	Alexandria	VA	350	5.7	$102.29	975	901
New York	High Acres Landfill	Landfill	Fairport	NY	325	5	$102.78	3,400	1,850
Pennsylvania	Delaware Valley RRF	WTE	Chester	PA	225	3.7	$103.25	2,688	3,340
Virginia	Atlantic - Waverly	Landfill	Waverly	VA	492	8	$105.92	10,000	4,570
New York	Covanta Energy of Niagara Falls	WTE	Niagara Falls	NY	408	6.1	$107.12	2,500	2,095
Pennsylvania	Alliance Sanitary Landfill	Landfill	Taylor	PA	198	3.1	$108.27	5,500	na
New York	Hempstead RRF - Covanta	WTE	Westbury	NY	119	2.1	$108.73	2,671	2,639
New Jersey	Gloucester RRF	WTE/RRF	Westville	NJ	207	3.5	$108.77	575	521
Massachusetts	Taunton Sanitary Landfill	Landfill	Taunton	MA	112	1.75	$110.72	685	287
Ohio	American Landfill	Landfill	Waynesburg	OH	551	8.5	$116.34	15,000	2,700
Maryland	Montgomery County RRF	WTE	Dickerson	MD	361	6	$117.61	1,800	1,466
Pennsylvania	Conestoga Landfill	Landfill	Morgantown	PA	282	4.75	$120.14	10,000	NA
New York	Modern Corporation	Landfill	Lewiston	NY	417	6.25	$120.51	2,612	2,600
Virginia	Wheelabrator Portsmouth	WTE	Portsmouth	VA	542	8.5	$122.88	2,000	1,652
Ohio	Tunnel Hill Reclamation	Landfill	New Lexington	OH	619	10	$125.82	8,000	2,700
Maryland	Quarantine Road Landfill	Landfill	Baltimore	MD	361	6	$131.61	NA	360
Virginia	King & Queen County	Landfill	Little Plymouth	VA	452	7.75	$134.69	NA	2,128
Ohio	Rumpke Beech Hollow	Landfill	Wellston	OH	664	10.25	$136.12	4,000	1,360
Massachusetts	Fitchburg/Westminster Landfill	Landfill	Westminster	MA	84	1.5	$137.54	1,425	761

Exhibit F

State of CT MSW Supply Assessment

November 30, 2013

Analysis of MSW Supply in the Central Connecticut Region

Prepared for:

Connecticut Resources Recovery Authority

CONNECTICUT RESOURCES RECOVERY AUTHORITY
CONNECTICUT'S RECYCLING LEADER

Prepared by:

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November 5, 2013

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Table of Contents

Tables

Figures

Appendices

1. Introduction

In 2013, State legislation (Public Act No. 13-285, Substitute Senate Bill No. 1081, An Act Concerning Recycling and Jobs) was enacted requiring the Connecticut Resources Recovery Authority (CRRA) to prepare a Transition Plan to evaluate the future role of CRRA and its facilities. As part of this Transition Plan, this report presents the analysis of the municipal solid waste (MSW) supply for the South Meadows Facility in the Central Connecticut Region, and the towns outside the region currently delivering MSW to the South Meadows Facility. This analysis included five different MSW management scenarios and their effects on the projected amount of MSW available to the South Meadows Facility for the period of 2014 to 2024. The five scenarios analyzed in this report are as follows:

1. Baseline Scenario - Recycling and composting rate remain constant
2. Scenario 1 - Increase in the diversion rate of organic material through composting and anaerobic digestion
3. Scenario 2 - Increase in the recycling rate
4. Scenario 3 - Increase in the composting and the recycling rates to the State's goal of 58 percent total diversion rate by 2024
5. Scenario 4 - Increase in the composting and the recycling rates to the State's goal of 58 percent, and decrease the per capita MSW generation to 0.6 tons-per-year (TPY) by 2024.

Also included are population and MSW generation projections for the targeted years of 2014-2024.

2. Towns Included in the Analysis

Towns included in the analysis are the towns in the Central Connecticut region and the towns that have delivered any amount of residential and/or commercial MSW to the South Meadows Facility in 2011, 2012 and/or 2013. Table 2-1 contains the full list of the towns taken into consideration in these analyses. There are 90 in total.

Table 2-1
Towns Inside and Outside the Central Connecticut Region That Have Delivered to the Mid-Connecticut Project

Town/ City	
Central CT Region	**Out of the Central CT region**
Andover	Beacon Falls
Avon	Bethel
Berlin	Bethlehem
Bloomfield	Brookfield
Bolton	Canaan
Bristol	Chester
Burlington	Clinton
Canton	Colchester
Cromwell	Colebrook
Durham/Middlefield	Cornwall
East Granby	Coventry
East Haddam	Danbury
East Hampton	Deep River
East Hartford	Essex
East Windsor	Goshen
Ellington	Guilford/ Madison
Enfield	Harwinton
Farmington	Killingworth
Glastonbury	Litchfield
Granby	Lyme
Haddam	Naugatuck
Hartford	New Fairfield
Hebron	New Haven
Manchester	New Milford
Marlborough	Newtown
Middlebury	Norfolk
Middletown	North Branford
New Britain	North Canaan
Newington	Old Lyme

Plainville	Old Saybrook
Plymouth	Oxford
Portland	Prospect
Rocky Hill	Ridgefield
Simsbury	Roxbury
Somers	RRDD#1 (Barkhamsted, New Hartford and Winchester)
South Windsor	Salisbury/Sharon
Southington	Southbury
Suffield	Stafford
Tolland	Stamford
Vernon	Thomaston
West Hartford	Torrington
Wethersfield	Waterbury
Windsor	Watertown
Windsor Locks	Westbrook
Wolcott	Woodbury

Eight towns from the Central Connecticut region have signed 20-year waste supply agreements for residential MSW with the Covanta Bristol Waste-To-Energy (WTE) Facility. Twelve additional towns have signed short-term waste supply agreements (four years on average) for the residential MSW, with different Covanta WTE plants in Connecticut (Preston, Agawam, Wallingford, Bristol). The commercial MSW from these 20 towns is available for delivery to the South Meadows Facility since the Covanta facilities are privately owned, and the towns do not control flow of the commercial waste. Table 2-2 contains a list of the towns with short-term and long-term waste supply agreements in place.

Table 2-2
Towns with Long-Term and Short-Term Waste Supply Agreements

Towns With Long-term Waste Supply Agreements	Towns With Short-term Waste Supply Agreements
Berlin	East Haddam
Bristol	East Hartford
Burlington	Enfield
New Britain	Guilford/ Madison
Plainville	Newington
Plymouth	Southbury
Southington	Suffield
Wolcott	Tolland
	Vernon
	Waterbury
	West Hartford
	Windsor Locks

2.1 Population Projections for the Considered Towns

Data on the populations of the considered towns was available for 2011, 2015, 2020 and 2025[1]. These population projections are from the Connecticut State Data Center. For the purposes of this report, linear increases in the population from 2011 to 2025 were assumed, and the populations for 2014, 2019 and 2024 were interpolated. Population projections used in the analyses are shown in Table 2-3.

Table 2-3
Population Projections

Year	2014	2019	2024
Population in the Central Connecticut Region	1,148,299	1,168,866	1,183,403
Population out of the Central CT Region	964,723	983,998	997,324
Total Population	2,113,022	2,152,864	2,180,726

[1] Connecticut State Data Center: http://ctsdc.uconn.edu/projections.html, accessed August 27, 2013

3. Amount of MSW Generated and Current MSW Management Practice (2011 data[2])

Complete data sets on generated, composted, recycled and disposed MSW were available for 2011 and they were used to define the basic scenario for further analysis.

The total amount of MSW generated in the 90 towns considered was approximately 1.8 million tons in 2011. Twenty-four percent of the generated waste was recycled, one percent was composted, and 75 percent was disposed in landfills or in the existing WTE plants. Table 3-1 shows the amount of MSW generated, recycled, composted and disposed in the analyzed towns as well as the total amount. It shows the towns from the Central Connecticut region have higher recycling rates than the towns outside the region.

Table 3-1
2011 MSW Generated, Recycled, Composted and Disposed in the Considered Towns in Connecticut

	TOTAL in the towns inside and outside of the Region		Towns in Central CT Region		Towns Outside the Region	
	TPY	%	TPY	%	TPY	%
Generated	1,819,842	100	990,210	100	828,865	100
Recycled	428,027	24	252,220	25	175,807	21
Composted	18,728	1	9,581	1	9,147	1
Disposed	1,372,323	75	728,410	74	643,912	78

Several towns did not report the recycled, composted and disposed MSW to the Connecticut Department of Energy and Environmental Protection (DEEP). For these towns the MSW generated was calculated using the town's population in 2011, and per capita generation rate of 0.9 TPY of MSW. The total amount of MSW generated by these towns was considered disposed with no recycling or composting. The following towns did not report to the DEEP: Andover, Hartford and Windsor.

3.1 Amount of MSW Delivered to the South Meadows Facility

As Table 3-1 shows, 75 percent (or around 1.4 million tons) of the generated MSW in the 90 towns included in this analysis was disposed in 2011. Fifty-eight percent of the total disposed waste (around 800,000 tons) was delivered to the South Meadows Facility for processing (Table 3-2). Around 40 percent of the disposed waste was processed in other WTE plants and/or deposited in landfills.

In addition to the waste coming from the towns, directly or through the CRRA transfer stations, a certain amount of waste is delivered from other recycling plants and transfer

[2] Summary report Estimated Municipal Solid Waste (MSW) Recycling and Disposal Rates For CT Cities and Towns FY2011 – DRAFT 9/12/2013- Connecticut Department of Energy and Environmental Protection

stations in the region (around 20,000 TPY). The amount of MSW delivered from all the sources to the South Meadows Facility in 2011, 2012 and 2013 is shown in Table 3-3.

Table 3-2
Amount of MSW delivered to the South Meadows Facility in 2011, 2012 and 2013[3]

Amount of MSW delivered to the South Meadows Facility			
	2011	**2012**	**2013 (first half)**
MSW (TPY)	818,375.71	776,840.40	318,384.35

Table 3-3 shows the total amount of MSW delivered to the South Meadows Facility from all the sources.

Figure 3-1 shows the decrease in the amount of MSW delivered to the South Meadows Facility. The 2013 tonnage is calculated as double the first half amount from Table 3-3. The decrease between 2012 and 2011 is five percent, but the decrease from 2012 to 2013 is 18 percent. The decrease in the amount of the MSW delivered to the South Meadows Facility is because certain amount of MSW delivered in 2011 went to other WTE plants or landfills in 2012 and 2013. Total amount of MSW generated in the considered towns in 2012 and 2013 have increased and is more than the operating capacity of the South Meadows Facility. The amount delivered to the South Meadows Facility may decrease further in 2014 when some of the short-term and the long-term agreements start.

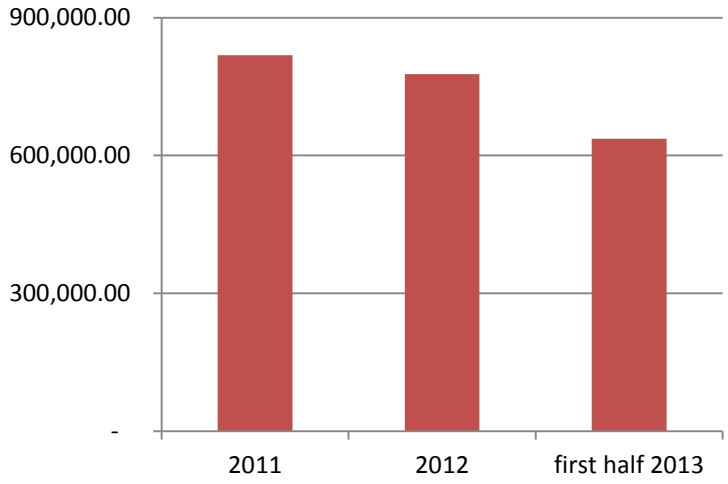

Figure 3–1
Amount of MSW Delivered to the South Meadows Facility in the Last Three Years

[3] CRRA tonnage reports for 2011, 2012 and 2013 years.

4. Composition of the MSW Going to the South Meadows Facility

To model the scenarios, the composition of the MSW currently delivered at the South Meadows Facility was identified, and three different data sources were found, as shown in Table 4-1.

Table 4-1
Composition of the MSW in Connecticut

	Yale School of Forestry and Environmental Studies[4]	Composition Study 2010- Composition of statewide disposed MSW	Composition Study 2010- Composition of MSW at South Meadows Facility
	%	%	%
Paper	30	26	25
Organics	27	27	29
Plastic	11	15	14
Metal	5	5	4
Glass	2	2	2
E-Waste	1	2	3
HHW	0	1	1
Other Waste	7	9	8
Misc. Waste	8		
C&D	10	14	15

For further analysis, the Composition of MSW at the South Meadows Facility as published Connecticut State-Wide Solid Waste Composition and Characterization Study, 2010, from Table 4-1 was accepted[5] (Figure 4-1).

[4]CT's Solid Waste Management System, Existing Infrastructure- Connecticut DEEP, June 13, 2012

[5] Connecticut State-Wide Solid Waste Composition and Characterization Study, Final Report- May 26, 2010

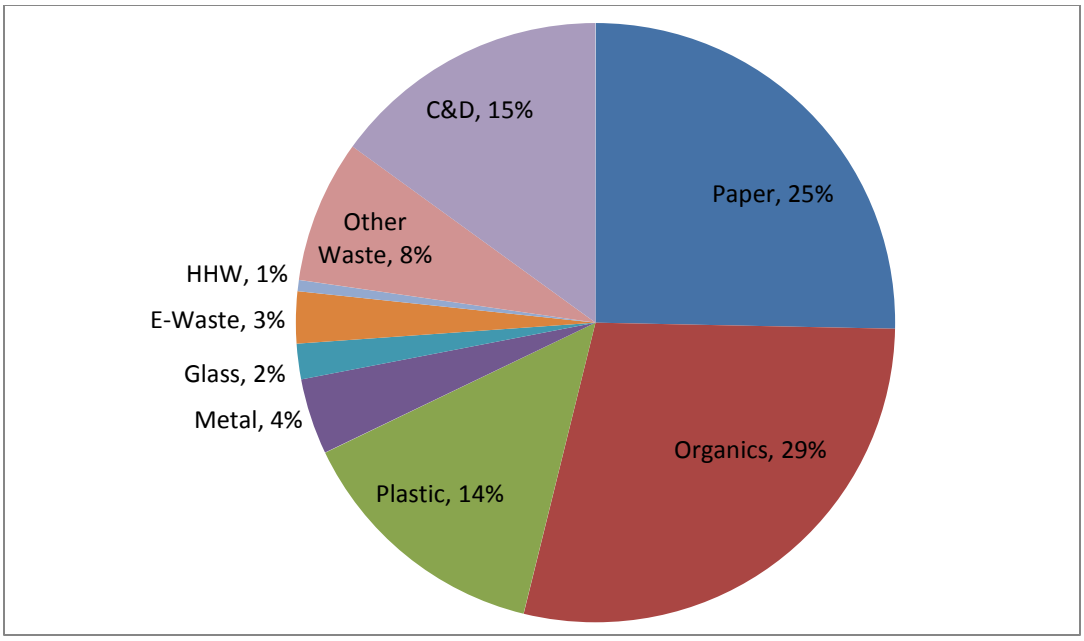

Figure 4–1
Composition of the MSW in Connecticut

5. MSW Generation Projections

To project the amount of MSW generated in 2014, 2019 and 2024 the following assumptions were made:

- Constant MSW generation per-capita of 0.9 TPY in the Baseline Scenario, Scenarios 1, 2 and 3;
- Decrease in the per-capita generation to 0.6 TPY by 2024 (targeted in the State of Connecticut Solid Waste Management Plan[6]) in Scenario 4; and,
- Population projections from Table 2-3

For Scenarios 1, 2 and 3 the increase in the MSW generation is a steady two percent per year. This increase is directly related to the increase in population.

In the Scenario 4, the generation per capita decreases from 0.8 TPY in 2014 to 0.7 TPY in 2019 and 0.6 TPY in 2024. The decrease in the per-capita generation results in an 11-percent decrease in the total amount of MSW generated from 2014 to 2019, and a 14-percent decrease in the MSW from 2019 to 2024. Table 5-1 shows the projected amounts of MSW generated, that was used further in the analysis.

Table 5-1
MSW Generation Projections for 2014, 2019 and 2024

Year	2014	2019	2024
Scenario 1, 2 & 3 per capita generation (TPY)	0.9		
Total MSW generated	1,901,720	1,937,577	1,962,654
Scenario 4 per capita generation (TPY)	0.8	0.7	0.6
Total MSW generated	1,690,418	1,507,005	1,308,436

[6] State Of Connecticut State Solid Waste Management Plan Amended December 2006

6. Waste Management Scenarios and Their Effects on the Amount of MSW Available as a Feedstock for the South Meadows Facility

To project the potential changes in the amount of MSW available as feedstock for the South Meadows Facility, five different waste management scenarios were developed as follows:

1. Baseline Scenario- Constant recycling and composting rate
2. Scenario 1 - Increase in the diversion rate of organic material through composting and anaerobic digestion
3. Scenario 2 - Increase in the recycling rate
4. Scenario 3- Increase in the composting and the recycling rates to the State's goal of 58 percent total diversion by 2024, defined in the State Solid Waste Management Plan.
5. Scenario 4 - Increase in the composting and the recycling rates to the State's goal of 58 percent, and decrease in the per capita MSW generation to 0.6 TPY by 2024.

The Baseline Scenario was developed as a benchmark for comparison and the recycling and composting rates remain consistent with 2011 rates as shown in Table 3-1.

Details of all the scenarios can be found in the Appendix 1.

In developing the models, the following assumptions were made:

- Recycling, composting and disposal rates from 2011 (Table 3-1) were considered current for the year 2014
- Population projections used were as shown in Table 2-3
- MSW generation projections were used as described in Section 5 and Table 5-1
- The MSW amount for disposal is 60 percent from residential and 40 percent from commercial[7]
- Between 2014 and 2019, the residential MSW from the towns with short-term and long-term waste supply agreements will not be available for the South Meadows Facility
- Between 2014 and 2024, the residential MSW from the towns with long-term agreements with Covanta's Bristol plant will not be available for the South Meadows Facility

6.1 Baseline Scenario - Constant Composting and Recycling Rates

The Baseline Scenario is a benchmark to describe the changes in the MSW available for the South Meadows Facility in Scenarios 1, 2, 3 and 4. The composting rate is one percent and the recycling rate is 24 percent throughout the 10-year period. In this scenario, the MSW generation rate per capita is constant at 0.9 TPY. The population projections used in the calculations are as explained in Table 2-3 and Section 2.1. The total amounts of MSW potentially available as feedstock for the in 2014, 2019 and 2024 are shown in Table 6-1.

[7] Municipal Solid Waste Generation, Recycling, and Disposal in the United States: Facts and Figures for 2010- US Environmental Protection Agency

Table 6-1
Amount of MSW Available as Feedstock for CRRA in TPY in the Baseline Scenario

	TOTAL in the towns inside and outside of the Region	Towns in Central CT Region	Towns Outside the Region
Year	**TPY**	**TPY**	**TPY**
2014	**1,119,369**	**538,691**	**580,678**
2019	**1,330,522**	**666,424**	**664,098**
2024	**1,347,271**	**674,204**	**673,067**

6.2 Scenario 1 - Increase In the Diversion Rate of Organic Material through Composting and Anaerobic Digestion

This scenario assumes the recycling rate will remain constant as in 2014 (24 percent) through 2024. The increase in diversion rate of organics through composting and anaerobic digestion was developed based on the amount of organics available in the MSW (Figure 2) and the existing legislation and efforts towards better management practices of organic waste in Connecticut. Organics comprise 30 percent of the MSW. Assuming a target of 50% recovery of available organics in 2024, then the highest diversion rate to expect by 2024 is 15 percent. Therefore, in this model, the diversion rate increases from one percent in 2014, to seven percent in 2019 and 15 percent in 2024. Table 6-2 shows the changes in diversion rate and their effect on the disposal rate.

Table 6-2
Scenario 1 Changes in the Composting and Disposal Rates from 2014-2024

Year	2014	2019	2024
Recycled	24%	24%	24%
Diverted organics	1%	7%	15%
Total Disposed	75%	69%	61%

The amount of MSW dedicated for disposal and available as a feedstock for the South Meadows Facility in 2014, 2019 and 2024 is shown in Table 6-3. Based on this scenario, the amount of MSW available only in the Central Connecticut region is not enough for the South Meadows Facility in the next 10-year period. The CRRA will have to source more MSW feedstock from outside the Central Connecticut region as is currently being done.

Table 6-3
Amount of MSW Available as Feedstock for CRRA in TPY in Scenario 1

	TOTAL in the towns inside and outside of the Region	Towns in Central CT Region	Towns Outside the Region
Year	**TPY**	**TPY**	**TPY**
2014	**1,119,369**	**538,691**	**580,678**
2019	**1,216,932**	**609,529**	**607,402**
2024	**1,089,381**	**545,150**	**544,231**

The total amount of MSW available for the CRRA, from inside and outside the Central Connecticut region is sufficient for the South Meadows Facility. The amount of MSW available in this model is around 35 percent more than the amount CRRA needs as a feedstock for this plant (710,000 TPY).

6.3 Scenario 2 - Enhanced Recycling Rate

This scenario assumes the diversion rate of organic waste will remain the same as in 2014 (one percent) through 2024. The increase in recycling rate was developed based on the targeted diversion rate of 58 percent defined by the State Solid Waste Management Plan. The recycling rate was modeled based on the amount of recyclables available in the MSW (Figure 2). The recycling rate in this model increases from 24 percent in 2014, to 34 percent in 2019, and 43 percent in 2024. As a result, the disposed amount of MSW decreases from 75 percent in 2014, to 65 percent in 2019, and 56 percent in 2024. Table 6-4 shows the changes in the recycling rate and their effects on the disposal rate.

Table 6-4
Scenario 2 Changes in the Recycling and Disposal Rates from2014-2024

Year	2014	2019	2024
Recycled	24%	34%	43%
Diverted organics	1%	1%	1%
Total Disposed	75%	65%	56%

The amount of MSW estimated to be disposed and available to CRRA as a feedstock for the South Meadows Facility in 2014, 2019 and 2024 is shown in Table 6-5. Based on this scenario, the amount of MSW available only in the Central Connecticut region is not enough for the South Meadows Facility in the next 10-year period. The CRRA will have to source more MSW from outside the Central Connecticut region as is currently being done.

Table 6-5
Amount of MSW Available as Feedstock for CRRA in TPY in Scenario 2

	TOTAL in the towns inside and outside of the Region	Towns in Central CT Region	Towns Outside the Region
Year	**TPY**	**TPY**	**TPY**
2014	**1,119,369**	**538,691**	**580,678**
2019	**1,146,385**	**574,194**	**572,190**
2024	**1,000,087**	**500,466**	**499,622**

The total amount of MSW available for the CRRA, from inside and outside the Central Connecticut region is enough for the South Meadows Facility. The amount of MSW available in this model is around 30 percent more than the amount CRRA needs as a feedstock for this plant (710,000 TPY). The total amount available in this scenario is lower than the MSW available in Scenario 1.

6.4 Scenario 3 - Increase in the Diversion of Organics and Recycling Rates to the State's Goal of 58 Percent Total Diversion By 2024

Scenario 3 combines Scenario 1 and 2 toward the State's goal of a 58 percent diversion rate by 2024, targeted in the State's Solid Waste Management Plan. The diversion rate of organics increases from one percent in 2014, to seven percent in 2019, and 15 percent in 2024. The recycling rate increases from 24 percent in 2014, to 34 percent in 2019 and 43 percent in 2024, and the disposal rate decreases significantly because of that. Changes in the recycling, composting and disposal percentage are shown in Table 6-6.

Table 6-6
Scenario 3 Changes in the Recycling and Disposal Rates from 2014-2024

Year	2014	2019	2024
Recycled	24%	34%	43%
Diverted organics	1%	7%	15%
Total Disposed	75%	59%	42%

The amount of MSW estimated for disposal and available to CRRA as a feedstock for the South Meadows Facility in 2014, 2019 and 2024 is shown in Table 6-7. Based on this scenario, the amount of MSW available from within the Central Connecticut region is around half the material needed for the South Meadows Facility in 2024. The CRRA will have to source more MSW feedstock from outside the Central Connecticut region as is currently being done.

Table 6-7
Amount of MSW Available as Feedstock for CRRA in TPY in Scenario 3

	TOTAL in the towns inside and outside of the Region	Towns in Central CT Region	Towns Outside the Region
Year	TPY	TPY	TPY
2014	1,119,369	538,691	580,678
2019	1,040,565	521,192	519,373
2024	750,065	375,349	374,716

The total amount of MSW available for the CRRA, from inside and outside the Central Connecticut region is a little bit more than the amount needed for the South Meadows Facility. The amount of MSW available in this model in 2024 is around five percent more than the amount CRRA needs as a feedstock for this plant (710,000 TPY). The total amount available in this scenario is significantly lower than the MSW available in Scenarios 1 and 2.

6.5 Scenario 4 - Increase in Diversion of Organics and Recycling Rates To the State's Goal of 58 Percent and Decrease in The Per Capita MSW Generation To 0.6 TPY By 2024

Scenario 4 takes the composting and recycling rate projections from Scenario 3 and applies it to a decrease in MSW generation as described in Section 5 and Table 5-1. Targeted per-capita MSW generation is 0.8 TPY in 2014, 0.7 TPY in 2019 and 0.6 TPY in 2024. The diversion of organics and recycling rates remain the same as in the Scenario 3 (Table 6-7).

The amount of MSW estimated for disposal and available under Scenario 4 to CRRA as a feedstock for the South Meadows Facility in 2014, 2019 and 2024 is shown in Table 6-8. Based on this scenario, the amount of MSW available from inside the Central Connecticut region is not enough for the South Meadows Facility in the next 10-year period. The CRRA will have to source more MSW feedstock from outside the region as is currently being done.

Table 6-8
Amount of MSW Available As Feedstock for CRRA in TPY in Scenario 4

	TOTAL in the towns inside and outside of the Region	Towns in Central CT Region	Towns Outside the Region
Year	TPY	TPY	TPY
2014	994,995	478,837	516,158
2019	809,328	399,155	340,858
2024	500,044	242,776	242,863

The total amount of MSW available for the CRRA, from inside and outside the Central Connecticut region (Table 6-8) appears sufficient in 2014 and 2019. The amount of MSW

available in 2024 is below the amount needed for the South Meadows Facility. The total amount available in this scenario is significantly lower than the MSW available in Scenarios 1, 2 and 3.

6.6 Summary of the Scenarios

Figure 6-1 shows the MSW amount available in 2014, 2019 and 2024 in different scenarios compared to the baseline. Scenarios 1 and 2 show a moderate decrease in the amount of MSW, though still more than the 710,000 TPY the South Meadows Facility needs. Scenarios 3 and 4 show significant decreases in the MSW available in 2024. Scenario 4 is the only one without sufficient MSW in 2024 and is the worst-case scenario for the South Meadows Facility.

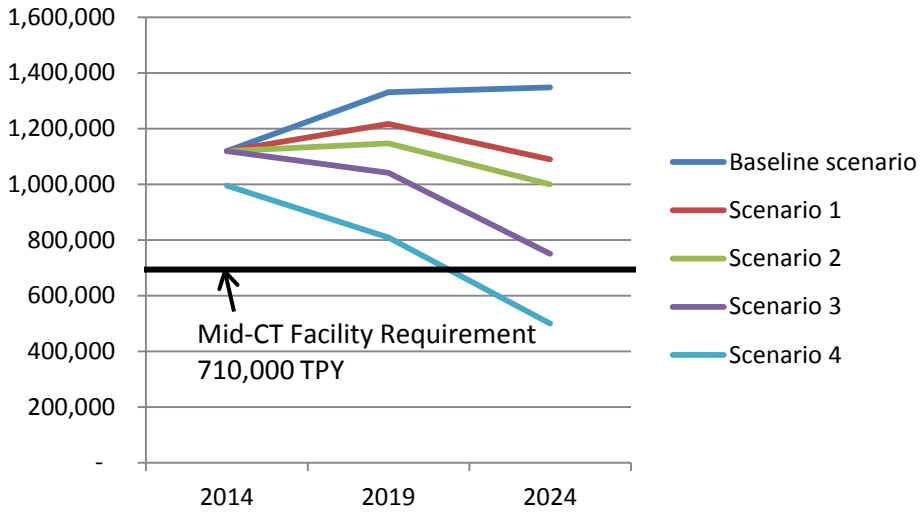

Figure 6–1
Comparison of the Amount of MSW Available for the South Meadows Facility in Different Scenarios Compared to the Baseline

7. Review of the Connecticut Governor's Recycling Task Force Report, 2012

7.1 Summary of Recommendations

A recycling working group was formed in April 2012 by Connecticut Governor Malloy to analyze the current status of recycling, and make recommendations for modernizing it. A report of results was published in December of 2012.

The recommendations described in the report are as follows:

- **Promote an environmentally beneficial infrastructure that balances the need for both stability and responsiveness under market conditions** and includes a diversity of systems and facilities to collect, process, and recover material and energy value, and to support the development of stronger markets for recovered commodities.
- **Foster economic development and job creation** through increased materials recovery that make raw materials available to in-state manufacturers.
- **Reduce economic, operational, and administrative burdens on municipalities** and individuals by encouraging modernization of pricing systems, data systems, and phasing in the potential for regional services.
- **Redefine the role of the Connecticut Resources Recovery Authority (CRRA) and the role and value of multiple Regional Solid Waste Authorities** in governance, responsibilities, and operations and provide recommendations for improvement.

These recommendations are needed in order for Connecticut to ultimately increase its recycling rate to 60 percent, mainly through more intensive food waste and C&D recycling. Recycling working group introduces the 60 percent recycling as the target in their report, slightly different than the 58 percent targeted by the State. Recommendations for bolstering the recycling rate include: expand the capacity of recycling facilities; financially incentivize the development of new recycling capacity and develop other financing mechanisms; promote product stewardship principles; develop an education and enforcement campaign to promote reuse, waste minimization and recycling; and implement unit-based pricing.

Additional recommendations are described in the report and suggest general improvement of the solid waste management system in Connecticut, such as, ensuring sustainability of the operation of the existing WTE facilities; simplifying and improving the data reporting requirements; and redefining the role of the CRRA.

7.2 Assessment of the Timeframe and the Likelihood of the Proposed Recommendations to Happen and the Effects on the South Meadows Facility

Analysis and recommendations related to redefining the role of the CRRA will be presented in CRRA's Transition Plan. In this report, comments are provided on the recommendations for increasing recycling and overall improvement of the State's waste management system.

The main recommendations are about how to improve the recycling, mostly through food waste and C&D. The target of a 60 percent diversion rate is in line with the target set in the State's Solid Waste Management Plan, to be achieved by 2024. This high diversion rate is

realistic only if the food waste is also diverted and processed as a separate fraction. This leads to the increased interest and support of recycling facilities for food-waste processing and recycling. Composting and anaerobic digestion are already under consideration by the State. The State has a law designed to flow commercial source separated food waste (from facilities generating at least 104 tpy food waste) to a processing facility (within 20 miles of the generating facility) once two such processing facilities exist, and has financial incentives for the anaerobic digestion as a processing option for food waste.

By 2024, it is reasonable to estimate that organics diversion will have increased, as organics diversion is currently at one percent and the goal is 15 percent, and planned diversion activities have yet to start. The effects of these changes on the South Meadows Facility are described in Scenarios 1 and 3.

Based on the recommendations in the state Solid Waste Management Plan, further increases in the recycling rate are expected to come from increased recycling C&D materials. Currently this material is not delivered to the South Meadows Facility and is not a feedstock. Therefore, increasing the recycling of C&D is not expected to affect the total amount, or the composition of the MSW available to the South Meadows Facility.

Appendix 1 - Detail Tonnage Breakdown of the Waste Management Scenarios

BASE CASE SCENARIO- Constant Recycling and Composting rates

	2014						2019						2024					
	TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region	
	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY
Disposed total	75%	1,434,669	**75%**	779,655	75%	655,014	75%	1,461,720	75%	793,619	75%	668,101	75%	1,480,638	75%	803,489	75%	677,148
Diverted total	**25%**	**467,051**	**25%**	**253,814**	**25%**	**213,237**	**25%**	**475,858**	**25%**	**258,360**	**25%**	**217,498**	**25%**	**482,016**	**25%**	**261,573**	**25%**	**220,443**
Recycled	24%	447,473	**24%**	243,174	24%	204,299	24%	455,910	24%	247,530	24%	208,380	24%	461,810	24%	250,608	24%	211,202
Composted	1%	19,578.38	1%	10,640	1%	8,939	1%	19,948	1%	10,830	1%	9,117	1%	20,206	1%	10,965	1%	9,241
TOTAL		1,901,720		1,033,469		868,251		1,937,577		1,051,979		885,598		1,962,654		1,065,062		897,591
MSW available for CRRA	**59%**	**1,119,369**	**52%**	**538,691**	**67%**	**580,678**	**69%**	**1,330,522**	**63%**	**666,424**	**75%**	**664,098**	**69%**	**1,347,271**	**63%**	**674,204**	**75%**	**673,067**

Scenario 1- Increase Composting Rate of Organic Materials

	2014						2019						2024					
	TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region	
	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY
Disposed total	75%	1,434,669	**75%**	779,655	75%	655,014	69%	1,336,928	69%	725,866	69%	611,063	61%	1,197,219	61%	649,688	61%	547,531
Diverted total	25%	467,051	**25%**	253,814	25%	213,237	31%	591,540	31%	321,168	31%	270,372	39%	756,209	39%	410,367	39%	345,841
Recycled	24%	447,473	**24%**	243,174	24%	204,299	24%	455,910	24%	247,530	24%	208,380	24%	461,810	24%	250,608	24%	211,202
Composted	**1%**	**19,578**	**1%**	**10,640**	**1%**	**8,939**	**7%**	**135,630**	**7%**	**73,639**	**7%**	**61,992**	**15%**	**294,398**	15%	159,759	15%	134,639
TOTAL		1,901,720		1,033,469		868,251	100%	1,937,577	100%	1,051,979	100%	885,598	100%	1,962,654	100%	1,065,062	100%	897,591
MSW available for CRRA	**59%**	**1,119,369**	**52%**	**538,691**	**67%**	**580,678**	**63%**	**1,216,932**	**58%**	**609,529**	**69%**	**607,402**	**56%**	**1,089,381**	**51%**	**545,150**	**61%**	**544,231**

Scenario 2- Enhanced recycling rate

	2014						2019						2024					
	TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region		TOTAL in all the towns considered (inside and outside of the Region)		Towns in the Central CT Region		Towns Outside the Region	
	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY
Disposed total	75%	1,434,669	**75%**	779,655	75%	655,014	65%	1,259,425	65%	683,786	65%	575,639	56%	1,099,086	56%	596,435	56%	502,651
Diverted total	25%	467,051	**25%**	253,814	25%	213,237	35%	678,724	35%	368,503	35%	310,221	44%	864,147	44%	468,942	44%	395,205
Recycled	**24%**	**447,473**	**24%**	**243,174**	**24%**	**204,299**	**34%**	**658,776**	**34%**	**357,673**	**34%**	**301,103**	**43%**	**843,941**	43%	457,977	43%	385,964
Composted	**1%**	19,578	**1%**	10,640	1%	8,939	1%	19,948	1%	10,830	1%	9,117	1%	20,206	1%	10,965	1%	9,241
TOTAL	100%	1,901,720		1,033,469		868,251	100%	1,937,577	100%	1,051,979	100%	885,598	100%	1,962,654	100%	1,065,062	100%	897,591
MSW available for CRRA	**59%**	**1,119,369**	**52%**	**538,691**	**67%**	**580,678**	**59%**	**1,146,385**	**55%**	**574,194**	**65%**	**572,190**	**51%**	**1,000,087**	**47%**	**500,466**	**56%**	**499,622**

Appendix 1 - Detail Tonnage Breakdown of the Waste Management Scenarios

Scenario 3-Increase in the Composting and Recycling Rates To The State's Goal of 58 Percent Total Diversion By 2024

	2014						2019						2024					
	TOTAL in all the towns considered (inside and		Towns in the Central CT		Towns Outside the Region		TOTAL		Central CT region		Out of the region		TOTAL		Central CT region		Out of the region	
	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY
Disposed total	75%	1,434,669	75%	779,655	75%	655,014	59%	1,143,171	59%	620,668	59%	522,503	42%	824,315	42%	447,326	42%	376,988
Diverted total	**25%**	**467,051**	**25%**	**253,814**	**25%**	**213,237**	**41%**	**794,407**	**41%**	**431,311**	**41%**	**363,095**	**58%**	**1,138,339**	**58%**	**617,736**	**58%**	**520,603**
Recycled	24%	447,473	24%	243,174	24%	204,299	34%	658,776	34%	357,673	34%	301,103	43%	843,941	43%	457,977	43%	385,964
Composted	1%	19,578	1%	10,640	1%	8,939	7%	135,630	7%	73,639	7%	61,992	15%	294,398	15%	159,759	15%	134,639
TOTAL	100%	1,901,720		1,033,469		868,251	100%	1,937,577	100%	1,051,979	100%	885,598	100%	1,962,654	100%	1,065,062	100%	897,591
MSW available for CRRA	**59%**	**1,119,369**	**52%**	**538,691**	**67%**	**580,678**	**54%**	**1,040,565**	**50%**	**521,192**	**59%**	**519,373**	**38%**	**750,065**	**35%**	**375,349**	**42%**	**374,716**

Scenario 4- Increase in Composting and Recycling Rates To the State's Goal of 58 Percent and Decrease in The Per Capita MSW Generation To 0.6 TPY By 2024

		2011	2014	2019	2024
	Population		2,113,022	2,152,864	2,180,726
Decrease in the MSW generation	MSW per capita (TPY)	0.9	0.8	0.7	0.6
	MSW total generated (TPY)		1,690,418	1,507,005	1,308,436
	% decrease	n/a	11%	13%	**23%**

	2014						2019						2024					
	TOTAL in all the towns considered (inside and		Towns in the Central CT		Towns Outside the Region		TOTAL in all the towns		Towns in the Central		Towns Outside the		TOTAL in all the towns		Towns in the Central		Towns Outside the	
	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY	%	TPY
Disposed total	75%	1,275,261	75%	693,027	75%	582,234	59%	889,133	59%	476,525	59%	343,293	42%	549,543	42%	290,761	42%	244,378
Diverted total	**25%**	**415,157**	**25%**	**225,612**	**25%**	**189,544**	**41%**	**617,872**	**41%**	**331,144**	**41%**	**238,559**	**58%**	**758,893**	**58%**	**401,527**	**58%**	**337,474**
Recycled	24%	397,754	24%	216,155	24%	181,599	34%	512,382	34%	274,607	34%	197,830	43%	562,627	43%	297,684	43%	250,197
Composted	1%	17,403	1%	9,457	1%	7,946	7%	105,490	7%	56,537	7%	40,730	15%	196,265	15%	103,843	15%	87,278
TOTAL	100%	1,690,418		918,639		771,779	100%	1,507,005	100%	807,669	100%	581,852	100%	1,308,436	100%	692,288	100%	581,852
MSW available for CRRA		**994,995**		**478,837**		**516,158**		**809,328**		**399,155**		**340,858**		**500,044**		**242,776**		**242,863**

Exhibit G

Ensuring Capacity for Connecticut's Municipal Solid Waste and Recyclables in Changing Market Conditions

November 30, 2013

Meeting the Challenge - Ensuring Capacity for Connecticut's Municipal Solid Waste and Recyclables in Changing Market Conditions

(A White Paper)

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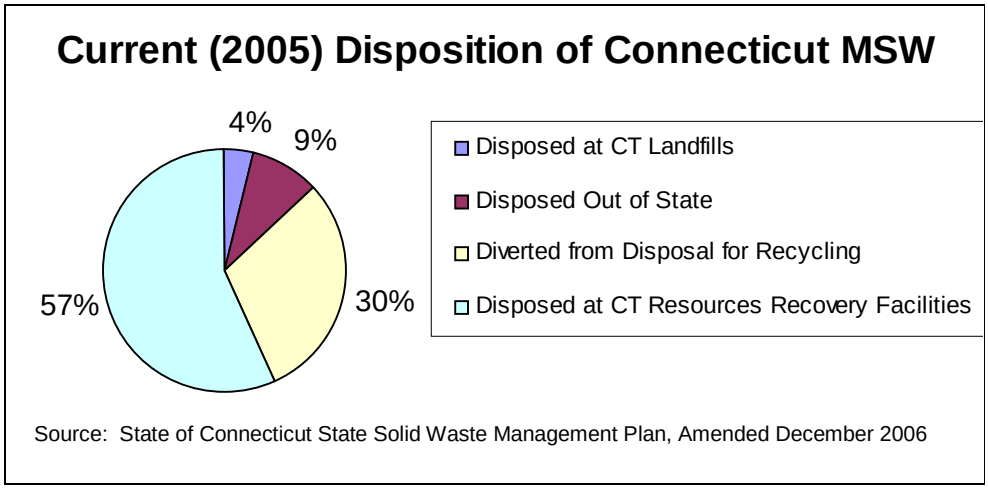
February 27, 2007

1.0 Defining the Challenge

Since the mid 1970s, Connecticut has benefited from an integrated solid waste management system that has been largely self-sustaining. This system, which was designed to meet the needs of the state's 169 municipalities, has focused on the recovery of energy and materials from the municipal solid waste ("MSW") stream generated in Connecticut.

Today, this integrated system includes six regional waste-to-energy facilities for MSW, seven regional intermediate processing facilities for recyclables, 112 transfer stations, several sites for composting yard waste and/or leaves, two landfills permitted to accept ash residue from the waste-to-energy facilities, and a third landfill permitted to accept MSW. This system manages approximately 90 percent of the estimated 3.8 million tons per year of MSW generated in Connecticut; the remaining 9 to 10 percent of MSW is transported out-of-state for disposal or processing. These figures do not include construction and demolition ("C & D") waste and oversized, bulky MSW, estimated at more than 1.1 million tons per year, of which less than 10 percent is estimated to be recycled and over 900,000 tons per year is estimated to be transported out-of-state for disposal.[1]



Shortfalls in Disposal Capacity

By 2024, with projected population growth and a reasonably vibrant economy, the MSW generated in Connecticut is estimated to reach over 5.2 million tons per year and the C&D waste stream over 1.5 million tons per year. Currently, existing processing and disposal capacity for Connecticut's MSW waste stream faces a shortfall of over 300,000 tons per year (approximately 800 tons per day). Processing and disposal capacity for the state's C&D waste stream faces a shortfall of over 900,000 tons per year (approximately 2,500 tons per day). In addition, there is a projected shortfall in landfill capacity for ash residue from existing waste-to-energy facilities. Once capacity at the Hartford Landfill is exhausted by the end of 2008, Connecticut will have only one landfill for ash residue, and it is privately owned and not reserved for Connecticut. Existing capacity at that landfill is forecast to be exhausted by 2019, and possibly before.[2]

[1] State of Connecticut State Solid Waste Management Plan, Amended December 2006.
[2] Ibid.

The result: Increasingly, Connecticut's municipalities will become more reliant on facilities outside Connecticut, and thus outside their control or management, to serve their disposal needs unless additional capacity in Connecticut is created.

The result: Increasingly, Connecticut's municipalities will become more reliant on facilities outside Connecticut, and thus outside their control or management, to serve their disposal needs unless additional capacity in Connecticut is created.

The Connecticut Department of Environmental Protection ("DEP"), with the input of many stakeholders, has crafted a substantive new amendment to the State of Connecticut Solid Waste Management Plan. This amendment calls for a panoply of initiatives by government and the private sector and additional mandates designed to blunt the generation of waste, including recovering for reuse, recycling and composting, to the greatest extent possible, the materials and compostable yard waste/food waste in the waste stream; achieving a waste reduction/reuse/recycling goal of 58 percent by 2024 (almost double the present estimated diversion level of 30 percent); and recovering the inherent energy value of the remaining waste for disposal through the existing waste-to-energy system infrastructure while minimizing to the greatest extent the amount of waste that ultimately requires burial in modern, lined landfills.

Yet, even with such compelling initiatives, with no increase in existing in-state MSW disposal capacity and no marked short-term increase in waste diversion, it is estimated that over 600,000 tons per year of MSW (approximately double the current rate) will require disposal out-of-state by 2010. In addition, unless there is a significant reduction in C&D waste, including an increase in C&D reuse and recycling, over 1.4 million tons per year of the C&D waste stream will need to be shipped out–of state for management by 2024, adding heavily to the already high export quantity.

In short, without substantial new funding, expansion of existing capacity, both for processing and disposal, and the political will to support these initiatives as the underpinnings for a self-sustaining solid waste management system, ***Connecticut's system will likely devolve from one that has been largely self-sustaining to one that is increasingly dependent on facilities and programs outside the state*** that are beyond the oversight, management, and control of Connecticut's local governments and the DEP.

The Risk of Out-of-State Disposal

Depending so heavily on out-of-state disposal is a high-risk strategy.

Depending so heavily on out-of-state disposal is a high-risk strategy.

Depending so heavily on out-of-state disposal is a high-risk strategy. Not only does it put the disposal system beyond the oversight, management and monitoring of Connecticut's municipalities and regulators, but it also subjects the waste generators in Connecticut to substantial uncertainties—uncertainty as to the transportation costs and risks to consistently move waste hundreds of miles to distant facilities, and uncertainty regarding future legislation and regulations in other states that could limit waste intake, add fees, or otherwise restrict out-of-state imports. While waste flows clearly transcend state boundaries, very few states, if any, embrace waste imports and the prospect of their increase. In fact, most states receiving significant waste quantities from outside their borders continue to examine and implement strategies that enable them to limit such imports. For example, Pennsylvania has a harms/benefits test that it now applies in permitting new facilities or expansions, and North Carolina just enacted a one-year moratorium on permits for new landfills and

certain expansions while its legislature studies the state's capacity needs and waste imports and exports.

Contributions of CRRA and Other Regional Solid Waste Organizations

The substantial portion of the existing solid waste management system for MSW in Connecticut has been developed and sustained through the Connecticut Resources Recovery Authority ("CRRA"). Created in 1973 as a public instrumentality and political subdivision of the State of Connecticut, CRRA's charge and mission is to plan, design, construct, finance, manage, own, and operate solid waste disposal, volume reduction, recycling, intermediate processing, and resources recovery facilities considered by CRRA to be necessary, desirable, convenient or appropriate in carrying out the provisions of the State Solid Waste Management Plan.

CRRA's overarching goal has been to serve its member municipalities through cost-based regional projects that are in the interests and for the benefit of the municipalities and their solid waste management and recycling objectives, and consistent with the State Solid Waste Management Plan. To this end, CRRA has developed, constructed, and now operates an integrated system of four regional waste-to-energy facilities, two regional recyclables processing centers, two landfills, and 12 transfer stations, providing for solid waste recycling and disposal services to more than 100 Connecticut cities and towns. In the aggregate, these projects manage more than 75 percent of the municipal solid waste generated in the state, and the waste-to-energy components produce on average approximately 160 megawatts of clean, renewable electrical energy each hour, representing approximately two to three percent of the state's electricity-generating resources. In carrying out its mission, CRRA contracts with private industry to construct and operate facilities. CRRA has executed contracts with the private operators of these facilities with terms expiring at various points over the next two to eight years, depending on the particular facility/contract.

In addition to CRRA, other regional authorities and/or organizations, each serving member communities' waste disposal and recycling needs, contribute significantly to the existing infrastructure, public oversight and self-sustainability of Connecticut's solid waste management system. These include, but are not limited to, the Bristol Resource Recovery Facility Operating Committee/Tunxis Recycling Operating Committee ("BRRFOC/TROC"), the Eastern Connecticut Resource Recovery Authority ("ECRRA"), the Housatonic Resources Recovery Authority ("HRRA"), and the Southeastern Connecticut Regional Resources Recovery Authority ("SCRRRA"). These entities also contract with the private sector for certain facilities and services they own and/or make available to benefit their member communities. Through these authorities and/or organizations, there are six regional waste-to-energy facilities that process MSW with a combined permitted design capacity of 2.6 million tons per year. (See Appendix A for information about these facilities.)

Of critical importance, **between 2008 and 2015, four of these six waste-to-energy facilities could be privately owned and under the full control of the private owner.** This is based on the terms of the contracts between the development organization, the municipalities, and the private operator (or owner). This development would effectively **transfer the control, oversight and assurance of processing capacity for over 1,463,000 tons per year of MSW in Connecticut from the public to the private sector,** potentially allowing that capacity previously dedicated to the needs of Connecticut municipalities through long-term contracts to be open for commitment to waste sourced at the highest market-clearing price, originating either within or outside Connecticut boundaries.

Combined with the fixed capacity of Connecticut's existing waste-to-energy infrastructure and the state's limited landfill and ash residue landfill capacity, this evolving scenario has the potential to markedly exacerbate the already decreasing self-sustainability of Connecticut's solid waste management system that was planned, structured, financed, constructed, and operated to serve the needs of Connecticut's municipalities.

2.0 The Impending Shift to Private Ownership in MSW Processing and Disposal Capacity and the Implications of this Ownership Change

Connecticut municipalities rely heavily on the six existing waste-to-energy facilities in the state for the processing and disposal of MSW that is not recycled. In addition, two ash residue landfills, one publicly owned and one privately owned, provide ash residue disposal for these facilities. As previously noted, ownership of four of these waste-to-energy facilities (Bridgeport Project, Bristol Project, Wallingford Project, and Southeast Project (in Preston)) is anticipated to shift into private control between 2008 and 2015, although there is some uncertainty regarding the ownership arrangement of the Wallingford Project after 2010. Further, **by the end of 2008, the capacity of the publicly owned ash residue landfill in Hartford will be exhausted.** The only remaining in-state ash residue landfill capacity, in Putnam, which is privately owned, is projected to be exhausted by 2019 or earlier depending on the arrangements with, and operating levels of, the waste-to-energy plants it will serve and how much out-of-state waste is accepted. **This situation poses significant risk in terms of capacity assurance and disposal cost to Connecticut municipalities.**

Public vs. Private Control

In choosing public ownership over private ownership, many communities, often working together through an authority, district or cooperative, have opted for capacity assurance and a greater control over costs, liability, continuity of service, and ability to adapt to the changing needs and conditions in their communities. In addition, through public control, public health and safety considerations are elevated, and there is public accountability for performance, a history of actual expenditures, and guaranteed public participation. Everything in a publicly owned project is a matter of "public record." The structure promotes public involvement in the actions and plans that are implemented, and standards are established in response to citizens' concerns. In a privately controlled project, there is typically more limited communication with the public and greatly limited access to project data, particularly financial and operational information. Public ownership answers to and benefits the citizens; private ownership answers to and benefits the stockholders.

In addition, through public control, public health and safety considerations are elevated, and there is public accountability for performance, a history of actual expenditures, and guaranteed public participation.

Public ownership answers to and benefits the citizens; private ownership answers to and benefits the stockholders.

In the private sector, price is determined by supply and demand; cost does not determine price. The private sector seeks the highest attainable price for any given quantity of output. Further, in the solid waste industry, private ownership does not necessarily equate to reduced risk since solid waste facilities involve risks that cannot be fully allocated away from the public. Private owners require additional returns for assumption of additional risks, and no matter how financially sound and

creditworthy a private owner may be (or appear to be), there is always the risk of insolvency or bankruptcy.

As the current long-term project contracts come to an end… those private companies will be unfettered in their ability to set disposal fees as high as the market will allow, operating as "merchant plants" and drawing waste from outside Connecticut from sources in New York, Massachusetts and Rhode Island that are looking for nearby alternatives…

In a competitive market, one would expect disposal fees at the waste-to-energy facilities in Connecticut to actually decrease when contracts expire, as the bonds providing the substantial financing for the facilities would have been retired. However, this is not expected to be the case in Connecticut. As the current long-term project contracts come to an end during the next decade and several waste-to-energy facilities shift fully into private ownership and control, those private companies will be unfettered in their ability to set disposal fees as high as the market will allow, operating as "merchant plants" and drawing waste from outside Connecticut from sources in New York, Massachusetts and Rhode Island that are looking for nearby alternatives to the higher cost, long-haul facilities which they are now using, displacing essential capacity for Connecticut residents at a time when a growing shortfall in available disposal capacity already exists.

Another concern is the extent and pricing of ancillary services that could be expected from the regional facilities under a full private ownership, merchant plant structure. Under the current long-term contracts with municipalities, certain of these projects include ancillary services, such as recycling and public education programs, that are bundled into the tipping fees. With the expiration of the long-term contracts and reversion of facilities to private ownership and control, such ancillary services would need to be unbundled and paid for separately, conducted by municipalities, or eliminated to the detriment of the communities. These services are critical to meeting new diversion goals.

Economics of Solid Waste Collection and Disposal: A Brief Refresher

Economists characterize industries along a yardstick ranging from perfectly competitive to monopolistic. The competitive industry—classic examples are agricultural, such as corn—is characterized by many buyers and sellers of an undifferentiated good or service, no significant technical, regulatory, or financial barriers to entry, and no significant economies of scale. In such a market, no seller has the ability to set the price; prices are set by the aggregate forces of supply and demand, and prices set result in low profit margins. When capacity is constrained and competitive characteristics are not present, the industry tilts towards the monopolistic or oligopolistic (i.e., "a market condition in which sellers are so few that the actions of any one of them will materially affect price and have a measurable impact on competitors")[3] model. In this situation, there are from one to a few producers of a good or service, which may be differentiated, barriers to entry are often significant, economies of scale are usually present, and prices are set by producers, usually to reflect a significant profit margin.

Solid waste collection and truck transport are two segments with very few barriers to entry. Trucks are easily financed, there are no proprietary techniques, and economies of scale are relatively minor, with average operating costs about 30 percent less for a large firm than for a one-truck operator.

[3] The American Heritage Dictionary of English Language, Fourth Edition Copyright © 2000 by Houghton Mifflin Company

Processing of recyclables is a segment where there are significant economies of scale. Financial and regulatory (permitting) requirements must be met, and siting often can be politically difficult. Processors also need to be able to market materials and manage relatively complicated equipment. In this segment, one would expect profit margins to be higher than for collection or truck transport.

Disposal is the least competitive segment of the solid waste industry. There are significant financial and regulatory requirements, and, generally, very powerful public and political opposition to siting (NIMBY syndrome), all of which make entry difficult. Also important, the economies of scale in landfill operations and in waste-to-energy plants are significant. The cost per ton to landfill decreases from over $50 in smaller landfills to under $12 in the largest landfills, exclusive of any legislated fees or host community fees. For these reasons, this is the segment of the industry where producers can be expected to earn the highest profit margins. In large waste-to-energy facilities, per-ton operating costs, exclusive of debt service, ash disposal, and legislated fees or host community fees, could be expected to range from approximately $35 to $45. Profit margins are especially attractive when debt on such facilities is retired and pricing is market-based.

Collection firms with disposal sites like to use their own disposal sites for waste they collect—a business model called vertical integration. Achieving vertical integration is highly desired by private sector firms, so much so that some firms have departed markets where there is not access to company-owned disposal capacity for waste collected in that market. For example, Allied Waste left the Connecticut market in 2003.

Increased Concentration in the Solid Waste Industry

An oft-noted trend in the solid waste industry is the movement towards increased concentration and away from the competitive model. In the late 90s, several mega mergers occurred: USA Waste acquired Waste Management and Eastern Environmental, renaming the combination Waste Management; and Allied Waste Industries acquired Browning-Ferris Industries, Inc. These acquisitions resulted in a huge increase in concentration. In 1993, the top 100 firms controlled about half the solid waste market. By 2003, the top four publicly traded firms controlled almost half the solid waste market, estimated at $46.5 billion. Waste Management alone controls over 49 percent of the entire landfill market in the United States; one of every two tons of MSW that is landfilled in the United States is buried in a disposal site owned by Waste Management. Together, all the publicly traded firms control over 60 percent of landfill tonnages. By any standards, this is a highly concentrated industry segment—one that meets the definitions of an oligopoly, or, in many local markets, a monopoly or duopoly.[4] Indeed, Smith Barney characterizes the entire solid waste industry as oligopolistic. [5]

In the late 90s, the newly combined solid waste firms digested their acquisitions. The combined firms have spent several years eliminating superfluous layers of management and overlapping responsibilities. Now, they're starting to flex their market powers, raising rates to allow for more attractive (to them) profit margins.

As evidence of this trend, in the Portland (Oregon) Metro area, the number of firms collecting commercial waste decreased by 40 percent over the decade from 1995 to 2004, while the share of the publicly traded companies increased by over 600

[4] A monopoly is a market with a single producer; a duopoly is a market with two producers.
[5] Leone Young, Solid Waste ABC's, (Citigroup, Smith Barney: June 7, 2005) p.7.

percent. Portland went from being a "Mom and Pop" hauling market to being a market largely dominated by publicly traded firms.

New York City, after the closure of the Fresh Kills Landfill in 2001, relies on private sector transfer and disposal options (with the exception of the Essex County, New Jersey, waste-to-energy facility in Newark and a few other facilities). Currently, 84 percent of the solid waste from New York City is handled through the transfer stations owned by three publicly traded firms, and then on to landfills owned by these firms. By any definition, this is not a competitive market. Rather, oligopoly is the most accurate description of the disposal industry sector serving New York City.

In Connecticut, two firms operate the state's six waste-to-energy plants: Covanta and Wheelabrator. One of these plants (Mid-Connecticut) is presently owned by CRRA and another (Lisbon) by ECRRA. Prices are largely set in long-term contracts, with spot prices for any available capacity usually set by the operator. When these long-term waste disposal contracts expire, if ownership reverts to the private operators, Connecticut's solid waste industry will have the economic characteristics of an oligopoly or duopoly. When this happens we can expect these operators to set prices based on market conditions rather than on cost plus a reasonable margin. In other words, prices within Connecticut can be expected to be set just below those of out-of-state disposal, which includes the cost to transport and dispose at such out-of-state locations.

3.0 A Time for Action

Connecticut has a long-established public policy that considers the management of solid waste to be a fundamental government service and responsibility. This public policy led to the resources recovery infrastructure and a self-sustaining solid waste management system, planned and developed through organizations such as BRRFOC, CRRA, ECRRA, HRRA, and SCRRRA. This system has served Connecticut's municipalities well for over 20 years, with assured capacity, controlled disposal pricing, and little dependence on MSW facilities outside Connecticut.

Connecticut has a long-established public policy that considers the management of solid waste to be a fundamental government service and responsibility. This public policy led to the resources recovery infrastructure and a self-sustaining solid waste management system, planned and developed through organizations such as BRRFOC, CRRA, ECRRA, HRRA, and SCRRRA.

Connecticut now faces significant increased concentration in the solid waste disposal industry at a time when the state is experiencing substantial shortfalls in disposal capacity. Over the next decade, Connecticut's municipal solid waste infrastructure could be expected to change from a publicly managed system of six waste-to-energy plants and two ash residue landfills to a system of four or five waste-to-energy plants owned by two private firms, one or two waste-to-energy plants owned by quasi-public authorities, and one ash residue landfill owned and controlled by a private-sector firm.

The state's solid waste industry is taking on all the characteristics of an oligopoly, and, indeed, on the ash residue landfill side, that of a monopoly. Natural monopolies, such as water and wastewater services, have traditionally been rate regulated. Now, the solid waste disposal industry in Connecticut is taking on the monopolistic characteristics that suggest the need for its rate regulation.

Doing nothing to address this situation could be expected to result in higher disposal prices, as demand for disposal services is very strong in the region, disposal capacity is increasingly limited, and alternatives to the in-state waste-to-energy facilities are distant and require long and expensive transport for their access. Doing nothing, at best, ensures uncertainty regarding the future costs and availability of capacity for MSW from Connecticut's municipalities, and, at worst, allows disposal prices in Connecticut to rise significantly with in-state MSW displaced by out-of-state sources, and private owners of existing facilities reaping windfall rates of return. Further, it could lead to existing regional projects becoming fragmented and destabilized.

Options for Meeting the Challenge

Option 1. Rate Negotiation
Option 2. Rate Regulation
Option 3. Ownership of New Waste-to-Energy Facility and/or Landfills by the Regional Resource Recovery Authorities
Option 3a. New Landfill Site in Connecticut for MSW and Ash under Public Ownership
Option 3b. New Waste-to-Energy Facility Site or Existing Facility Expansion in Connecticut under Public Ownership
Option 3c. Out-of-State Landfill Owned by One or More Connecticut Regional Resources Recovery Authorities

Options for Meeting the Challenge

Option 1. Rate Negotiation

One option is for local government groups to jointly patronize each of the waste-to-energy facilities, staying unified within BRRFOC, CRRA, ECRRA, HRRA, and SCRRRA, and attempt to negotiate reasonable rates, reflecting decreased debt service due to the retirement of the bonds that originally financed the facilities and a "fair return" to the owners and operators of the facilities. If Connecticut implements aggressive recycling programs and steadily increases the recycling rate to achieve its 58 percent goal much earlier than 2024, with significant increases in the next several years, demand for waste disposal would be reduced from present levels, and market forces might favor agreement on a reduced disposal price. There is no guarantee of a favorable outcome. Attempts to negotiate agreements such as this have not been successful in Connecticut to date.

The pros of this option include:

- It could result in favorable rates for municipalities, especially if some negotiation leverage can be achieved; and
- It could help to retain the existing projects as structured and maintain project unity and cooperation in other regional waste reduction/recycling initiatives under the new amendment to the State Solid Waste Management Plan.

The cons of this option include:

- The owners/operators of the waste-to-energy facilities are likely to be unwilling to negotiate anything close to cost-based rates; and
- It may be difficult to keep so many municipalities united.

Option 2. Rate Regulation

Another option is for the Connecticut General Assembly to authorize traditional utility–type rate regulation of the waste-to-energy facilities and the ash residue landfill. This move would impose a type of cost-plus pricing, rather than the market-

based pricing system that the private firms would be expected to apply were the General Assembly to do nothing to address the situation.

The pros of this option include:

- Rates for disposal could be controlled to provide for a reasonable profit similar to utility rate regulation keeping waste disposal costs for municipalities more predictable and closer to cost-based pricing, and citizens would see a substantial reduction in pricing;
- There is lots of experience in setting utility rates and an existing infrastructure in Connecticut;
- This approach would be less expensive to implement in comparison to, say, purchasing facilities at fair market value;
- Municipalities would be able to develop budgets and plan with reasonable assurance of the costs for disposal/processing;
- Existing regional projects may be able to stay intact under new or extended contracts when existing long-term contracts expire; and
- The existing Department of Utility Control could potentially assume this role.

The cons of this option include:

- Utility-type rate regulation of solid waste disposal would be a significant move and require a major change in policy by the Connecticut General Assembly that would be vigorously opposed by the private sector participants. Few states have enacted such rate regulation;
- It would create a new administrative burden and possibly an additional layer of government for the State of Connecticut to fund and manage;
- Unless there was some regulation of capacity to ensure a "set-aside" for Connecticut municipalities or in-state generators, the regulation of rates per se would not necessarily resolve the state's disposal capacity needs; and
- With MSW recognized as a commodity in interstate commerce and the history of court decisions regarding flow control, the state may be limited in its ability to mandate capacity in private facilities for Connecticut municipalities over out-of-state sources with which the private sector may contract.

<u>Option 3. Ownership of New Waste-to-Energy Facility and/or Landfills by the Regional Resource Recovery Authorities</u>

The bargaining position of the regional authorities would be enhanced if they had a reasonable alternative to the privately controlled monopoly or oligopoly of waste-to-energy facilities, such as:

a. An in-state site permitted for an ash residue landfill or an ash residue and MSW landfill;
b. An in-state site permitted for another waste-to-energy facility; or even
c. Ownership of an out-of-state landfill able to receive significant quantities of Connecticut waste at rates that are close to cost-based.

Given the rates now being paid by Northeast municipalities such as New York City for out-of-city waste transfer and disposal, and given the rates now being charged at Connecticut's waste-to-energy plants, it is not likely that out-of-state transfer and disposal offers would be at a price lower than the currently prevailing price range in Connecticut. That is why ownership of a facility would provide significant leverage.

Option 3a. New Landfill Site in Connecticut for MSW and Ash under Public Ownership

The pros of this option include:

- It would provide needed disposal capacity for Connecticut municipalities under public control and ensure non-discriminatory, cost-based pricing;
- It would enhance Connecticut's ability to remain self-sustaining in the management of its solid waste and ash residue;
- It would improve the bargaining position of the regional resources recovery authorities and give them negotiation leverage in their deliberations with the private sector; and
- It would retain revenues in Connecticut otherwise potentially lost to out-of-state outlets, to the benefit of Connecticut's economy.

The cons of this option include:

- Substantial opposition to the site and siting of any new landfill in Connecticut would be encountered, and there would be uncertainty in the schedule and final outcome of the siting/development process;
- It requires the expenditure of significant public funds to obtain a site and procure and construct the landfill;
- Eminent domain power likely would be needed by the regional authorities;
- There would be certain environmental impacts associated with additional in-state landfill(s);
- The public owner(s) would retain certain long-term liability upon site closure and continuing post-closure care responsibility; and
- Connecticut has committed to a hierarchy of waste management that avoids MSW landfills.

Option 3b. New Waste-to-Energy Facility Site or Existing Facility Expansion in Connecticut under Public Ownership

The pros of this option include:

- It would provide for needed MSW processing capacity under public control and ensure cost-based, non-discriminatory pricing that is a lower cost to taxpayers;
- It would enhance Connecticut's ability to remain self-sustaining in the management of its solid waste;
- It would allow additional energy recovery from MSW and contribute to the state electricity supply from renewable fuel;
- It would improve the bargaining position of the regional resources recovery authorities and give them negotiation leverage in their deliberations with the private sector; and
- It would retain revenues in Connecticut otherwise potentially lost to out-of-state outlets, to the benefit of Connecticut's economy.

The cons of this option include:

- Substantial opposition to the site and siting of any new waste-to-energy facility would be encountered, and there would be uncertainty in the schedule and final outcome of the siting/development process;
- It requires the expenditure of significant public funds to obtain a site and procure and construct the facility;

- Eminent domain power likely would be needed by the regional authorities; and
- There would be certain environmental impacts associated with an additional in-state waste-to-energy facility.

Option 3c. Out-of-State Landfill Owned by One or More Connecticut Regional Resources Recovery Authorities

The pros of this option include:

- It would provide for needed MSW disposal capacity under public control and ensure cost-based, non-discriminatory pricing;
- The ability to acquire property and site a landfill outside Connecticut while difficult at best, could potentially be less costly and less difficult than doing so in Connecticut;
- It would improve the bargaining position of the regional resource recovery authorities and give them negotiation leverage in their deliberations with the private sector; and
- Environmental impacts to Connecticut would be minimized.

The cons of this option include:

- This may require legislation for a regional resources recovery authority or group of such authorities to own/operate and/or finance assets outside Connecticut;
- It is a complex undertaking of uncertain duration and outcome-overall process could take several years to go through site acquisition, siting, permitting, and construction;
- The public owner would incur substantial front-end development costs without certainty of ultimate landfill construction, although cost-sharing with development partner(s) is possible;
- The public owner would incur property acquisition and capital construction costs, which could be much higher than projected if a lengthy development period ensues;
- The public owner would have all or most of the long-term liability for the site, except to the extent certain liability could be passed to or shared with a contracted operator or development partner(s) and sources of waste;
- The public owner runs the risk that the siting/permitting process is unsuccessful and the landfill is not constructed;
- There is also some risk of future legislation restricting the public owner's ability to export/import to an out-of-state site;
- The public owner's ability to monitor a landfill operation perhaps several hundred miles distant may be constrained;
- Substantial transport costs would be incurred in moving waste from sources in Connecticut to a distant out-of-state landfill; and
- Disposal revenues that would benefit Connecticut's economy would largely be lost to an out-of-state economy.

Conclusion

In a waste processing and disposal capacity strained environment, such as exists in Connecticut, and is projected to worsen without a significant increase in waste

diversion, the private, vertically integrated waste service companies would have tremendous pricing power. They could push waste to their facilities at predatory prices.

The way to prevent this situation from happening is to make sure Connecticut has sufficient disposal capacity, owned and operated for the public benefit, and dedicated to managing waste generated in Connecticut. There are options, but the regional resources recovery authorities and their municipal members need to work together in deciding on a preferred course, which may include seeking assistance from the Connecticut General Assembly. Now is the time for action.

…but the regional resources recovery authorities and their municipal members need to work together in deciding on a preferred course…

Appendix A

Regional Resources Recovery Facilities in Connecticut[1]

Selected Information	Bridgeport RRF	Bristol RRF	Mid-CT RRF	Southeast RRF	Wallingford RRF	Lisbon RRF
Permitted Design Capacity (TPY)	821,250	237,250	888,888	251,485	153,300	195,640
Year Bonds Will Be Paid Off	2008	2014	2012	2015	2009	2020
Operator	Wheelabrator	Covanta	MDC/ Covanta	Covanta	Covanta	Wheelabrator
Number of Towns Contracted[2]	19 (Towns contracted to CRRA; CRRA has contract with Wheelabrator)	14	70	16	5	5 + 11
2005 Member Tipping Fee ($/ ton)	$69	$66	$70	$60	$57	$60-$66
Fee Covers	Disposal, Recycling Education, Recyclables Processing	Disposal	Transfer, Disposal, Recycling Education, Recyclables Processing at Hartford IPC (no tipping fee), Electronics Recycling	Disposal, Electronics Recycling, Education	Disposal, Electronics Recycling	Disposal
Ash Disposal Site	Putnam	Seneca Meadows (NY)	Hartford	Putnam	Putnam	Putnam
Post-Contract Ownership	Wheelabrator	Covanta	CRRA	Covanta	Covanta	Eastern CT Resource Recovery Authority

[1] Source: State of Connecticut State Solid Waste Management Plan, Amended December 2006, Appendix F

[2] A total of 129 CT municipalities of 169 are currently under contract for MSW disposal at one of the six in-state regional resources recovery facilities. The Housatonic Resources Recovery Authority ("HRRA") communities (11) have an arrangement with Wheelabrator. Their MSW can be delivered to either the Lisbon facility or the Bridgeport facility. Currently, most of this waste is delivered to the Lisbon facility; however, it not contracted to that facility. These 11 communities are therefore not included in the 129 contracted/member communities.

Exhibit H

New and Emerging Technology Assessment

November 30, 2013

Review of New and Emerging Technologies

For

Municipal Solid Waste Management

Prepared for:

Connecticut Resources Recovery Authority

CONNECTICUT RESOURCES RECOVERY AUTHORITY

CONNECTICUT'S RECYCLING LEADER

Prepared by:

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November 5, 2013

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Table of Contents

Tables

Figures

Appendices

1. Introduction

1.1 Project Background

The Connecticut Resources Recovery Authority's (CRRA) South Meadows Facility (Facility) serves the Municipal Solid Waste (MSW) disposal needs of 50 municipalities in Connecticut. The Facility includes a 3,000 tons-per-day (TPD) waste processing facility (WPF), and a 2,400 TPD energy generating facility located in Hartford (both of which, for purposes of this Report, are described as the Facility or the South Meadows Facility). Approximately 710,000 tons per year (TPY) of post-recycled municipal solid waste are processed at the Facility. The Facility is located on a 80-acre site served by truck, rail (rail is currently not functional but could be made functional if a use is found) and barge via the Connecticut River. The WPF produces a refuse-derived fuel for combustion in the energy generating facility. Non-processible waste from the WPF is landfilled in Massachusetts. Ash residue from the energy generating facility is disposed at a privately owned and operated landfill in Putnam, Connecticut.

For the Facility, CRRA is currently under agreement with each of the participating municipalities via municipal service agreements for the management and disposal of MSW generated within the corporate boundaries of each of the participating municipalities. The Facility also accepts waste from haulers and spot waste from municipalities and haulers. The WPF is operated by NAES Corporation under contract to CRRA. The power and energy generating facility is also operated by NAES under contract to CRRA. Electrical energy from the power and energy generating facility is marketed into the day ahead market by Nextera Energy Power Marketing LLC.

As the Facility ages, as legislation to enhance recycling and composting has been enacted, as concerns to reduce impact on climate change have advanced, and as new technology to more efficiently recover material and energy from MSW has developed, CRRA has for several years been evaluating MSW management and disposal strategies that might replace the Facility. One option under consideration is new and emerging MSW management technologies (often referred to as conversion technologies (CT)) that could potentially replace the Facility. CRRA prepared reports in 2010 and 2012 to identify and describe these technologies.

In 2013, State legislation (Public Act No. 13-285, Substitute Senate Bill No. 1081, An Act Concerning Recycling and Jobs) was enacted requiring CRRA to prepare a Transition Plan to evaluate the future role of CRRA and its facilities. As part of the Transition Plan, CRRA is to evaluate the benefits and consequences of a transition of the Facility to an alternative use such as a solid waste management facility. CRRA has hired GBB, to work in concert with J Binder Consulting LLC, to develop this report titled "Review of New and Emerging Technologies" (Report). This Report addresses the legislative requirement for CRRA to conduct an assessment of the benefits and consequences of the transition of the Facility to an alternative use. This Report also updates the earlier 2010 CRRA work to evaluate new and emerging technology and to further consider the goals and objectives of the State Solid Waste Management Plan last amended in 2006.

1.2 Objective

The objective of this updated Report is to identify and describe new and emerging technologies that could potentially replace the Facility in the shortest time possible, i.e., technologies that are now or will be commercially available in the near future, have the capability of reliable and cost-competitive waste disposal, enhance materials and renewable energy recovery, reduce environmental impacts, and are otherwise appropriate for consideration as alternatives to traditional waste-to-energy (WTE) technology for the management of up to 710,000 TPY of post

recycled, mixed, unsorted MSW. This Report also addresses the potential for a smaller MSW facility if current source reduction, recycling and organics management programs are enhanced consistent with the State Solid Waste Management Plan, or if the Facility attracts fewer customers. In addition, this Report assesses Anaerobic Digestion (AD) technology that could be used to process source-separated organics, such as food waste. The AD assessment was conducted to review technology that could support Connecticut Public Act No. 11-217 which mandates recycling and composting of source-separated organic materials by commercial entities.

It should be noted that to implement a new MSW facility would require detailed, site-specific procurement planning, and the procurement, permitting, financing, design and construction of a facility, activities likely to take six or more years. Such implementation activities are discussed in detail later in this Report. Similar activities are required for implementing an AD facility for source-separated organics, activities likely to take four or five years.

This Report also summarizes available information from recent studies and reports on this subject, including: earlier reports by CRRA; New York City; Los Angeles County; Taunton, Massachusetts; and other locations in the United States (U.S.) and Canada. It also includes information obtained in September 2013 from multiple technology providers that have projects in operation or development in the U.S. and Canada and whose technology could potentially be applied at the Mid-CT Project. In addition, the Report describes examples of recent and ongoing initiatives by public agencies in the U.S. and Canada to develop demonstration and commercial facilities using these technologies. This Report addresses planning level issues for a new "greenfield" facility. It does not address existing site issues or issues related to the potential integration of a new facility with the use of existing facilities on the site. Although such integration is beneficial to consider, such an analysis would require a detailed, site-specific feasibility study that examines the condition of existing equipment and how to best integrate new facilities.

Technologies considered reviewed herein include those that use thermal, biological, hydrolysis, chemical, and mechanical processes, or some combination of these processes. Traditional technologies such as composting or co-composting, materials recycling facilities (MRFs) for separation and recycling of waste, conventional WTE (traditional mass-burn, refuse-derived fuel and fluid bed combustors), and landfilling are not the subject of this Report. New and emerging technologies are, however, compared to conventional WTE technology as a point of reference, since it is the most widely used technology in the U.S. being used successfully for the reduction of MSW to minimize landfilling and generating energy, and an alternative is being considered to this technology for the Facility.

1.3 Content of Report

Included in this Report are:

- A description of the criteria established to evaluate new and emerging technology;
- A description of new and emerging technologies and the status of development in the U.S., Canada and overseas;
- A schedule for potential implementation of a replacement facility to the South Meadows Facility;
- the project delivery approaches and role that CRRA can play in such implementation;
- A description of an associated role that CRRA could play as a state-wide resource center for new and emerging technology; and
- Suggestions for legislative initiatives or regulatory initiatives that would benefit development of new and emerging technology in Connecticut.

2. Criteria for Review of New and Emerging Technology

As noted in the Introduction, recent state legislation requires that CRRA develop a Transition Plan for achieving a sustainable business model that improves the long-term financial stability of CRRA. One part of that requirement states that an assessment of the benefits and consequences of the closure or sale of South Meadows Facility be done as well as an assessment of the transition of that Facility for alternative uses, such as a solid waste management facility. As part of conducting the assessment for a transition to an alternative use, CRRA has prepared this updated review of new and emerging technology.

To assist in preparing this Report, comparative review criteria have been developed that reflect CRRA goals to provide reliable service, improve technical and environmental performance, enhance materials recovery and renewable energy production, and increase diversion from landfilling of residuals. The review criteria include the following:

a) The technology is reliable as evidenced by its history of commercial use or demonstration of potential for commercial use so as to be able to replace the Facility as shortly as possible after 2019, considering time for project development (commercial use is defined as in regular use to process MSW on a contract basis).

b) The technology is capable, with no or reasonable scale-up, of processing current MSW loads at the Facility, i.e., approximately 710,000 TPY of mixed, unsorted MSW, or lesser quantities representing achievement of increased source reduction, recycling and organics processing or fewer customers.

c) The technology has the flexibility to accommodate existing MSW collection practices currently in use in Connecticut and to accommodate changes that may result from enhanced source reduction and recycling programs and separate organics collection.

d) The technology provides for enhanced separation of materials for recycling and/or beneficial use of MSW to produce marketable products and has the ability to produce renewable energy in the form of electricity or fuels.

e) The technology provides for improvements in environmental performance such as reduced greenhouse gas emissions and increased diversion from landfills.

f) The technology is capable of being economically competitive with other management/disposal options available in the marketplace, considering all development, financing, design, construction and operating costs, less revenues from sale of energy and products.

g) The technology is compatible with the goals of the State Solid Waste Management Plan as amended in 2006.

In addition to review of technologies for the criteria described above, this Report documents for those technologies, the site size required for a facility, the type of waste recycled and beneficially used, energy production, the level of diversion from landfilling, environmental issues, potential for public acceptability and a risk profile. The risk profile provides comment on technical reliability, ability to meet performance expectations, market strength for recycled materials and beneficial use products, system costs and plant economics, and environmental impacts.

Technologies that meet the criteria are described and compared to traditional WTE technology such as that in place currently at the South Meadows Facility.

The evaluation in this Report is based on information available from the literature, including information from other evaluations completed by public entities considering the use of new and emerging technology to meet their future needs, and from information presented by technology companies, including that obtained from communications in September 2013. In the case of the former, in many instances data was reviewed, checked and independently verified by the reviewers to the extent possible, including use of information gained during site inspections of commercial and demonstration facilities. Information provided by technology companies was reviewed for practicality.

3. Review of New and Emerging Technologies

New and emerging technologies, often referred to as Conversion Technologies (CT) in the literature and in this Report, are processes that convert MSW, either mixed, or source-separated components, into useful products such as renewable energy, renewable fuels, chemicals, and digestate/compost. Renewable energy includes electricity, steam and heat. Renewable fuels can include biodiesel, gasoline, cellulosic ethanol, compressed natural gas (CNG), and other fuels. Unlike traditional WTE facilities that incinerate waste in an oxygen-rich environment, CT's utilize thermal gasification technologies, biological processes such as anaerobic digestion, and chemical and mechanical processes to convert waste materials into products.

CT's are receiving substantial attention in the U.S. and overseas because they offer many "potential benefits" for waste management when compared to landfilling and traditional WTE technology. These benefits include enhanced material recovery to help municipalities attempt to achieve recycling and diversion goals/requirements and reduce landfilling needs, more efficient production of electricity using combined cycle generation, flexibility in types of end products that can be produced such as electricity, fuels, chemicals and digestate/compost, higher value end products, e.g. fuels and chemicals, which can reduce disposal costs, and reduced air emissions, including greenhouse gas emissions. Recent attention in the U.S. is focused on use of thermal conversion and anaerobic digestion technology for production of fuels and chemicals as these products provide the greatest economic benefit. In California, compliance with Federal renewable fuel standards, as well as those in California, and meeting greenhouse gas (GHG) emission reduction requirements, are leading to the replacement of fossil diesel fuel for powering MSW collection and transfer trucks with renewable fuels.

Certain CT's are in commercial operation for MSW overseas, and in initial operation and testing, commissioning, start up and construction as well as planning and development in the U.S. and Canada. Several facilities currently in initial operation, commissioning, start up and construction in the U.S. and Canada are scheduled to be fully operational on a commercial basis in 2014 and 2015. However, the economic competitiveness in the U.S. is still to be determined.

Conversion technologies typically include three components: front-end preprocessing (including materials recovery); the conversion process; and the product/energy recovery systems. Often the front-end preprocessing requirements can be satisfied by an existing or new material recycling facility (MRF). Integrating a MRF and conversion technology facility can effectively help meet community recycling and diversion goals.

3.1 Technology Description

CT's can be categorized into several broad categories: thermal, biological, hydrolysis, chemical processing and mechanical processing. Those technologies that have advanced furthest in project development and initial commercialization in the U.S. and Canada and that enjoy the greatest degree of commercialization overseas, include thermal technologies, such as gasification technologies, and biological processes, such as anaerobic digestion technologies.

3.1.1 Thermal Processing

Thermal technologies use heat during the course of treatment to convert the organic fraction of the waste to synthesis gas. Common types of thermal treatment include gasification, pyrolysis and plasma gasification. Each involves different temperatures and levels of oxidation. In general, thermal technologies take place in a high-temperature reaction vessel. Air or oxygen may be added to the reactor to influence the composition of the resulting products. Preprocessing of the waste feedstock may or may not be required, depending on the technology.

If required, preprocessing typically includes removal of metals, glass and inert materials, feedstock sizing, and in some cases, drying of the feedstock. Metals and glass would be recycled and marketed, if possible. Other marketable recyclables such as paper, cardboard, and plastics can also be recovered in a preprocessing facility or an up-front materials recycling facility.

Gasification processes usually occur above 1,300 °F and use some level of oxygen or air in the process. Pyrolysis typically occurs at temperatures above 400 °F, in the absence of air. Plasma gasification uses very high temperatures (temperatures of 7,000 °F or more in the ionized plasma) to break down the feedstock into elemental by-products. Plasma can be used independently or with gasification and pyrolysis systems.

Synthesis gas is composed principally of hydrogen and carbon monoxide and a small fraction of carbon dioxide and other gases. The synthesis gas can be combusted to generate electricity, steam and heat, or it can be used to produce fuels or chemicals.

With gasification and plasma systems, the inorganic fraction of waste can be converted into vitrified residue for use as aggregate or fill material. With pyrolysis, the residual solid material is a char, which can be used as a fuel, or for other purposes.

Another type of thermal treatment, catalytic cracking, uses catalysts to accelerate the breakdown of polymers (such as those found in plastics) into single basic units, or monomers. The monomers can be further processed using cracking methods to produce fuels such as low-sulfur diesel and gasoline.

Synthesis gas that is produced is converted to energy in the form of electricity, steam and heat, or fuels, such as ethanol, methanol, hydrogen, or drop-in fuels such as gasoline or diesel. Electricity can be created by co-generation or combined cycle systems. Net electricity output (i.e., after accounting for the parasitic use of electricity at the facility) can range from 550 to 900 kWh per ton of MSW feedstock. Ethanol production can range from 50 to 90 gallons of ethanol per ton of MSW feedstock. Drop-in gasoline, in one facility design that uses natural gas as a supplement, is cited as having the capability to produce approximately 100 gallons of gasoline per ton of incoming MSW feedstock.

Thermal conversion technologies can typically divert more than 90 percent of incoming feedstock from landfilling, some technologies claim 95 percent diversion or higher, and some claim complete diversion. This is accomplished by recovery of recyclables in preprocessing (as noted earlier), by energy production, by product recovery during the synthesis gas and wastewater cleanup processes, and with several gasification technologies, by vitrifying the residue, enhancing the opportunity for marketing the material as an aggregate or fill material.

Thermal conversion technologies can reduce the amount of GHG emissions when compared to landfilling of MSW and when compared to traditional WTE combustion of MSW. As reported by CalRecycle and the California Air Resources Board (CARB), "Over the long term, newer MSW technologies, such as gasification, may offer additional greenhouse gas benefits beyond existing mass-burn technology especially for residual streams where recyclable materials have already been recovered."[1]

Site size requirements for thermal conversion technologies vary widely, depending on the technology chosen and the energy products produced, e.g., electricity or fuels. For preprocessing

[1] CalRecycle and the California Air Resources Board, "Municipal Solid Waste Thermal Technologies," June 18, 2013. Tech. Paper.

and thermal treatment of 500 to 1,000 tons-per-day (TPD) of mixed MSW, site size requirements would typically be between 10 and 15 acres. For facilities of 1,000 to 2,000 TPD, site size would typically be between 15 and 25 acres, and for facilities between 2,000 TPD and 3,000 TPD, site size would typically be between 25 and 35 acres. Site size requirements are larger for a facility with a fuel production system (such as ethanol) as compared to an electrical generating system.

Figure 3-1 provides a schematic of a typical thermal gasification process.

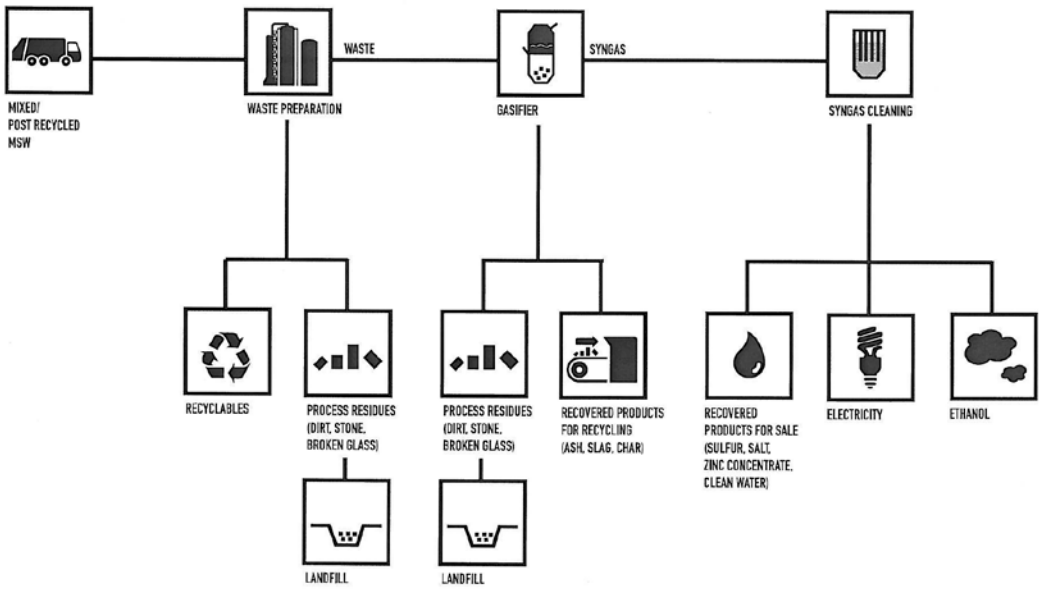


Figure 3-1
Schematic of Typical Gasification Process

Advanced combustion is another form of thermal conversion. Although not normally recognized as conversion technology, it is an advanced form of mass-burn technology that enhances energy generation, materials recovery and protection of the environment. Advanced thermal combustion achieves a high efficiency of electrical energy (up to 30 percent or slightly higher), processes and recycles bottom ash to maximize diversion from landfill disposal (claiming up to 98 percent diversion, provided ash can be beneficially used and not landfilled), and uses advanced flue gas cleaning technologies (e.g., multiple scrubbers in series with one or more baghouses). Higher net electrical efficiency is achieved by design modifications to conventional mass-burn systems such as improvements that allow for higher steam temperature and pressure. The high rate of diversion is achieved by processing bottom ash to recover the inert components of waste such as sand, stone and metals for reuse and/or recycling. Advanced flue gas cleaning focuses on selective product separation in which residues can be converted into usable materials and sold as products (e.g., calcium chloride, gypsum). Advanced thermal combustion systems can be integrated with a front-end MRF for materials recovery prior to combustion. Examples of advanced thermal combustion technology currently in commercial operation overseas include facilities in Hamburg, Germany, and Amsterdam, The Netherlands. The City of Los Angeles is also currently considering these technologies.

3.1.2 Anaerobic Digestion

Anaerobic digestion (AD) is a biological process that converts biodegradable organic material to biogas (primarily methane) which can be used to generate electricity or produce a fuel, and to digestate, which can be further processed (cured by traditional aerobic means) into compost to be

used as a soil amendment, or used directly as a fertilizer in agricultural applications. The process takes place in an oxygen-free environment, as compared to traditional aerobic composting, which takes place in the presence of oxygen and produces compost only. AD is commonly referred to as a wet or low-solids process, where the material is typically less than 15 percent solids, normally in liquid form, or a dry or high-solids process, where the material is typically more than 15 percent solids, normally in solid form. Each has its advantages and disadvantages with regards to pre-processing, efficiency in converting organic material to methane, complexity and cost. Wet AD processes are more commonly used to digest a mixture of biosolids and food waste. Dry AD processes are more commonly used to digest a mixture of food and green waste.

AD can be used with mixed MSW as feedstock or with source-separated organics, such as food waste and green waste, or food waste and biosolids as feedstock. Use of AD requires preprocessing of mixed MSW to recover an organic-rich fraction of the waste, and typically requires preprocessing for source-separated organics, such as food waste and green waste to remove lingering contaminants such as metal, plastics, ceramics and grit. Preprocessing needs are a function of the AD technology and the end use for the products of the process.

The AD process occurs in either a batch or continuous manner. With the batch process, the feedstock is placed into the sealed digester, and digestion takes place over a period of days, usually up to 30 days. At the end of the digestion period, the digester is opened and digestate removed, typically with a front-end loader. With a continuous process, the feedstock is continuously fed into the digester and digested material is continuously removed using different types of feed and conveying systems.

AD occurs in a heated, sealed digester. There are two ranges of operating temperatures; mesophilic (typically between 95 and 105 degrees F) and thermophilic (typically between 125 and 140 degrees F). Some technologies use both in their process. The higher thermophilic temperature range is effective for destroying pathogens, and requires a shorter digestion period. Such higher temperatures allow the digestate to be used directly for agricultural purposes, without the need for further curing or thermal treatment. The thermophilic process is more costly, however, due to the higher costs of heating the material being digested.

A benefit to AD, as compared to traditional aerobic composting, is that AD recovers the energy value of the feedstock, and produces a fertilizer or soil amendment, i.e., compost. To recover energy, combined heat and power systems are used. For food and green waste as feedstock, the net electricity generation (after accounting for the parasitic use of electricity at the facility) can range from 100 kWh to 350 kWh per ton of feedstock[2]. If a fuel is produced from the biogas (which is primarily methane) from the anaerobic digester, it is typically compressed natural gas (CNG) or cleaned for injection into a natural gas pipeline. For food and green waste as feedstock, net methane output (after accounting for in-plant parasitic use such as for heating the digester) can range from 1,000 cubic feet/ton to 4,500 cubic feet/ton. Electricity and CNG outputs vary widely depending on the feedstock and the type of digestion process. For example, food waste has a significantly higher potential for production of biogas than green waste, hence electricity or CNG might be energy outputs from a food waste AD system. Different AD processes also have different in-plant requirements for electricity and gas.

When combined with front-end preprocessing, AD processes have the potential to divert more than 60 percent of the incoming mixed MSW feedstock from landfilling. For source-separated

[2] Summary of Responses to Request for Expressions of Interest, Organics Material Processing Facility, dated July 23, 2012 from ARI staff to Peter Egan, CRRA

feedstock (green waste and food waste), the diversion rate is typically greater than 85 percent, depending on the level of contamination in the feedstock and the extent of preprocessing utilized. These diversion levels assume that the digestate or compost is a marketable product, and is not landfilled. Digestate from an AD system can account for 25 to 35 percent of the incoming feedstock by weight, if not dried. Compost production can account for 40 percent or more of incoming food waste and green waste.

When compared to landfilling, the use of AD results in reduction of greenhouse gas emissions. When compared to landfilling, and assuming that 75 percent of compostable/digestible materials are diverted from landfilling (a level estimated by CalRecycle and CARB necessary to meet the 75 percent recycling goal in AB341), on a state-wide basis, the agencies estimate that the "resulting greenhouse gas emission benefits are expected to be approximately 4.5 to 5.6 MMTCO2e per year." [3] Such benefits include the additive benefits of AD and composting. When considering AD only, the CalRecycle and CARB estimate that the GHG benefit would be 2.06 MMTCO2e per year for AD, when compared to landfilling.

Site size requirements for an AD facility, which includes a front-end preprocessing system, for handling 500-1,000 tons per day (TPD) of mixed MSW, and with space provided for composting the digestate would range in size from 10 acres to 20 acres. If digestate were to be shipped off the site without composting, the site size could be reduced to 5 to 10 acres. Site size requirements would increase beyond 30 acres for facilities exceeding 1,500 TPD with on-site composting.

Site size requirements for a dry AD facility, with no or minimal front-end preprocessing, for handling 30,000 to 60,000 TPY of source-separated food waste and green waste, and providing space for composting the digestate, would range between 5 acres and 10 acres. If digestate were to be shipped off site without composting, site size requirements would range between 2 and 5 acres.

Site size requirements for a wet AD facility, with minimal front-end processing, for handling 30,000 to 60,000 TPY of source-separated food waste and biosolids, and providing space for drying or gasifying the digestate, would range between 1 and 3 acres. If the digestate were to be composted at the same location, an additional 2 to 5 acres would be required.

Interest has grown in the U.S. in digestion of food waste and biosolids at wastewater treatment plant sites to provide for biosolids management that achieve Class A biosolids, and to use combined heat and power equipment to produce renewable electricity and heat to supply the wastewater treatment plant's needs.

See Figure 3-2 for a typical AD process.

[3] "Composting and Anaerobic Digestion," Draft, June 18. 2013, CalRecycle and CARB.

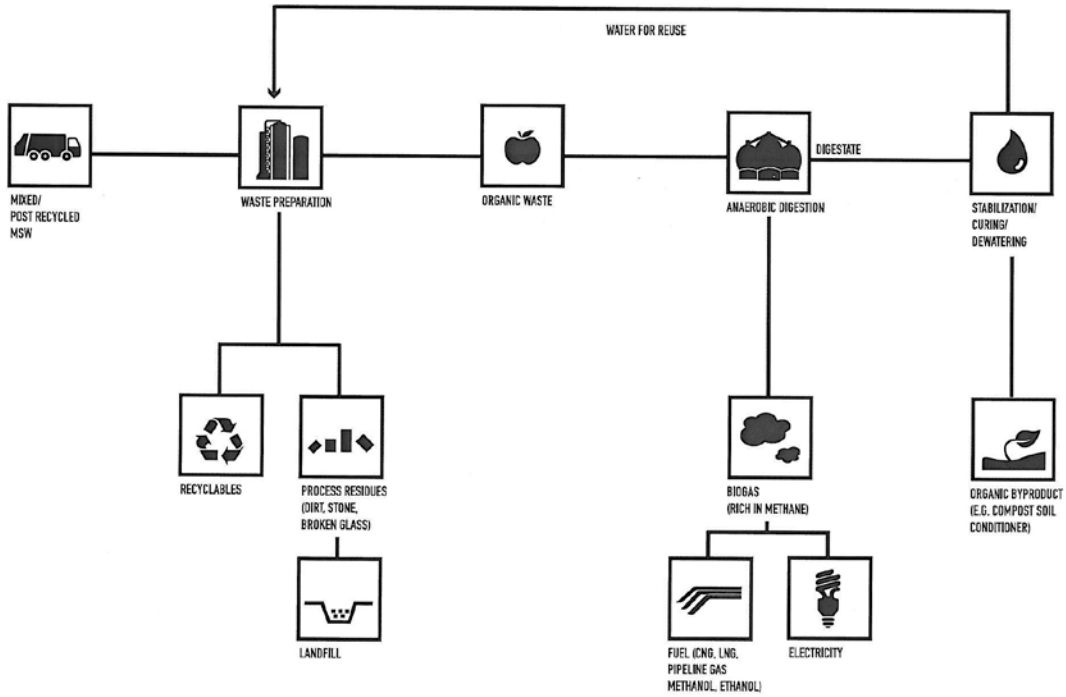


Figure 3-2
Schematic of Typical AD Process

3.1.3 Hydrolysis, Chemical and Mechanical Processing

For MSW application, hydrolysis includes: the acid-catalyzed reaction of the cellulose fraction of the waste (e.g., paper, wood, food waste, yard waste) with water, i.e., acid hydrolysis, to produce sugars, followed by fermentation of the sugars to ethanol; and enzymatic hydrolysis that uses enzymes derived from common fungi to produce ethanol.

Chemical processing refers to technologies that utilize chemical means to convert MSW into usable products. Chemical processing is typically part of thermal and biological processing systems. Chemical processing includes depolymerization, which involves the breakdown of large molecular compounds into smaller, relatively simple compounds that can then be refined into other useful products. The process is an advanced thermal reforming process that utilizes water as a solvent, converting the organic fraction of MSW into energy products, oils and special chemicals. Further processing of the oils via distillation, solvent extraction, or cracking can be used to produce higher value oils. Depolymerization also produces carbon solids, which can be activated and used as a filter medium or as a soil amendment.

Mechanical processing includes technologies that mechanically process MSW to recover/produce fuel products and/or recover fiber for use in papermaking. Mechanical processing of MSW to produce a refuse-derived fuel is generally not considered a conversion technology. Recovery of fiber for papermaking is considered a conversion technology. Recovery of fiber generally includes use of a steam autoclave to condition the MSW, followed by mechanical screening to recover recyclables and separate the organic fraction from the inorganic fraction. The organic fraction is then pulped with water to recover long-fiber pulp for papermaking. The sludge generated from the process is typically anaerobically digested. The organic fraction that is not recovered as paper pulp can be combusted as a fuel.

3.2 Status of Development

Thermal conversion technologies have operated commercially since the 1990s overseas using MSW as a feedstock. Facility sizes typically range from 100 to 700 TPD. The largest plasma gasification system is currently under construction in Northeast England to convert 950 tonnes per day (1,050 U.S. TPD) of MSW into 50 Megawatts (MW) of electricity. Commissioning is expected in early 2014. Public sector interest in new and emerging solid waste management conversion technologies has only recently increased in the U.S., based on the desire to enhance recycling and beneficial use of waste, produce renewable energy, reduce dependence on landfilling and imported fossil fuels, and reduce GHG emissions. Public investigations and initiatives have been conducted, or are underway, in New York City; Los Angeles (City and County), California; Santa Barbara (City and County), California; Sacramento, California; Salinas, California; and Taunton, Massachusetts. Many of the earlier investigations focused on identifying new and emerging technologies and compiling available technical, environmental and financial information for such technologies. Some of these public-sector initiatives include consideration of demonstration facilities, while others intend to proceed directly to procurement for a full-sized commercial facility. Other initiatives are in a more advanced stage.

Los Angeles County has recently established a web-based database for CT. In putting together this database, it conducted a survey of conversion technology companies. The survey results are summarized on the County's web site for conversion technology, www.socalconversion.org, under the tabs of "Resources" and "Technical". The listing provided there is not all inclusive of companies that may provide CT services, but is a representation of current interest in the marketplace in California. The listing provides information on companies that are geared to develop facilities ranging in size from 100 TPD to greater than 1,500 TPD for MSW and source-separated materials processing. For each company listed, the web site offers a description of the technology, identifies reference facilities, and describes an optimum project size from the company's perspective. Several of the companies referenced in this Report are included in the listing.

With regard to several public sector initiatives, the City and County of Los Angeles have received proposals for demonstration facilities, have selected technology providers and have or are in the process of negotiating contracts. In April 2010, the Los Angeles County Board of Supervisors voted to pursue design and construction of three demonstration facilities, two gasification facilities sized at 168 and 360 TPD, and one AD facility sized at 150 TPD. The AD facility, privately owned, is currently under construction by a waste collection and management company, focused initially on processing of source-separated organic waste. Operation is expected in late 2014 or early 2015. The County is also evaluating commercial-scale CT options within the County to reduce reliance on landfilling. The City of Los Angeles is negotiating to design and construct a 150 TPD AD facility and larger-scale commercial facilities. Salinas Valley, California, had received proposals for a full-sized commercial facility, and was in the process of contract negotiations for a facility of approximately 700 TPD, using plasma arc gasification, but recent permitting issues prevented it from going forward. Santa Barbara received proposals in June 2010 for a 700 TPD commercial facility to extend landfill life and has selected a company to pursue a mixed waste AD facility converting waste to electricity. The project is currently undergoing environmental review as part of the California Environmental Quality Assessment CEQA process. The City of Glendale, California is currently evaluating proposals for a CT facility to reduce landfill disposal.

On the east coast, the City of Taunton, Massachusetts received six proposals for a commercial facility in June 2009, selected a preferred proposer, and signed a contract with Interstate Waste Technologies (IWT) in December 2012 for a 1,770-TPD gasification facility that will produce drop-in gasoline fuel. The facility is currently in permitting, with operation expected in 2016/2017. As part of its process to consider integration of new and emerging technologies into its long-term

solid waste management practices, New York City conducted detailed technology assessments. It decided to implement a two-stage approach, i.e., a demonstration facility, up to 500 TPD, expandable to a commercial sized facility up to 1,000 TPD, considering both AD and gasification technologies. It released an RFP for such a facility(ies) in 2013, evaluated proposals and is in the process of negotiations with companies for a facility(ies) to be located outside of the City.

Private initiatives are also underway in the U.S. and Canada. Plasco Energy Group, based in Ottawa, Canada, has operated a commercial gasification demonstration facility (150 TPD) with a plasma torch on the residue/inert fraction for several years, and received its permit for continuous operation in 2011. Plasco is currently constructing a larger, commercial facility (450 TPD) to serve the City of Ottawa. Startup is expected in late 2014/early 2015. In Vero Beach, Florida, a private commercial gasification facility (300 TPD of processed feedstock) has been constructed by INEOS. It began operation converting green waste to ethanol in 2012. It is permitted to take MSW as a feedstock and will be conducting tests of MSW as a feedstock in 2014. In Edmonton, Canada, a MSW gasification-to-ethanol facility (330 TPD of processed feedstock) is currently under construction by Enerkem, with startup and methanol production expected in late 2013 followed by ethanol production in early 2014. Another MSW gasification-to-ethanol facility (approximately 300 TPD) near Reno, Nevada, is currently under construction by Sierra Biofuels, with expected operation in 2013/2014. In Montgomery, New York, Taylor Biomass Energy is developing a 1050 TPD gasification facility to process MSW, C&D and wood waste, and produce electricity. Construction is expected to start in late 2013, with operation in December 2015. These private companies have developed optimum module sizes based on their facilities described earlier that allow for provision of these facility sizes, or expansion using several modules to construct facility sizes for up to 2000 TPD or more of post recycled, mixed MSW.

In addition to the MSW initiatives discussed above, there is increasing interest in developing AD facilities for source-separated organic waste, such as food waste and green waste. There are currently several AD operating facilities in the U.S. and Canada, with many more under construction and/or in development. Most experience with AD is in Europe. Some of the AD technologies in Europe have been operating on a commercial basis with source-separated organic municipal waste since the early 1990s. Plant sizes range from less than 10,000 TPY to more than 100,000 TPY. In North America, most experience with source-separated municipal organic waste has been in Canada, including a 45,000 TPY AD facility that has been operating in Dufferin, Ontario since 2002.

While AD has been in successful operation for many years in the U.S. to process biosolids from wastewater treatment plants, it is only now gaining interest in the U.S. for processing certain materials within MSW, as public jurisdictions seek to further beneficially use the energy value and divert organic waste from landfills. Consequently, AD has not yet been applied commercially to any great extent in the U.S. for MSW or source-separated organics from MSW. In 2011, the first commercial dry AD facility for food waste began operation at the University of Wisconsin. It is designed to process 10,000 TPY. In Monterey, California, a dry AD facility for food and green waste (5,000 TPY) initiated operations in early 2013. Several other projects are in development and construction on a larger scale (as large as 80,000 TPY in San Jose, California), or are being considered by public jurisdictions. In Perris, California, CR&R started construction this summer of its AD facility to convert 150 TPD of food and green waste to CNG to fuel its collection fleet. The facility is expected to be operational in 2014. Palo Alto, California, has released its RFP for an AD facility, or export, for approximately 60,000 tons per year of food scraps, yard trimmings and biosolids and received multiple proposals in August 2013 for a commercial facility. Proposals are currently under review.

As noted above, thermal treatment and AD technologies for source-separated organics have demonstrated the greatest degree of commercial application overseas, and are in initial operation,

testing, startup/commissioning, construction or project development in the U.S. and Canada for MSW, and in the case of AD for source-separated organics.

Appendix A and Appendix B to this Report illustrate several systems in operation overseas and/or under development and/or construction, commissioning and initial operation in the U.S. and Canada. These Appendices do not list all facilities, but highlight many of those that may be appropriate for the Mid-CT Project.

Despite the initiatives described above, there are several challenges to development of conversion technologies in the U.S. Some of the more prominent challenges include:

- **Lack of commercial development, including economic information in the U.S.** Thermal conversion technologies and AD technologies are successfully used to manage post-recycled, mixed municipal solid waste in Europe, Israel, Japan and other countries in Asia, but are not yet in commercial operation on MSW in the U.S. For the most part, there have been pilot or demonstration facilities of thermal conversion technologies in North America (including Canada, Mexico and the U.S.), but the absence of commercial facilities operating in this country has been an obstacle to demonstrating the capabilities and benefits of these technologies for processing MSW. As such, the economics of these technologies are also lacking a track record. As noted above, a limited number of commercial facilities are in initial operation in the U.S. and Canada, and several additional facilities will be in the next two years. Operating history and cost history with these thermal facilities will be available over the next several years. Interest in AD of source-separated organics is strong, and several facilities have recently been placed in operation, or are in startup or construction in the U.S. and Canada. Interest in mixed waste AD facilities is limited.
- **Lack of development/acceptance for certain product markets in the U.S., or regulatory hurdles for product use.** Conversion technologies generate readily marketable electricity or fuel as a primary product, but also generate secondary products that may not have a strongly developed market. Examples include the digestate (compost) from AD and aggregate from thermal conversion technologies.
- **Unclear permitting pathways**. Applicability of regulations for environmental permitting is unclear, non-existent, or problematic. Several states are addressing the issues. In Massachusetts, regulations are being developed to facilitate permitting of AD projects for source-separated organics. Massachusetts has issued its updated Solid Waste Management Plan in April 2013; the updated plan lifted the moratorium on permitting thermal gasification projects for MSW, but not traditional WTE projects. However, it places a statewide tonnage cap (350,000 TPY) on permitting for gasification projects. Massachusetts does not currently recognize MSW-based thermal conversion technology projects as eligible for renewable energy credits. California is still working to develop legislation, regulations and policies directed to thermal conversion technology. At issue are policies as to whether thermal conversion technologies are eligible for renewable energy credits and diversion credits from landfilling.
- **Public education**. Since conversion technologies are only now coming into commercial use in the U.S., there is a need to educate the public, regulatory staff and elected officials about the characteristics of conversion technologies.

3.3 Estimated Costs

For this Report, estimated costs have been prepared for new and emerging technologies for various facility sizes, representing those facility sizes that are or can be commercially achieved by analyzing information available in the literature from other similar studies as cited in this Report,

and by using information provided in September 2013 by technology companies. The numbers presented are preliminary, non-site specific, planning-level figures, meant to provide a basis for comparison to market prices for waste disposal, as an indicator to assess if new and emerging technologies can potentially be market competitive for a facility at the South Meadows Facility. The economics are based on a "greenfield facility", one that assumes that the existing Facility is replaced. It is expected that a future, detailed feasibility study would be completed to look at the viability of using the existing Facility and site infrastructure, as well as to estimate definitive, project specific costs.

Estimated costs are presented for thermal conversion technologies that would be available in the following three size ranges for post-recycled, mixed MSW:

- 500-1,000 TPD
- 1,000-2,000 TPD
- 2,000-3,000 TPD

These size ranges represent ranges for which technology providers do or plan to provide facilities, using multiples of standard module size to achieve the larger facility sizes. The size ranges also provide an opportunity to address the existing waste throughput of South Meadows Facility (approximately 710,000 TPY: 2,288 TPD at 85 percent plant capacity factor [allowing for scheduled and unscheduled downtime]) as well as smaller facility sizes to accommodate enhanced source separation, recycling and organics management, or the possibility of fewer customers.

Estimated construction, operating and maintenance costs are provided, as well as the cost per ton (service fee) for waste disposal, considering project revenues. It should be noted that the costs are based on literature findings or from technology providers. Information for eight technology providers was obtained for this review, reflecting both electricity and fuel production. The eight companies represent several with projects that have achieved commercialization overseas and others that have projects in initial operation, testing, startup/commissioning or advanced stages of development in the United States and Canada. These companies include:

- Alter NRG
- Enerkem
- INEOS
- Interstate Waste Technologies
- Plasco Energy
- AEB Amsterdam
- Green Conversion Systems
- Herhof gmbH

Prices for energy products were checked against September 2013 market prices and found to be reasonable or on the conservative side. The prices assumed for energy revenues for thermal conversion projects were 5 cents per kWh for electricity (includes renewable energy credits), $2.00/gallon for wholesale cellulosic ethanol, and $3.00/gallon for wholesale drop-in fuels such as gasoline or diesel. The electricity prices include current pricing for sale of renewable energy credits by CRRA for the South Meadows Facility. Fuel prices noted are market-driven prices in the Northeast. Renewable energy credits for fuels arising from certification by US EPA through Renewable Identification Numbers RINs were not added to the market prices noted above. These credits are currently valued at approximately $1.00/gallon, and their use would lower the resulting tip fees from those currently shown for fuels projects. Market prices for recovered materials products were estimated by technology providers, and were not considered a significant contributor to revenue, when compared to energy revenue for thermal conversion facilities. Further, the basis for the tip fees is private financing of facility development and construction

costs over a 20-year operational period. Public financing would likely reduce costs, as would extending the financing term to 30 years, the latter not an unlikely financing approach. Public grants and low-interest loans (such as those from the U.S. Department of Energy) or loan guarantees (such as those from the U.S. Department of Agriculture) which is in place for several of the initial U.S. projects noted herein, have not been considered in the analysis. The future of federal and state grants and loans is uncertain, particularly in light of current economic conditions.

Future energy and materials market prices are not certain, although the need for fuels, particularly renewable cellulosic fuels as driven by national legislation, is expected to be strong. Indications of this trend are evident in the success of private companies to attract private project financing with off take agreements in the five-year range, although project life expectancy and debt payment are normally 20 years. Materials market prices will be driven by international needs, perhaps more than U.S. needs, as significant manufacturing has moved overseas. Both energy and materials prices will be driven by the national and international economies.

Estimated costs for thermal conversion of post-recycled, mixed MSW are provided in Table 3-1.

Table 3-1
Estimated Costs for New and Emerging Technology ($2013)
Thermal Conversion of Mixed, Post Recycled MSW

Facility Size	Construction Cost ($/Installed Ton)	O&M Cost ($/Ton Annual Throughput)	Service Fee(4) ($/Ton)
500-1,000TPD(1)			
Electricity	$390,000-400,000	$80-85	$ 184
Fuel	$145,000-305,000	$15-55	$45-70
1,000-2,000TPD(2)			
Electricity	$275,000-365,000	$30-85	$104-154
Fuel	$145,000-380,000	$15-195	$45-70
2,000-3,000TPD(3)			
Electricity	$160,000-270,000	$15-95	$99-149
Fuel	……Assume comparable to Fuel at 1,000-2,000 TPD……		

(1) 164,250 -328,500 TPY based on 90% annual availability
(2) 328,500-657,000 TPY based on 90% annual availability; 310,250-620,500 TPY based on 85% annual availability
(3) 657,000-985,500 TPY based on 90% annual availability; 620,500-930,750 TPY based on 85% annual availability
(4) Does not include cost for management oversight, site costs (if any), or payment of host community payments or payment in lieu of taxes, if any.

Construction costs in the U.S. are quite variable based on the region and labor rates. Service fees are highly dependent on not only construction, financing and O&M costs, but also revenues. To obtain private financing, debt service coverage ratios required by lenders impact revenue requirements and tip fees that must be charged. Consequently, it is not always possible to model the construction and O&M cost numbers above, and calculate the estimated service fees.

It can be seen from Table 3-1, that fuels projects in general have lower service fees due to the higher value of fuel as a product as compared to electricity. It is noted further that the service fees for electricity projects are based on 5 cents per kWh, which in certain areas may be low by longer-term historic standards, but reflects recent pricing that is based on the low cost for natural gas. The low end of the installed costs and O&M costs for fuels projects are based on assumptions by the technology provider as to the recyclables, inert materials and moisture content of MSW. The high end of the O&M costs for fuel projects is based on using natural gas as a supplemental fuel. There are economies of scale for larger facility sizes for per-ton construction and O&M costs for electricity projects, but that is not reflected in the numbers for fuel projects. This is due, in part, to the different technologies used for fuel projects to produce ethanol. In addition, for the facility sizes exceeding 1,000 TPD, the numbers reflect different types of fuel produced, e.g., ethanol or drop-in gasoline. The higher construction and O&M numbers in this range for fuels projects generally reflect drop-in gasoline production, as compared to ethanol production. However, with production of drop-in fuels, the product value is higher, offsetting the higher construction and O&M costs.

Table 3-2 presents estimated costs for AD of source-separated food and green waste.

Table 3-2
Estimated Costs for New and Emerging Technology ($2012)
$/Ton of Annual Throughput (5)[4]

Anaerobic Digestion of Source-separated Food and Green Waste

Facility Size	Construction Cost ($/Ton Throughput)	O&M Cost ($/Ton Throughput)	Service Fee (6) ($/Ton)
30,000-60,000 TPY	$278-1,126	$9-100	$54-95

Table 3-2 is based on a market survey of companies responding to a Request for Expressions of Interest issued by CRRA in April 2012. The range of cost estimates reflect the differences in design-e.g. preprocessing needs, batch or continuous feed, wet or dry systems, digestion temperature-mesophilic or thermophilic, final curing requirements, etc. The service fees are based on assumptions by the companies for sale of renewable electricity at 10 cents per kWh, adjusted by this report to reflect a sale price of 5 cents per kWh, and in the case of sale of CNG at $2.25 per gallon equivalent.

Pursuit of new and emerging technologies is generally trending toward production of fuel and "green" chemicals; as such projects offer higher market-based commodity prices for the products as compared to electricity. Electricity prices have declined in the Northeast and nationwide as a result of declining natural gas prices. In addition, other alternative energy sources of electricity, such as solar and wind, have been decreasing in price as those technologies mature and overseas suppliers offer low-cost equipment, increasing competition and resulting in declining market pricing for renewable electricity. The trend from electricity to fuel is likely to continue as a result of lower electricity prices from natural gas and other renewable sources, which discourages electricity projects. In addition, uncertainty in renewable electricity pricing results from public debate in jurisdictions where incentives for renewable energy credits for electricity are being

(5)[4] Comparison from CRRA May 2010 Report was updated to address addition of fuels as a potential energy product. Only electricity was considered in the May 2010 report.

(6) Does not include cost for management oversight, site costs (if any), or host community benefits or payment in lieu of taxes, if any.

considered, whether produced from traditional WTE projects, including gasification projects. This has been a focus of debate in Massachusetts and California.

3.4 Comparison to Conventional Waste-to-Energy Technology

Table 3-3 compares the technology categories (i.e., thermal processing, both gasification and advanced combustion, and mechanical processing with gasification or combustion) that meet the criteria in Section 2 of this Report to conventional WTE technology currently in use at the South Meadows Facility.

Table 3-3
Comparison of New and Emerging Technology Categories to Conventional Waste-to-Energy Technology for MSW

Criteria	Thermal Processing Gasification	Thermal Processing Advanced Combustion	Mechanical Processing with Gasification or Combustion
Readiness and Reliability	D	C	C
Facility Size and Design Flexibility	C	C	C
Utilization of Existing Infrastructure	C	C	C
Utility Needs	C	C	C
Extent of Beneficial Use of Waste	A	A	A
Residuals Requiring Disposal	A	A	A
Environmental Impacts (Emissions)	A	A	A
Siting Requirements (Acreage Required)	C	C	C
Public Acceptability	A	A-C	A-C
Cost7[5]	A-C	C	C
Experience of Project Sponsors8[6]	C-D	C-D	C-D
Ownership Preferences	C	C	C
Risk Allocation Among the Public and Private Parties	C	C	C

Legend
A = potentially advantageous as compared to conventional WTE
C = potentially comparable to conventional WTE
D = potentially disadvantageous as compared to conventional WTE.

A comparison for the other technology categories – hydrolysis, chemical and mechanical processing with fiber recovery – could not be made since these technologies have not processed

7[5] Comparison from CRRA May 2010 Report was updated to address addition of fuels as a potential energy product. Only electricity was considered in the May 2010 report

8[6] Depends on specific project sponsor

MSW at a commercial stage and information is not available to allow an informative, reliable comparison. A comparison was not made for AD for MSW as a mixed waste feedstock since Connecticut legislation and DEEP permitting practice do not allow mixed MSW as feedstock for digestion/composting. In addition, mixed waste AD facilities, with on-site composting of the digestate, would require more space than available for processing the current quantity of MSW, i.e., 710,000 TPY. Smaller AD facilities could be considered.

Although several thermal processing technologies, both with gasification and advanced combustion, and mechanical processing technology with gasification and combustion are being commercially applied outside the U.S. for mixed MSW and at pilot and demonstration facilities in the U.S. and Canada, conversion technologies have limited operating experience when compared to conventional WTE technology. WTE has been commercial in the U.S. for several decades and is demonstrated to be a proven and reliable method of solid waste disposal. Currently, there are nearly 90 WTE facilities in operation in the U.S. These WTE facilities have a wide range of rated design capacities, with the largest being approximately 3,000 TPD. Of the conversion technologies, thermal processing with gasification or advanced combustion and mechanical processing with gasification or combustion are expected to be comparable with regard to facility size and flexibility. The largest gasification facility currently in operation (in Japan) and processing MSW is a 600 TPD gasification facility. As noted earlier, a large MSW plasma gasification project (approximately 1,050 TPD) will be coming on line in England this fall. The capacity of the largest advanced combustion facility in Amsterdam is processing approximately 1,600 TPD. Mechanical processing with gasification or combustion is being accomplished commercially overseas by Herhof at 600 TPD. To date, mixed MSW AD technologies generally have had lower design capacities and are not likely suitable at a size of 710,000 TPY. Also, in general, and as would be expected, the overall experience of the project sponsors that offer the conversion technologies is not as extensive and as well developed as the companies offering conventional WTE technology. It should be noted, however, that several companies in the conventional WTE business (such as Waste Management and Covanta) have entered or are evaluating technologies with which to enter the innovative technology industry.

The conversion technologies offer certain potential advantages in comparison to conventional WTE. The air emission levels from conversion technologies are expected to be less than with conventional WTE. The thermal gasification technologies and AD technology produce and combust a synthesis gas or biogas, rather than a solid fuel (MSW). Inherent with the combustion of a gas (compared to combustion of a solid material, such as MSW), emissions would potentially be lower. Also, the gas can be cleaned prior to combustion. The thermal gasification processes also cool the gases after the heating process to prevent reformation of dioxin and furans. With AD, the conditions for formation of certain air pollutants (e.g., dioxins, furans, mercury) are not present. Emissions from advanced combustion and mechanical processing with gasification and combustion are expected to be reduced when compared to traditional WTE technologies due to additional air pollution control equipment.

Thermal gasification technologies provide the potential for use of combined cycle power systems, thereby allowing increased efficiency for electric generation. Thermal gasification technologies and AD technologies provide the potential for converting the gas to fuels, including compressed natural gas, hydrogen, ethanol, methanol, gasoline and biodiesel. Overall, the conversion technologies are also potentially advantageous because they may produce less residuals requiring disposal, since with many gasification processes the residual is vitrified as part of the process, enhancing its acceptability and marketability for use as aggregate and fill material. However, with the exception of electricity, fuels and traditional recyclables, market development would be required for many of the end products of the innovative processes. Lack of successful marketing would increase the disposal rate.

Since the conversion technologies have potentially lower emissions than conventional WTE, they enhance materials and energy recovery, and have potentially fewer residuals requiring disposal, the conversion technologies may also garner greater public acceptability. It is possible to add front-end and/or back-end materials recovery systems to increase materials recovery. This is referred to as Advanced Thermal Combustion in this Report.

Certain conversion technologies are eligible for federal and state incentive programs for funding, and/or credits for renewable energy production or reduction in greenhouse gas emissions. If available, these programs could result in a reduction in estimated tip fees provided in this Report.

Project sponsors will consider a variety of project delivery and ownership approaches, including private financing. Also, many project sponsors appear willing to offer an industry-standard risk profile: the developer would guarantee project performance, and the public entity would guarantee the delivery of MSW and the payment of tipping fees.

3.5 Risk Profile

As described earlier in this Report, although certain aerobic, AD, thermal gasification, advanced combustion and mechanical processing with gasification or combustion processes are serving commercial needs for mixed MSW management outside of the U.S., there are no commercial installations yet operating in this country for MSW. Accordingly, when compared to conventional WTE technology, which has had widespread use in the U.S. for three decades (and in Europe for even a longer period), there is limited operational and economic data available from these overseas alternative technology-based facilities, and there is not yet operational data available for any commercial U.S. facilities. However, as reported in Section 3.2 of this Report, this situation is changing, as MSW facilities using thermal conversion technology are now in initial operations, testing, startup/commissioning, construction or advanced stages of development in the U.S. and Canada. Over the next three years, operational data should become available from these facilities to supplement that available from pilot and demonstration facilities in the U.S. and Canada. Further, it should be noted that application of advanced combustion processes and mechanical processes with gasification and combustion would involve less technical risk than the other conversion processes, since they have wider commercial application overseas.

As described in detail in Section 3.2 of this Report, despite the ongoing public and private initiatives underway and the progress being made, there are several challenges to development of conversion technologies in the U.S. Some of the more prominent challenges include: lack of commercial development in the U.S.; lack of defined/guaranteed costs and economics of projects in the U.S.; lack of development/acceptance of certain product markets in the U.S. or regulatory hurdles to product use; unclear or uncertain permitting pathways; and lack of knowledge of the technologies by the public, regulatory staff and elected officials.

Considering these challenges, the project risk for using these technologies in a commercial setting is higher than that for conventional WTE technology, including that for reliability, performance, market strength for certain products, environmental impacts and cost. This is not to say that reliability and performance standards cannot be achieved for estimated costs, but that the track record is currently limited compared to traditional WTE technology and the costs are both vendor and consultant estimates without a definitive track record. This situation is not unlike that in the late 1970s and early 1980s when what is now conventional WTE technology was being introduced into the U.S. as a new technology from Europe and Japan.

As this Report presents, there are potential benefits to these emerging technologies when compared to conventional WTE technology, including the potential for lower air emissions and potentially enhanced recovery and use of other MSW constituents for recycling and production of

renewable electricity, fuels and green chemicals, and reduced quantities of residuals requiring landfill disposal.

Based on technologies commercially demonstrated outside of the U.S., and the recent progress in the U.S. and Canada, selected thermal processing technologies are promising (including gasification and advanced combustion) and could be considered to serve the South Meadows Facility communities, with suitable project definition and risk sharing between the public and the private sponsors. As described in Section 4 of this Report, any new, thermal replacement facility would take six to seven years to develop. Based on current State legislation and DEEP permitting practices, only source-separated AD can move forward. Such a project would take four to five years to develop.

3.6 Summary of Findings

Findings of the technology evaluation are summarized below for the review criteria.

1. ***Readiness/Reliability of Technology:*** Thermal conversion and AD technologies have advanced to the commercial stage overseas and are in the process of initial commercial operation, testing, start-up, construction and development in the U.S. and Canada, and would be most capable of being placed in operation in the shortest time frame at the South Meadows Facility. Several facilities currently in initial operation and/or start-up in the U.S. and Canada will have additional performance information available in 2014 , as will facilities currently under construction that reach operational status in 2014 and 2015. Data is available from commercial facilities overseas; but, operating and performance data, including transferable costs and project economics, is currently limited in the U.S. and Canada to initial operations, start up and testing at commercial facilities, and to operation of pilot and demonstration facilities. Success with new and emerging technology used commercially overseas must be "transferred" to address specific waste characteristics, local alternative disposal costs, product markets and environmental permitting requirements in the U.S. Considering the current status for new and emerging technology, the project risk for using these technologies in a commercial setting is greater than that for traditional WTE technology. This is not to say that reliability and performance standards cannot be achieved for estimated costs, but that the track record is currently very limited compared to traditional WTE technology. Typically, a commercial thermal conversion facility for mixed MSW could be brought on line in six to seven years. An AD facility for source-separated food and yard waste could be operational in four to five years.

2. ***Facility Sizing/Scale Up:*** For both a thermal MSW facility and a source-separated food and green waste facility, facilities of a size (or with module sizes of the appropriate size or that can reasonably be scaled up, can be combined to create a larger facility of the size desired), are currently in commercial operation overseas, and/or in initial operations, commissioning, start up, construction or advanced stages of development in the U.S. and Canada. Because the technologies are offered as modular units that can be combined as needed to achieve different facility sizes, the technologies provide flexibility to be developed in facility sizes that can accommodate for a thermal MSW facility, current MSW flows to the South Meadows Facility, or reduced sizes to accommodate increased source reduction, recycling and composting, or fewer customers. AD facilities are also offered in modules, allowing accommodation of desired quantities of source-separated organics.

3. ***Flexibility of Technology for Use with Existing or Modified Collection Practices:*** Thermal MSW conversion facilities can accept MSW with varying degrees of separation reflective of existing collection practices for post-recycled mixed MSW or for modified collection practices where food waste and other organics are separately collected. For

thermal conversion facilities, preprocessing, if required, can be designed to the level to accommodate the incoming waste characteristics to produce a feedstock to meet the particular thermal conversion technology needs. This flexibility allows for acceptance of MSW as well as source-separated MSW in which recyclables and organics have been removed. Source-separated food and yard waste facilities using AD are typically designed for minimal preprocessing to achieve the needed feedstock for digestion, and would require separation of these materials at the source and separate collection.

4. ***Enhanced Materials and Renewable Energy Recovery, Environmental Performance, and Diversion from Landfilling:*** State goals to improve environmental performance, enhance materials recovery and renewable energy production, and increase diversion from landfilling can potentially be met.

   With regard to enhancing beneficial use of waste, new and emerging technologies offer, by design, the potential to increase materials recovery, renewable energy production, and diversion from landfilling as compared to traditional WTE technology. They also provide a means to reduce air emissions, including greenhouse gas emissions. Flexibility provided to produce electricity or fuels from syngas allows the technology to be developed to enhance product marketability and pricing. In many cases, vitrification of the residue allows greater opportunity and market acceptance for use of the residue materials as aggregate and fill material.

5. ***Compatibility with State Solid Waste Management Plan:*** Using thermal conversion for a mixed MSW facility and accepting source-separated food and green waste for an organics processing facility advance the goals of the State's 2006 Solid Waste Management Plan and are compatible with meeting identified infrastructure needs to do so. The thermal, mixed MSW facility has the ability to accept waste after recycling and composting efforts have occurred, thereby diverting waste that would have been landfilled or combusted, recovering additional recyclable materials and producing renewable electricity, fuels or chemicals. The organics processing facility would process source-separated food and green waste from residential and commercial sources and produce renewable electricity or fuel, as well as fertilizers and soil amendments such as compost.

6. ***Competitive Economics:*** Based on Table 3-1, estimated service fees for thermal conversion facilities for mixed MSW range between $99 and $184 per ton of MSW for facilities generating electricity, and between $45 and $70 per ton of MSW for facilities producing fuel. For source-separated food and yard waste facilities, service fees are estimated in this Report to range between $54 and $95 per ton. These ranges reflect variations in construction, financing, and O&M costs, the market value of electricity as compared to fuels, and assumptions on facility performance, energy output, and materials recovery.

   If renewable fuel is the energy product, estimated service fees for MSW thermal conversion projects appear to be competitive with and can be competitive with future market prices for waste management. For thermal conversion projects generating electricity to be competitive, pricing incentives, such as eligibility for renewable energy credits, would be needed to increase revenues from electricity sales, or other incentives such as grants and low-interest loans would be needed to reduce financing costs. Excluding the cost of separate collection of food and yard waste, AD of food and yard waste appears competitive now, and would likely remain so in the future.

4. Potential for Implementation of New and Emerging Technology at the South Meadows Facility

4.1 Applicability, Comparison to Review Criteria

This Report has gathered information on new and emerging technologies to evaluate whether they can reasonably meet the evaluation criteria (Section 2 of this report) deemed desirable for a replacement facility for the South Meadows Facility for mixed MSW as a feedstock. As noted in Section 3, thermal conversion and AD technologies have advanced to the commercial stage overseas, and are in the process of commercialization in the U.S. and Canada. As such, they would be most capable of being placed in operation in the shortest time frame. AD technologies for mixed MSW were not assessed as current State legislation and DEEP permitting practice preclude using mixed MSW for producing compost products. Focus was placed on thermal conversion technology as the most reasonable technology to replace the South Meadows Facility for mixed MSW. To accommodate source-separated organics, such as food waste, focus was placed on reviewing AD technologies as they provide a means to not only recover valuable soil products, but also capture the renewable energy value of such wastes.

Thermal conversion technologies that can accommodate various facility sizes for mixed MSW, i.e., 500-1,000 TPD, 1,000-2,000 TPD, and 2,000-3,000 TPD were considered. The objective was to compare the information to the review criteria in Section 2 of this Report to evaluate whether new and emerging technology could reasonably replace the existing South Meadows Facility and satisfy future needs in a changing regulatory and public policy environment. This required assessing the flexibility of technologies to address scenarios that represent current MSW flows to the South Meadows Facility and reduced future waste quantities that might result from increased source reduction, recycling and composting programs developed in the State, or from fewer customers. To address the current MSW waste flow, 710,000 TPY, a facility in the 2,000-3,000 TPD size range would be needed. For a reduced flow that would accommodate increased source reduction, recycling and organics programs in line with State goals for 2024, i.e., 58 percent recycling as expressed in the 2006 Amendment to the Solid Waste Management Plan, a facility in the 1,000-2,000 TPD range would be needed. A facility in the 500-1,000 TPD size range would require more aggressive programs to reduce, recycle and manage organics.

This Report has also gathered information for development of a source-separated organics processing facility, considering technologies that could accept 30,000 to 60,000 TPY of food and green waste. The information presented in this Report is based on a market survey of technology providers conducted by CRRA in April 2012, assessing what technology sizes were market ready, preliminary pricing by technology providers, and could provide an adequate level of service for multiple customers to satisfy the needs of Public Act No. 11-217, which mandates recycling and composting of source-separated organic materials from commercial sources.

Both the mixed MSW facility and the organics processing facility advance the goals of the State's 2006 Solid Waste Management Plan, and are compatible with meeting identified infrastructure needs to do so. The MSW facility has the ability to accept waste after recycling and composting efforts have occurred, thereby diverting waste that would have been landfilled, recovering additional recyclable materials and producing renewable electricity, fuels or chemicals. The organics processing facility would process source-separated food and green waste from residential and commercial sources and produce renewable electricity or fuel, as well as fertilizers and soil amendments, such as compost. Both the MSW thermal conversion facility and the source-separated organics processing facility have the flexibility to be constructed in different sizes or to be expanded over time, by grouping individual technology modules to accommodate size needs.

As noted, in addition to being compatible with the goals and needs as identified in the State Solid Waste Management Plan discussed, to assist in preparing this Report, comparative review criteria were developed that reflect State goals to provide reliable service, improve technical and environmental performance, enhance materials recovery and renewable energy production, and increase diversion from landfilling. These criteria are as follows:

a) The technology is reliable as evidenced by its history of commercial use or demonstration of potential for commercial use so as to be able to replace the existing South Meadows Facility as soon as possible after 2019, considering time for project development (commercial use is defined as in regular use to process MSW on a contract basis).

b) The technology is capable, with no or reasonable scale-up, of processing current MSW loads at the Facility, i.e., approximately 710,000 TPY of mixed, unsorted MSW, or lesser quantities representing achievement of increased source reduction , recycling and organics processing or fewer customers

c) The technology has the flexibility to accommodate existing MSW collection practices currently in use in Connecticut and to accommodate changes that may result from enhanced source reduction and recycling programs and separate organics collection.

d) The technology provides for enhanced separation of materials for recycling and/or beneficial use of MSW to produce marketable products and has the ability to produce renewable energy in the form of electricity or fuels.

e) The technology provides for improvements in environmental performance such as reduced greenhouse gas emissions and increased diversion from landfills.

f) The technology can be economically competitive with other management/disposal options available in the marketplace, considering all development, financing, design, construction and operating costs, less revenues from sale of energy and products; and

g) The technology is compatible with the goals of the State Solid Waste Management Plan as amended in 2006.

Information provided in Section 3 of this Report indicates these goals can potentially be met. Facilities of a size, or with module sizes that exist or can reasonably be scaled up or combined to create a larger facility of the size desired, are in commercial operation overseas, and/or in initial operations, commissioning, start up, construction or advanced stages of development in the U.S. and Canada. Because the technologies are offered as modular units that can be combined as needed to achieve different facility sizes, the technologies provide flexibility to be developed in facility sizes that can accommodate current MSW flows to the South Meadows Facility, or reduced sizes to accommodate increased source reduction, recycling and composting, or fewer customers. In addition to the facilities currently in initial commercial operation and testing in the U.S., several commercial facilities will come on line in the U.S. and Canada in 2014 and 2015. A commercial thermal facility could be brought on line at the South Meadows Facility in six to seven years, as further described in Section 4.2.

Although there has been significant progress in recent years with development of new and emerging technology in the U.S. and Canada, there remains limited operating data and economics from pilot, demonstration and commercial facilities that are in initial operations and/or testing. Moreover, success with new and emerging technology used commercially overseas must be “transferred” to address specific waste characteristics, product markets and environmental permitting requirements in the U.S. Considering the current status for new and emerging technology, the project risk for using these technologies in a commercial setting is, at this time,

greater than that for traditional WTE technology. This is not to say that reliability and performance standards cannot be achieved for estimated costs, but that the track record is currently limited compared to traditional WTE technology. This situation is not unlike that in the late 1970s and early 1980s when what is now traditional WTE technology was being introduced into the U.S. as a new and emerging technology from Europe and Japan. Challenges to development of new and emerging technology in the U.S. are described in more detail in Section 3.2 of this Report.

Noting the above status, public jurisdictions are developing new and emerging technology projects in several ways. Those willing to accept the risks with new technology now, are seeking the potential benefits as quickly as possible, and have limited time to meet waste management needs, are pursuing full-size commercial facilities, with proper attention to performance goals and risk allocation, mainly borne by the private-sector developer. Those that are more cautious, but seek the potential benefits and have more time to meet waste management needs, are pursuing smaller sized demonstration projects, that once proven, can be readily expanded to full-size facilities. Still others are monitoring the experience with and performance of commercial facilities currently coming on line to determine if expectations can be met before they make a decision to pursue these technologies. Section 4 of this Report presents implementation steps and a schedule for these development options.

With regard to enhancing beneficial use of waste, as described in Section 3, new and emerging technologies offer the potential to increase materials recovery, renewable energy production, and diversion from landfilling as compared to traditional WTE technology. They also provide a means to reduce air emissions, including greenhouse gas emissions, also described in Section 3.

From an economic perspective, the preliminary estimated tip fees for MSW thermal conversion projects are potentially competitive with – and can be competitive with – future market prices if renewable fuel is the end product. For thermal conversion projects generating electricity to be competitive, pricing incentives would be needed for sale of electricity, or other incentives such as grants and low-interest loans. Excluding the cost for separate collection of food and yard waste, or other organics, AD of food and yard waste appears competitive now, and would likely remain so for the future. Lastly, as noted earlier in this section of the Report, thermal conversion technology for processing mixed MSW and anaerobic digestion facilities for source-separated organics are compatible with that needed to meet the goals of the State Solid Waste Management Plan.

4.2 Implementation Activities

Implementation of new and emerging technology at the South Meadows Facility would include a multi-step process: project definition as part of a detailed, site-specific feasibility study; procurement of the design, construction and operation of the facility; permitting; financing; and design, construction, start up and operation of a facility. Table 4-1 provides a suggested implementation schedule for development of a thermal conversion, mixed waste MSW facility. Table 4-1A provides a schedule for development of a thermal conversion facility, assuming that activivity is first foucsed on monitoring performance of other new commercial facilities coming on line in the next few years, before a decision is made to proceed with procurement of a facility Table 4-2 provides a suggested plan for development of a source-separated organics processing facility for food and green waste, to help meet State needs to satisfy the requirements of Public Act No. 11-217, which mandates commercial recycling and composting of source-separated organic materials, including food scraps, food processing residue, and soiled or unrecyclable paper, and to accommodate community-driven organics management programs. CRRA might consider one or both types of facilities for meeting the State's future needs and goals.

As a first step for future consideration of a MSW project, project and site-specific procurement planning is recommended to:

- Supplement and verify information presented in this Report
- Assess potential community and customer interest
- Define the desired project as to size and performance goals
- Assess the potential to use existing equipment and site infrastructure
- Monitor and update progress and assess data from thermal conversion facilities currently in initial operation, start up and advanced stages of development
- Assess project interest and gather information via a Request for Information to private companies in the marketplace.

Such procurement planning should also address the potential impact of technology transfer issues to the U.S., and specifically Connecticut, such as the impact of potential differences in waste composition and waste management practices, capital costs and project economics, product markets, regulatory requirements and related environmental issues. As part of such a study, CRRA and South Meadows Facility community representatives might also wish to meet with sponsoring companies and/or visit selected, commercially operating facilities to gain further insight for potential application at the South Meadows Facility. Implementation of a source-separated organics facility would require similar steps as a mixed MSW, thermal conversion facility.

There are several options for development of a thermal, mixed waste MSW facility depending on CRRA comfort with the reliability and economics of the technologies. Those options could include: implementation of a full-size commercial facility at the start: development of a smaller size, but expandable commercial facility, followed by a suitable test period to ensure facility performance, and, if deemed successful, followed by expansion to a full-size facility; or initial monitoring of the performance of other commercial facilities coming on line, and if expectations are met, initiating procurement planning. Tables 4-1 and 4-1A present suggested implementation steps and a schedule for a mixed waste, MSW facility. In either the case of a full-size facility, or an expandable commercial facility, a total of six to seven years is required from the feasibility study to initial facility operation. If the option to monitor performance of other facilities for several years prior to conducting procurement planning is selected, the implementation schedule is extended by the number of years of initial monitoring. If the option for an expandable facility is selected, then a period of 18 months for facility performance testing is suggested, followed by an additional 18 months to complete the construction of the expansion. With this latter option, 36 months is added to the initial six to seven years to achieve operation of the desired full-size facility, a total of about 10 years, or if two to three years of premonitoring is also conducted, a total of 12 to 13 years. The use of the expandable facility approach or an initial monitoring approach would include the need to continue the operation of the South Meadows Facility, or portions thereof for an additional three to seven years for disposal of the waste not sent to the expandable facility, or, if the South Meadows Facility is shut down, to implement alternative disposal means, either with existing facilities in Connecticut or out of state. The advantage of these later approaches is to provide a greater degree of confidence in technology performance before committing to a full sized facility, or in the case of premonitoring, before committing to develop a facility. In addition, it allows time to monitor progress in increased recycling and composting efforts undertaken to meet the State's 2024 goals, and to size the thermal conversion facility accordingly.

Table 4-2 presents suggested implementation steps and a schedule for a source-separated organics processing facility. In this situation, the suggested plan is for development of a full-size facility from the start, as development of the technology is more advanced and proven, both overseas and in the U.S. and Canada. Approximately four to five years is estimated for project development.

The schedules presented assume private design, construction and operation of a facility. The facility could be either publicly or privately owned. A discussion of options for project delivery, and the pros and cons for those different options, are presented in Section 5 of this Report.

Table 4-1
Implementation Steps/Schedule
Development of Post Recycled, Mixed Waste MSW Facility

(Full Size or Expandable Commercial Facility)

Implementation Step		**Months**
1.	Project/Site Specific Procurement Planning (Includes Concurrent Monitoring of Other Facilities)	12-15*
2.	Preparation of Request for Proposals for Options for Expandable Commercial Facility and/or Full Project Size	6*
3.	Proposal Preparation by Companies	6
4.	Proposal Evaluation/Selection	6*
5.	Contract Negotiations	4-6*
6.	Permitting	12-15
7.	Facility Design/Construction	24
8.	Facility Start Up/Commissioning	6
Commercial Operation (TOTAL)		76-84 months
For Expandable Commercial Facility, Additional Time after Operation Achieved		
• Performance Testing/Analysis		18 months
• Expansion to Full Size		18 months

*Milestone Decision Points

Table 4-2
Implementation Steps/Schedule
Initial Monitoring, Development of Post Recycled, Mixed Waste MSW Facility

(Full Size or Expandable Commercial Facility)

Implementation Step		**Months**
1.	Monitor Progress of Other Facilities Prior to Procurement Planning	24-36*
2.	Project/Site Specific Procurement Planning	12-15*
3.	Preparation of Request for Proposals for Options for Expandable Commercial Facility and/or Full Project Size	6*
4.	Proposal Preparation by Companies	6
5.	Proposal Evaluation/Selection	6*
6.	Contract Negotiations	4-6*
7.	Permitting	12-15
8.	Facility Design/Construction	24
9.	Facility Start Up/Commissioning	6
Commercial Operation (TOTAL)		100-120 months
For Expandable Commercial Facility, Additional Time after Operation Achieved		
• Performance Testing/Analysis		18 months
• Expansion to Full Size		18 months

*Milestone Decision Points

Table 4-3
Implementation Steps/Schedule
Development of Source-separated AD Organics Facility

Implementation Step		**Months**
1.	Project/Site Specific Procurement Planning	3*
2.	Preparation of Request for Proposals	4*
3.	Proposal Preparation by Companies	4
4.	Proposal Evaluation/Selection	4*
5.	Contract Negotiations	4-6*
6.	Permitting	9-12
7.	Facility Design/Construction	18-24
8.	Facility Start Up/Commissioning	2-4
Commercial Operation (TOTAL)		48-61 months

*Milestone Decision Points

5. Project Delivery Approaches

5.1 Methods of Project Delivery

There are many project delivery methods available for developing a conversion technology facility. These methods involve different approaches for ownership, financing, design, construction and operation of the facility. The traditional approach for project development for public works infrastructure has been the "public model" with public ownership, public financing, the "design-bid-build" (DBB) approach for design, bidding and construction activities, and public operation. In the past 20 years, increased interest has grown in alternatives to this traditional public model, particularly for projects that are costly, utilizing new technology that may not have a long "track record", or technology that is licensed and only available through alternative project delivery options. Such interest has resulted from the potential opportunities for private financing; lower cost, shorter design and construction schedules, and the ability to shift design, construction and performance risk, where appropriate, from a public entity to a private company. This potential to shift risk for financing and technical and economic performance is particularly attractive for development of CT technologies, which at this time, while operating commercially outside the U.S., are only now in initial operations, coming on line, or being constructed or considered for commercialization in the U.S. In addition, many Federal funding options including grants, loans or loan guarantees may only be available to private companies.

Public Model

With traditional DBB, the public entity contracts with an engineer to design the project, prepare bid specifications and, typically, oversee construction, and with a *separate* contractor(s) to construct the project. The public entity is responsible for directing the separate contractors and assuring overall project coordination. Operation can be either public or private.

The most utilized alternative project delivery methods for public infrastructure (with the public model) include design-build (DB), design-build-operate (DBO) and design-build-own-operate-transfer (DBOOT). DB and DBO methods allow public ownership and financing for the facility, but the approach for designing and constructing the facility changes from the traditional DBB approach to design-build or design-build-operate. With DB and DBO, the responsibility for designing, bidding and constructing the facility is vested in a single entity, responsible to its public client for overall system performance. With DB, operation of the facility can be public or put out under separate contract to a private entity. With DBO, operation of the facility is the responsibility of the private DBO company. With both DB and DBO, financing and ownership is by the public client. With the DBOOT approach, a private entity assumes project development risk and provides private financing along with design, construction and operation of the facility. Initially, the private entity owns the facility. At the end of a specified term, ownership of the facility would be transferred to the public entity and the public entity would be responsible for continued operation of the facility, either by public employees or through a private operating contract.

Private Model

The private model is another alternative to traditional DBB. With the private model, a private entity is responsible for project development, financing, designing, constructing and operating the facility. The private entity owns the facility and provides a service to the public; i.e., receives and processes municipal solid waste or source-separated materials for a fee. Unlike the DBOOT approach, ownership is not transferred to the public entity at some agreed-to time.

5.2 Advantages and Disadvantages of Different Project Delivery Methods

Design-Bid-Build Method

The key advantages of using the DBB method include its acceptance by public officials, its wide use, and the opportunity for control it provides the public entity in directing design; i.e., making design decisions, approving the design, and establishing equipment and facility specifications. Public officials are familiar and experienced with its procedures, from procurement of the design engineer through project design, bidding and construction; have practices and documents in place to facilitate future use of this delivery method; are knowledgeable of the companies that provide the services needed; and are generally comfortable in its application. Also, many public entities feel strongly that their communities are better served by their having the ability to control design to the extent allowed by this delivery method.

Disadvantages of DBB include the potential for:

- Higher overall project cost due to the requirement to bid to a prescribed design (i.e., little latitude by contractors to select and implement alternative designs that may also do the job at less cost and/or improve facility performance)
- A longer project completion schedule, and the inefficiencies in communication and job completion with separate responsibility for design and construction
- Reduced work quality due to the requirements during bidding to accept the "low bid" for construction
- Increased cost risk since there is no guarantee by a single party of a fixed price for design and construction
- The potential for an increase in the number of change orders, claims, or disputes since there is no single party accepting the risk for both design and construction
- Longer project design and construction schedules since construction cannot commence until design is 100 percent complete and bidding completed
- Increased public exposure to risk associated with non-performance (i.e., there is no single point of guarantee for facility price, the schedule for completion and facility performance).

Again, this higher risk posture results primarily because there is no single point of company responsibility for design and construction, as there are separate contracts for design and construction between the public entity and the responsible companies. If something does not work properly with regard to price, schedule, or performance, the potential exists for the designer to point to the construction contractor for poor performance and for the construction contractor to point to poor design. Resulting disputes must be resolved by the public entity and ultimately may lead to the public entity paying to "fix" the problem, and dispute resolution procedures may cause schedule delays. The public entity will be responsible for long-term facility performance during operations, unless a private operating contract is awarded. In such a case, however, since it would not have participated in design or construction, the private operator may not be willing to accept operating performance risk to the extent desired by the public entity, or it may do so, but at a higher cost than might be possible with DBO or DBOOT.

It should be noted that both the advantages and disadvantages cited above have been noted by those that practice in this field. As a result, variations to DBB have developed. They include Construction Manager at Risk, in which the Construction Manager assumes responsibility for subcontractors during construction; and Design/Construction Manager at Risk in which the public entity retains a single party for design and to manage construction. Neither of these methods, however, reaches the level of private contractor responsibility inherent in DB, DBO, or DBOOT methods of project delivery discussed below.

Design-Build, Design-Build-Operate, and Design-Build-Own Operate-Transfer Methods

The key advantages of using the DB, DBO or DBOOT method include the following:

- They provide for integration of design and construction and, in the case of DBO and DBOOT, operation activities, which facilitates communication, efficiency of performance and reduces the potential for oversights
- They use a performance-based specification in procurement which allows consideration of alternative designs, which can result in lower project cost for equivalent performance
- They provide the ability to select a contractor based on criteria other than just low cost (for example the qualifications or risk sharing profiles offered by individual proposers), which reduces the potential for reduction in project quality
- They offer the potential for lower overall project cost due to flexibility in design, a shorter design and construction schedule and more efficient completion of work, resulting from one point of management for integrated services and more efficient communication
- They reduce the number of potential change orders, claims, and disputes since there is one party responsibility for design and construction
- They allow a shorter overall schedule for design, and a guaranteed price and schedule for design and construction, and for DBO and DBOOT, for operations
- They provide a guarantee for project performance

In addition to DB and DBO advantages, DBOOT also provides for private financing and ownership of the facility, and the shifting of the risks inherent in both to the private owner. DBOOT also provides for the sale of the facility to the public client at an agreed to date. DB, DBO, and DBOOT project delivery allow contracting with companies that have a substantial management, financial and technical resource base, both nationally and internationally. Such expertise can be helpful in research, planning, trouble-shooting, training, regulatory review and optimization, particularly for CT technologies only now being introduced commercially in the U.S.

In the case of DBO and DBOOT, private operations also allows for a long-term (typically up to 20 years, and in some cases longer) performance guarantee and substantial operations cost and performance risk is passed on to the private operator, including maintenance, repair and replacement, staffing, staff training, staff licensing and certification, labor negotiations, compliance with performance specifications, meeting environmental permit and safety requirements, and, with the general exception of unforeseen circumstances, such as acts of God or changes in law, price risk. Typically, in a private operations contract, the private operator is paid a fixed annual service fee (or fixed unit price, such as dollar per ton ($/ton)) with adjustment allowed for inflation. This feature of private operations provides the benefit of predictable future costs specified by contract, which assists community financial planning and budgeting. With DBOOT, the service fee is also typically subject to escalation by an inflation index.

Other benefits of DBO and DBOOT project delivery include less need for day-to-day public management of operations, allowing the public entity to focus its efforts on long-range planning and implementing those projects necessary for meeting public needs.

Financial benefits of DBO and DBOOT include the private entity's bearing of the cost and risk associated with some or all of the up-front project development activities, such as permitting.

DBOOT provides for private financing of the facility. Either DB or DBO project delivery may also provide the option for private financing (with initial private ownership) of the design and construction of the facility or improvements thereto, with permanent "take out" financing by the public client (and transfer of ownership to the public sector) upon completion *and acceptance* of the facility or improvements and, with DBO, private financing of capital improvements to the operating facility over time.

Disadvantages of DB, DBO and DBOOT include:

- Diminished control over approval of detailed design decisions since the project is based on performance-based procurement specifications (although design review can be conducted by the public entity with DB, DBO or DBOOT project delivery)
- If there is *not* public oversight, the potential for diminished quality in work during design and construction of the facility

For DBO and DBOOT, disadvantages also include:

- *Without* public oversight, the potential for inadequate maintenance and upkeep of facilities during operation
- Potential for a reduction in the level of service, if the operation's contractor is not adequately monitored
- Lack of flexibility in providing service with public employees when and where one wants to do so to meet a public need
- Potential for reduced competition for designing and constructing future capital improvements to the facility, as others may perceive that the operator has a competitive edge in bidding such work
- In some instances, resistance by the public and organized labor to private operations of public infrastructure. This resistance to private operations by the public and organized labor can lead to difficult decision making by elected officials.

Those practicing DB, DBO and DBOOT project delivery (both public entities and the private DB, DBO and DBOOT companies) have developed means to mitigate the disadvantages cited above. Those means include:

- Developing a strong, protective contract which includes provisions for liquidated damages for nonperformance and contract termination for provisions that include the right to termination for default, and can include the right to termination for convenience
- Provision of substantial financial security by the company to ensure compliance with contract standards
- Providing for rigorous public and independent engineering and financial oversight of contractor services to ensure that performance standards are met over the full term of the contract
- Conducting regular and unannounced facility inspections
- Insisting on regular reporting (monthly, quarterly and annually) and daily communication
- If there is a transition from public to private operation, providing offers of employment to public employees at wages and benefits equivalent to those they had while public employees.

Suitable contracts and procedures have been developed and are readily available for consideration and use by those public entities that select DB, DBO and DBOOT project delivery.

With DB there may be some companies that are unwilling to provide their license to use the technology to a public operator. That might also be the case with DBO and DBOOT, if the public entity is to become the public operator, after an initial term of private operation. Discussions with technology providers would be necessary to determine which providers would make use of their technology subject to private operation. In addition, with DB and DBO with public ownership, use of Federal funding assistance through the Department of Energy (DOE) is not possible.

Private Model Delivery Method

The key advantages of the private model are full-risk assumption by the private company for the project's success, including the technical, environmental, performance and cost risk of project development, financing (and assumption of debt payment responsibility), design and construction and operation, and all necessary activities to provide service, including operation and maintenance cost risk. The private model presents the least number of obstacles for rights for use of a particular technology, as the private company has licensing rights, which may only be available through private ownership. As noted earlier, the private model also offers the opportunity to seek Federal funding assistance through DOE.

The disadvantages include the loss of public ownership and control of key municipal infrastructure, and likely higher costs for service. Generally, the cost of capital for private financing, including the cost of equity participation, is higher than what could be expected under public financing and ownership (which then would increase overall project costs). Moreover, other options (such as DBO and DBOOT) can offer a similar level of design, construction, schedule, performance and cost risk protection to the public sector. A major difference is that with the private model, the public entity is not obligated to make debt service payments, but must agree to a service contract for purchase of services.

5.3 Project Delivery for Conversion Technology

Based on the advantages and disadvantages of the project delivery methods presented and the current status of CT technology development in the U.S., at this time, public entities engaged in development of such projects are generally following either the Private Model or the DBOOT project delivery method for financing, design, construction and operation of a CT facility. These provide for development of a CT, placing financing, design, build and operational responsibility on the private company as well as the responsibilities of ownership. If desired, DBOOT provides a means for public purchase of the conversion technology facility. These are the least risky approaches for the public entity. They provide the protection of guaranteed long-term operating performance at the least technical, environmental and financial risk to the public entity. It also reflects the fact that the public entity does not currently operate CT technology or facilities. To hire on and train staff to operate and maintain a complex waste management facility, such as a CT facility, may not be an easy undertaking, nor do most public entities consider it advantageous, at least initially, to accept the risk of facility performance during operations under these circumstances.

In addition, the licenses for many CT technologies are held by private companies and use of such technology may only be available through private or DBOOT delivery. Lastly, certain funding opportunities such as under the DOE are available only to privately owned projects.

A public ownership option is also worth considering. Should the public entity want to consider a public ownership option, with public financing, as a means to reduce project financing costs, it is recommended that a DBO project delivery approach be considered. Although the public entity will assume debt payment risk with public ownership, a DBO project delivery will provide the benefits of the Private Model or DBOOT model with respect to private assumption of design, construction and operational responsibility and risk.

6. Role of CRRA at Mid-CT Project for MSW Processing, for Organics Processing, and as a Resource Center for New and Emerging Technology

CRRA has traditionally played a role statewide for development of solid waste management infrastructure to serve the MSW needs of the State. Activities have included studying the feasibility of new facilities, implementing facilities as needed, including conducting siting studies, obtaining waste commitments from participating communities sufficient to support facility development, negotiating off-take agreements, permitting facilities, financing facilities, procuring the design, construction and operation of facilities, and overseeing the design, construction and operation of said facilities. CRRA has acted both as the owner of facilities and it has acted to consolidate community participation in obtaining waste services from privately owned facilities. In this capacity, CRRA has also served to educate the public about recycling, composting, WTE, and the overall management of municipal solid waste. In addition, CRRA has worked in concert with state legislators and the DEEP to develop MSW solid waste plans and legislation, policy and permitting requirements for MSW facilities.

For development of new and emerging technologies, CRRA can play a continuing role as it has traditionally played in implementation of solid waste management infrastructure. Such an organization is vital to facilitate development of new and emerging technology, as it has the experienced resources, capabilities and legislated powers, such as bonding capability for project financing, and abilities to site facilities and aggregate and pledge municipal solid waste from participating customers. Such abilities are critical for attracting private company participation in designing, constructing and operating facilities and, if desired, to privately finance these facilities. Public-private partnerships of this nature have been the cornerstone of successful municipal solid waste management in Connecticut. This is the case for a thermal conversion, mixed MSW replacement facility at the South Meadows Facility as well as development of a source-separated organics processing facility.

Further, CRRA can play an important role in educating the public, elected officials and the DEEP about the advantages and disadvantages of new and emerging technology, and serve as a central resource center for dissemination of related information. This can assist other public jurisdictions who are evaluating the potential for new and emerging technology and need assistance in feasibility studies, planning, procurement and implementation of such facilities. It can further assist the legislature and the DEEP in its initiatives to evaluate the most beneficial means to manage municipal solid waste, and help put in place desired legislative initiatives and permitting regulations.

7. Beneficial Legislative and Regulatory Initiatives

As discussed in Section 3.2 and elsewhere, there are several challenges to successfully developing new and emerging technology in Connecticut. The following suggestions are offered to encourage and facilitate project development:

- Continue CRRA's role in its current capacity for infrastructure development and public education for MSW management so that it may be applied to new and emerging technology. Consider CRRA as a platform for piloting, demonstrating, testing, and implementing new and emerging technologies.
- Recognize the ability of new and emerging technology to recover materials from the thermal process, gas and wastewater cleanup processes and count such recovery towards meeting the Connecticut's goals for recycling.
- Adopt a state renewable fuels standard that encourages increased use of renewable fuels from new and emerging technology. This will result in higher market prices for renewable fuels, helping to offset the cost of waste disposal for communities. In addition to national legislation, California, for example, has adopted its own renewable fuel standards.
- Encourage use of "green chemicals" as can be produced from the synthesis gas of new and emerging technologies to enhance marketability of those products.
- Adopt legislation that promotes aggressive use of recycled materials, renewable fuels and green chemicals in procurement practices for state agencies.
- Promote criteria that encourage selection of new and emerging technologies for state grants and low-interest loan programs. Consider State financing for a facility(ies).
- Consider modifying, clarifying existing State legislation and DEEP permitting practice that prevents AD/ composting of mixed MSW feedstock. New separation technology has permitted modern materials recycling facilities to effectively separate recyclables and organics from mixed MSW. Increased competition among technologies will foster lower costs that will benefit the public. Also, separate collection of source-separated organics will add to the cost of collection, particularly in residential applications.
- Clarify and include new and emerging technology as an integral part of the State's solid waste management hierarchy at a level below recycling/composting but higher than traditional waste to energy to reduce dependency on landfilling, and to recognize the technology as being a needed part of efforts to maximize recycling, materials recovery and production of renewable energy.

8. References

Information provided in this review of conversion technology has been prepared utilizing recent public conversion technology reports and documents as well as information obtained by the authors of this Report through participation in related professional organizations and conferences and communications with companies experienced with conversion technology. The following reports and sources are acknowledged:

- CRRA
- New York City
- Taunton, Massachusetts
- Los Angeles County
- the City and County of Santa Barbara, California
- Palo Alto, California
- Cal Recycle
- the California Air Resources Board

Also, the following thermal conversion companies are acknowledged:

- Alter NRG
- AEB Amsterdam
- Enerkem
- Green Conversion Systems
- Herhof GmbH
- INEOS
- Interstate Waste Technology
- NRG
- Plasco Energy
- Sierra Biofuels
- Taylor Biomass Energy

Further, the following AD companies that participated in the CRRA 2012 market survey are recognized:

- Arrow Ecology and Engineering Overseas
- CCI Bioenergy
- Harvest Power, L.P.
- Ciminelli/BDI-Bioenergy
- International AG/Greenpoint Energy Partners LLC
- RosRoca Envirotec
- Sustainable Generation
- Clean World Partners
- Mustang Renewable Power Ventures/Bekon
- Organic Diversion/Bioferm
- Organic Waste Systems/Dranco
- Orgaworld Canada, Ltd.
- WeCare Organics
- Zero Waste Energy/Kompoferm

APPENDICES

APPENDIX A: ILLUSTRATIONS OF GASIFICATION FACILITIES FOR MIXED MSW PROCESSING

IWT Thermoselect Gasification – Chiba, Japan
330 TPD
Operating since 1999

Waste in Pit, JFE/Thermoselect GasificationFacility, Kurashiki, Japan, 610 TPD Mixed MSW, Commercial Operation since 2005

Westinghouse Plasma Gasification System, Utashinai, Japan
300TPD Mixed MSW (or 165TPD Auto Shredder Residue), Electricity
Commercial Operation in 2003

Fulcrum Bioenergy Sierra Biofuels Plant
near Reno, Nevada
200-300 TPD MSW Gasification to Ethanol Plant
Operation anticipated end of 2013

Enerkem Pontotoc, Mississippi
300 TPD MSW Gasification to Ethanol Project
(Expandable to 600TPD)
10 Million Gallons Ethanol/Year
Construction Start 2013; Operation 2014/2015

Plasco Trail Road Plasma Gasification to Electricity Facility, Ottawa, Canada
150 TPD MSW, Demonstration Facility Operating since 2007, Recently Permitted/Upgraded for Commercial Use in 2011/2012, 4MW Electric Generating Capacity

INEOS BIO INDIAN RIVER, FLORIDA, GASIFICATION TO ETHANOL FACILITY
OPERATING SINCE FALL OF 2012 ON GREEN WASTE, ETHANOL PRODUCTION 1ST QTR 2013
PREPROCESSED MSW TESTING IN FIRST HALF OF 2014
(300 TPD DRY FEEDSTOCK, 8 MILLION GAL/YR ETHANOL, 6MW GROSS POWER)

ENERKEM EDMONTON, ALBERTA, MSW GASIFICATION TO ETHANOL FACILITY UNDER CONSTRUCTION (PICTURE TAKEN MAY 2013), OPERATIONS EXPECTED IN 2013 (METHANOL)/2014(ETHANOL)
(110,000 TPY PREPROCESSED MSW, 10 MILLION GAL/YR OF ETHANOL)

APPENDIX B: ILLUSTRATIONS OF DRY ANAEROBIC DIGESTION FACILITIES FOR SOURCE SEPARATED FOOD AND YARD WASTE AND MIXED MSW

(EXCERPTED FROM FINAL FEASIBILITY STUDY REPORT FOR ENERGY/COMPOST FACILITY, PALO ALTO, CA, FEBRUARY 2012)

APPENDIX B

Description of Companies, Technologies Responding to RFI

For

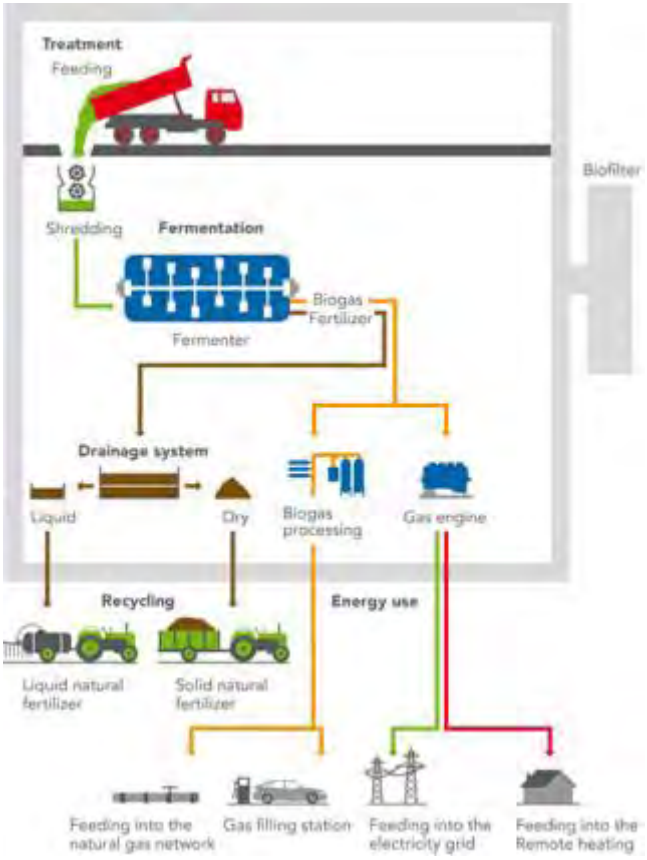
Dry Anaerobic Digestion Technology

For

Source Separated Food Scraps and Green Waste Materials

With Potential for Biosolids Treatment

Company (Technology)	**ST Engineering Group (Axpo-Kompogas)**
Source Material	Food Scraps, Yard Trimmings, Biosolids
Type of Anaerobic Digestion	Dry, thermophilic, single stage
Location and Size of Selected Reference Facilities	Zwolle, Netherlands (45,000 TPY; operating since 2010)
Number of Plants in Commercial Operation (40+ globally)	Kompogas provided a list of 40 reference facilities. Most of the reference facilities are in Europe. Kompogas licenses the technology; it does not own the facilities.
Preprocessing Requirements	Preprocessing typically includes shredding, removal of ferrous metals, screening and the separation of components that can be used for energy generation.
Technology Description	The Kompogas technology is a dry, thermophilic single stage anaerobic digestion process. The collected organic waste is deposited in a deep bunker. Each type of waste is registered as it is received. The material is thoroughly mixed by an overhead crane. The mixed material is then shredded to a uniform size of 50 mm (2-in.). Pre-processed, shredded waste is transferred from an intermediate storage area to a feeder, where a homogeneous pumpable mixture is produced. The material passes through a heat exchanger to raise the temperature of the prepared feedstock and into the fermenter. Incoming material is mixed with fermented product in order to inoculate the incoming material and accelerate the fermentation process. The material moves through the fermenter horizontally in a plug flow fashion. A heating system maintains the temperature within the fermenter, and the material is mixed by a slowly moving longitudinal agitator to ensure optimum mixing and degassing of the fermenter contents. The retention time in the fermenter is about 14 days. Biogas and digested material are extracted from the fermenter for additional treatment and storage. The biogas is cleaned, dried and compressed and used to generate electricity. The digestate is dewatered using a screw press and aerobically composted. The liquid fraction of the digestate which is extracted from the screw press can be utilized as a liquid fertilizer. The plant is enclosed to minimize odor emissions; the plant is also equipped with biofilters to treat the air emissions from the plant.
Products	Electricity and digestate. The biogas is proposed to be used to generate electricity. The digestate is dewatered after being extracted from the fermenter. The digestate is further processed to produce a cured compost product. The dewatering liquid which is separated from the digestate is processed and used as a liquid fertilizer.

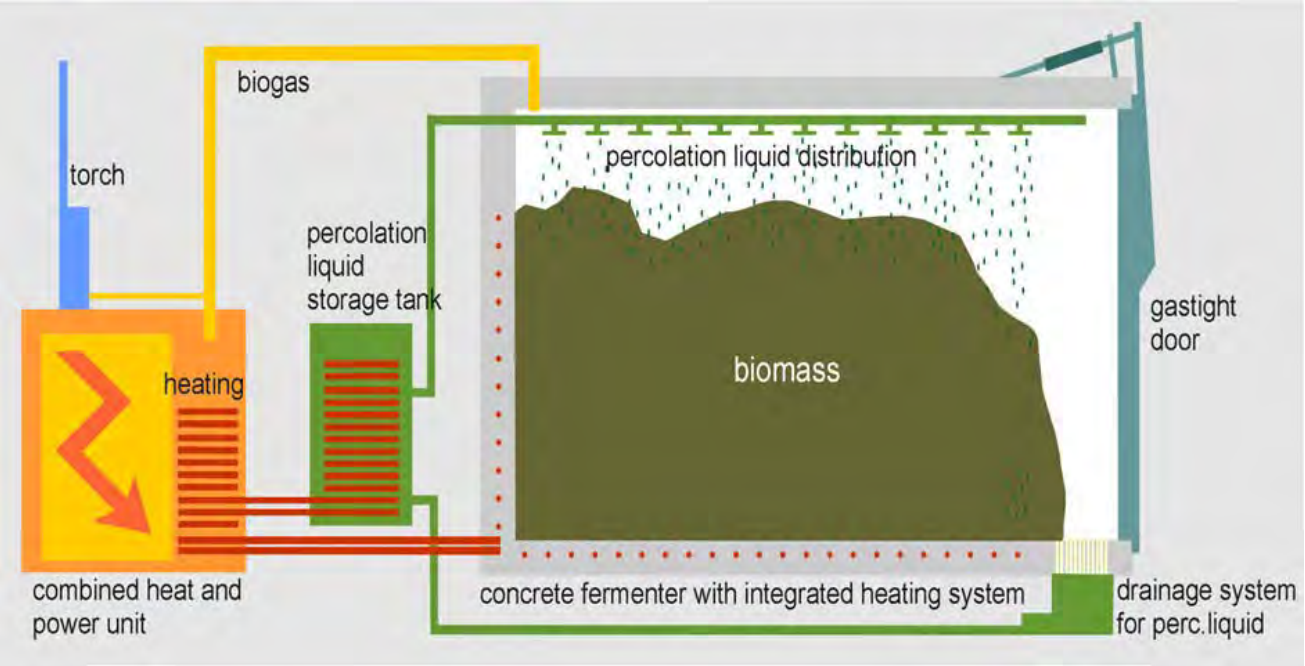


Kompogas Process Diagram

Kompogas Facility
Zwolle, Netherlands
45,000 TPY Biowaste; Natural Gas Use, 2010

Kompogas Facility
Zwolle, Netherlands (?)
45,000 TPY Biowaste; Natural Gas Use, 2010

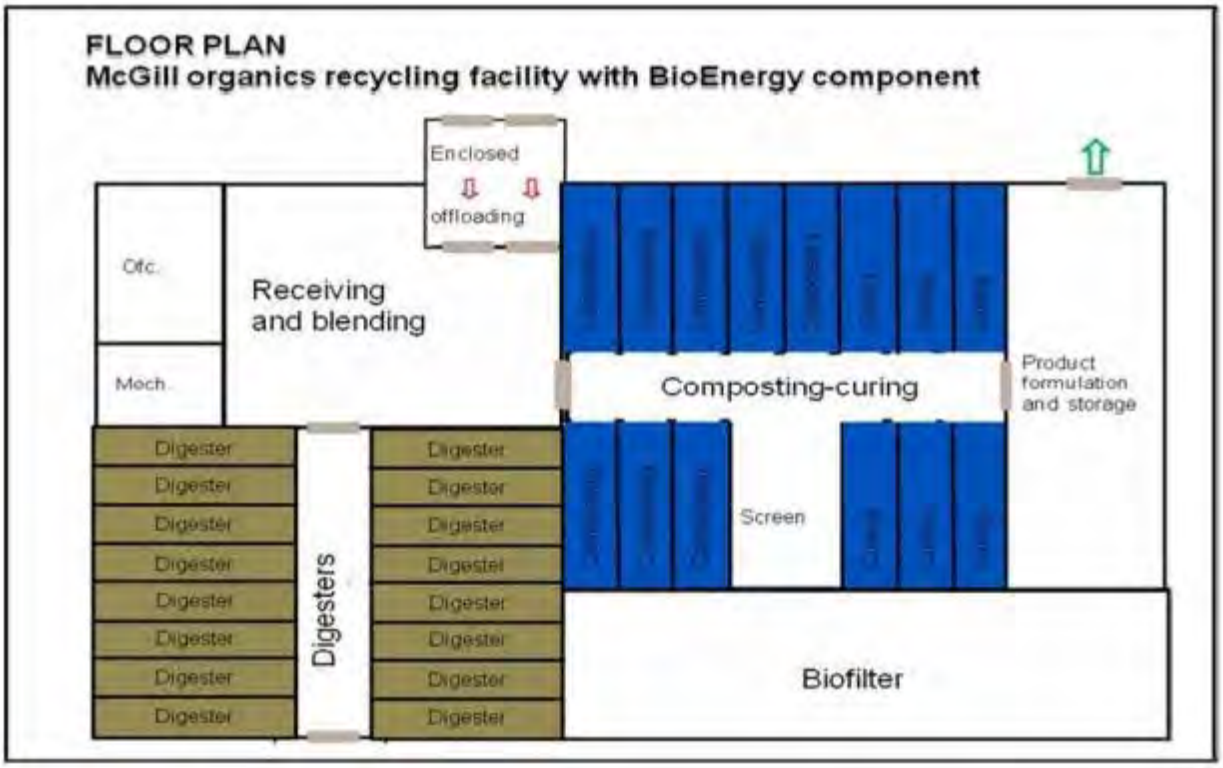
Company (Technology)	**Mustang Renewable Power Ventures (BEKON dry fermentation process)**
Source Material	Food Scraps and Yard Trimmings
Type of Anaerobic Digestion	Dry, single stage, mesophilic batch fermentation process
Location and Size of Selected Reference Facilities	Hille, Germany (44,000 TPY; treating Biowaste; operating since 2009)
Number of Plants in Commercial Operation	The BEKON RFI response lists 15 reference plants in Europe; most of them are in Germany.
Preprocessing Requirements	No preprocessing of the food scraps, yard trimmings or biosolids is needed for the process.
Technology Description	The BEKON technology is a batch process. Incoming material is loaded by a front end loader into the digester (fermenter). It is inoculated with percolate. The fermenter is a gas tight concrete tank with a hydraulically operated gastight door. During the fermentation process, percolation liquid is collected from the bottom of the fermenter, stored in a storage tank, and continually sprinkled over the fermenting material. This ensures a continual inoculation of the material with anaerobic microorganisms. The percolation liquid storage tank is heated using heat exchangers. Additionally, the floor of the fermenter is heated using heat exchangers. These two heating sources maintain the temperature of the fermenter in the desired range. The fermenting material is not mixed or stirred during the fermentation period. On average, the material remains in the digester for 28 days. When the batch process is complete, the digester is opened and the digested material is removed.
Products	Biogas or electricity and compost. The biogas is dried and cleaned and combusted in a combined heat and power generator. Some of the excess heat from the generator is used to heat the digester through heat exchangers. Another option that was provided in the RFI response is to clean the gas and use it for natural gas powered vehicles, or pressurize it and transmit it to the gas utility. At the completion of the batch process, the digesters are emptied and the digested material can either be further composted or spread directly on fields.



BEKON Process Diagram

BEKON Facility
Hille, Germany
44,000 TPY Biowaste; 1,000 kW Electricity
2009

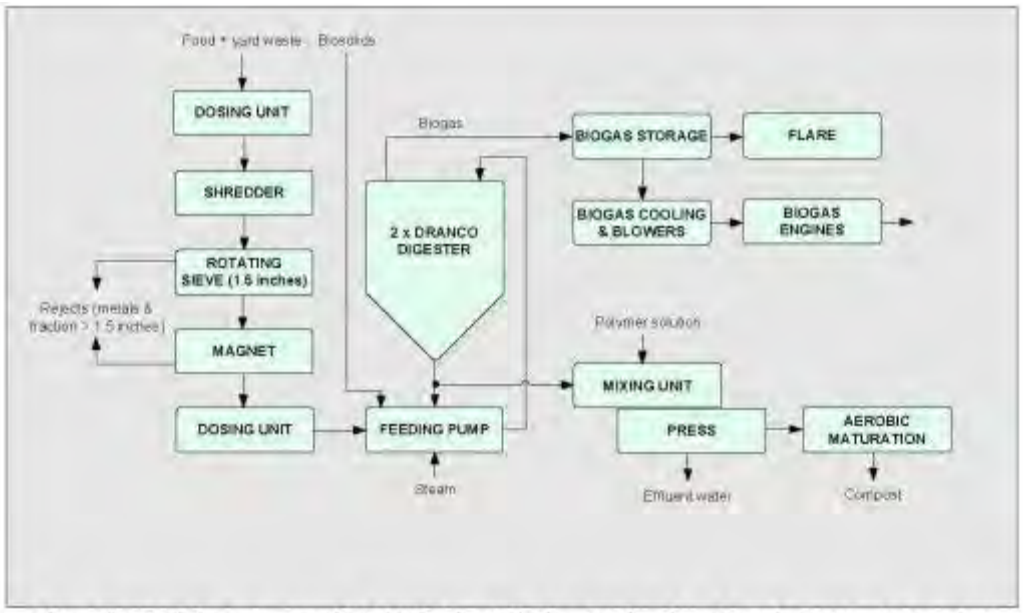
Company (Technology)	**McGill Compost (BioFerm Energy Systems)**
Source Material	Food Scraps, Yard Trimmings, Biosolids
Type of Anaerobic Digestion	Dry, mesophilic, single stage
Location and Size of Selected Reference Facilities	Moosdorf, Germany (35 tpd; treating SSOW; operating since 2009) Oshkosh, Wisconsin (under construction, anticipated start-up in 2011)
Number of Plants in Commercial Operation (28)	The response to the RFI states that there are 28 BioFerm reference plants worldwide; these plants are located in Germany, Czech Republic, Hungary, Italy, Chile, Japan, Kenya, and South Africa. The first BioFerm plant in North America is currently under construction in Oshkosh, Wisconsin.
Preprocessing Requirements	Prior to being placed in the fermenter, the incoming waste is inoculated with digested material.
Technology Description	Organic materials are off-loaded indoors and blended to prescribed ratios. Materials with high energy content are routed to anaerobic digestion. Materials with lower energy content are routed to composting. All mixing of materials is conducted within a building, with ventilation air directed through biofilters to eliminate odors. The BioFerm process is conducted in modular chambers. Each module is filled with organic waste and fermented in a batch mode. Incoming material is inoculated with digested material and placed into the fermenter module, and the fermenter is sealed shut. The fermenter is a gas tight, water tight concrete tank. During the fermentation process, percolation liquid and additional leachate liquid is collected from the bottom of the fermenter, stored in a storage tank, and periodically sprinkled over the fermenting material. This ensures inoculation of the material with anaerobic microorganisms. The percolation liquid storage tank is heated using heat exchangers. Additionally, the floor of the fermenter is heated using heat exchangers. These two heating sources maintain the temperature of the fermenter in the desired mesophilic range. The fermenting material is not mixed or stirred during the fermentation period. The fermenting material is held in the fermentation chamber for a 28-day retention time. The modular nature of the facility results in a consistent production of methane. When the batch process is complete, the fermenter module is opened and the digested material is removed.
Products	Biogas, electricity and compost. The biogas is collected from each fermenter module, mixed, and stored in a gas storage bag. The gas is cooled, dried, and cleaned and burned in a CHP unit or a boiler unit. Alternatively, the biogas may be compressed and used as pipeline quality gas or as vehicle fuel. At the completion of the batch AD process, the digested material is further composted using static pile, forced aeration composting. The exhaust air is treated in a biofilter. The composted material may be sold as compost or used as an ingredient in other soil amendment products.



BioFerm Process Diagram

BioFerm Plant
Moosdorf, Germany
13,000 TPY Municipal Organic Waste; Electricity

Company (Technology)	**Organic Waste Systems (DRANCO)**
Source Material	Food Scraps, Yard Trimmings, Biosolids
Type of Anaerobic Digestion	Dry, themophilic, single stage
Location and Size of Selected Reference Facilities	Vitoria, Spain (330 tpd; treating mixed MSW; operating since 2006) Brecht, Belgium (55 tpd; treating SSOW; operating since 1992) Brecht, Belgium II (151 tpd; treating SSOW; operating since 2000)
Number of Plants in Commercial Operation (17)	Approximately 17 commercial plants, primarily operating on biowaste.
Preprocessing Requirements	Preprocessing typically includes screening and other sorting techniques to remove non-biodegradable components, (e.g., plastic, textiles, metals, glass, stones, etc.) which can be recycled as applicable, followed by shredding to reduce the feedstock to < 40 mm.
Technology Description	The DRANCO technology is a dry, single stage anaerobic digestion technology. Incoming waste is unloaded into the reception hall. The reception hall doors are closed at all times, except when trucks and shovel loaders are entering or leaving the hall. The material is either loaded into the shredder or is sent directly to the dosing unit. In the dosing unit, the pre-processed, shredded waste is mixed with digested material and a small amount of steam (to raise the temperature) and fed into the top of the digester. The material moves through the digester in a plug flow manner, from top to bottom, over a period of several days. The material moves by gravity only, with no mixing. Digested material is removed from the bottom of the digester. A small fraction of the material is diverted for post-processing. Most of the material (85%-90%) is mixed with incoming waste and fed back into the digester, resulting in an average retention time of 20 days. Biogas rises to the top of the digester where it is extracted for storage and treatment. The digestate leaving the digester is dewatered using a screw press and aerobically composted.
Products	Biogas or electricity and digestate. The biogas may be used to generate electricity or cleaned and sold as fuel. The digestate must be aerobically processed to produce a cured compost product.



Flow sheet of the proposed DRANCO installation for food and yard waste – Scenario 2

Proposed DRANCO Process Diagram

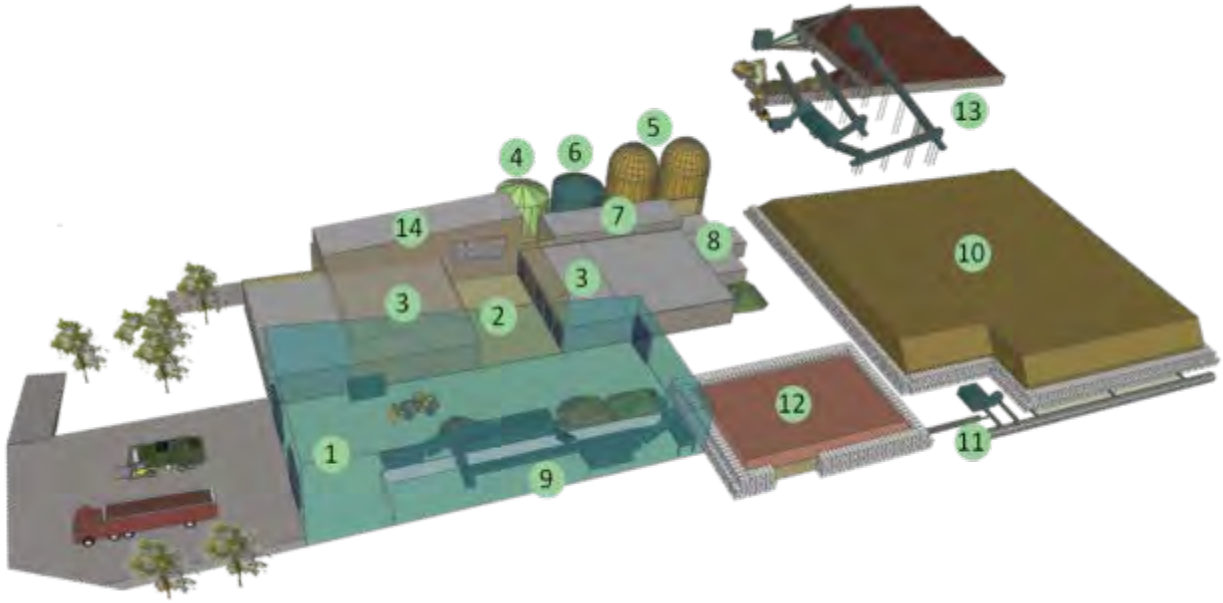
Seoul, South Korea DRANCO Facility (30,000 TPY)

DRANCO Facility
Terrassa, Spain
25,000 TPY Biowaste; Electricity
December 2006

DRANCO Facility
Vitoria, Spain
330 TPD Mixed MSW
2006

DRANCO Facility
Brecht, Belgium
20,000 TPY Biowaste (Brecht I)
50,000 TPY Biowaste (Brecht II)
Electricity
July 1992 (Brecht I)
January 2000 (Brecht II)

Company (Technology)	**GICON Bioenergie GmbH**
Source Material	Food Scraps, Yard Trimmings, Biosolids (5,000 TPY)
Type of Anaerobic Digestion	Dry, mesophilic, two-phase
Location and Size of Selected Reference Facilities	Lisbon, Portugal (150 tpd; treating SSOW; operating since 2004) Richmond, BC, Canada (450 tpd; treating food waste and yard waste; construction is in progress, expected completion in 2012)
Number of Plants in Commercial Operation (30)	The response to the RFI states that there are 30 GICON reference plants located in Europe. Six of these plants process municipally derived organic waste.
Preprocessing Requirements	Preprocessing includes manual removal of non-biodegradable materials from the incoming waste.
Technology Description	The material is placed in the receiving hall and non-biodegradable contaminants are removed. The food waste and yard waste are mixed in the appropriate proportions by weight, depending on the moisture content of the food waste. The mixed material is loaded into the concrete hydrolysis percolators using a front end loader. The doors to the percolators are sealed tight. Some of the liquid that percolates through the waste is collected and stored in a heated tank, and sprinkled onto the waste during the anaerobic digestion process. The anaerobic digestion process in the hydrolysis percolator is a batch process. The retention time in the hydrolysis percolator is two weeks. Some of the liquid that percolates through the waste is directed to the methane digester, where the liquid is treated anaerobically and methane is generated. The methane digester is a completely mixed stirred tank reactor. The digested material is aerobically composted.
Products	Biogas or electricity and compost. The biogas may be used to generate electricity or cleaned and sold as fuel. The digested material is further composted in an unturned Covered Aerated Static Pile (uCASP) system, which results in a finished compost product.



1. Organic Waste Receiving Hall
2. Hydrolysis Percolator Loading Hall
3. Hydrolysis Percolators
4. Hydrolysate Buffer Tank
5. Methane Digesters
6. Digester Effluent Buffer Tank
7. HSAD Mechanical Room
8. Combined Heat and Power Units
9. uCASP Feedstock Mixing
10. Covered Aerated Static Pile (uCASP)
11. Ventilation System
12. HSAD and uCASP Biofilter
13. Screening, Curing, Finished Product

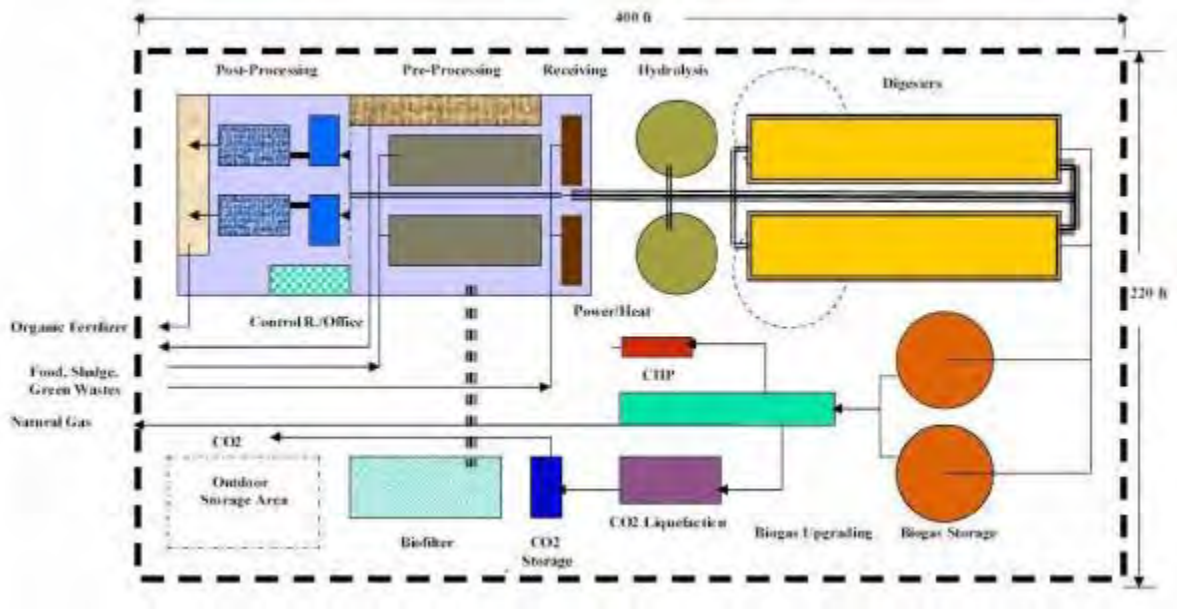
Harvest Power (GICON)
Palo Alto Facility Concept

GICON Facility
VALORSUL Facility, Lisbon, Portugal; 2004

Company (Technology)	**STRABAG (formerly Linde KCA)**
Source Material	Food Scraps, Yard Trimmings, Biosolids
Type of Anaerobic Digestion	Dry, thermophilic, single stage
Location and Size of Selected Reference Facilities	Lemgo, Germany (50,000 TPY, operating since 2000)
Number of Plants in Commercial Operation (4)	The response to the RFI lists 13 STRABAG plants in operation, and four (4) plants which are suitable as reference plants, treating waste similar to that proposed by Palo Alto.
Preprocessing Requirements	Preprocessing may include mechanical pre-treatment, milling, screening, separation of ferrous metals, separation of non-ferrous metals and hand-picking of recyclables.
Technology Description	The STRABAG technology is a dry, thermophilic single stage anaerobic digestion process. The STRABAG technology is designed to operate at concentrations of 15%-45% solids. Incoming food scraps are fed through trommel drums to remove inorganic contaminants, if any. The cleaned material is then placed on the floor of the waste receiving area and mixed with yard trimmings, biosolids, and digestate dewatering liquid. This mixture is macerated to ½ -inch size and pumped to aerated hydrolysis vessels with a retention time of 2 to 3 days. After this period, the hydrolyzed material is then pumped into the digesters. The material moves through the digester horizontally in a plug flow fashion. The material is mixed using a series of transverse, in-line agitators, which prevent the formation of floating scum and settlement of material. The retention time in the anaerobic digesters is typically 21 days. A conveyor frame is fixed to the bottom of the digester to transfer the sediments to the digester discharge. Biogas and digested material are extracted from the fermenter for additional treatment and storage. The digested material is dewatered by high speed centrifuges. The wastewater is conveyed to the receiving area to be mixed with the incoming material. The dewatered digestate is pelletized and aerobically finished for use as a compost product.
Products	Biogas, electricity and digestate. The biogas may be used to generate electricity or cleaned and sold as fuel. The digestate is dewatered after being extracted from the digester. The digestate is aerobically processed to produce a cured compost product.

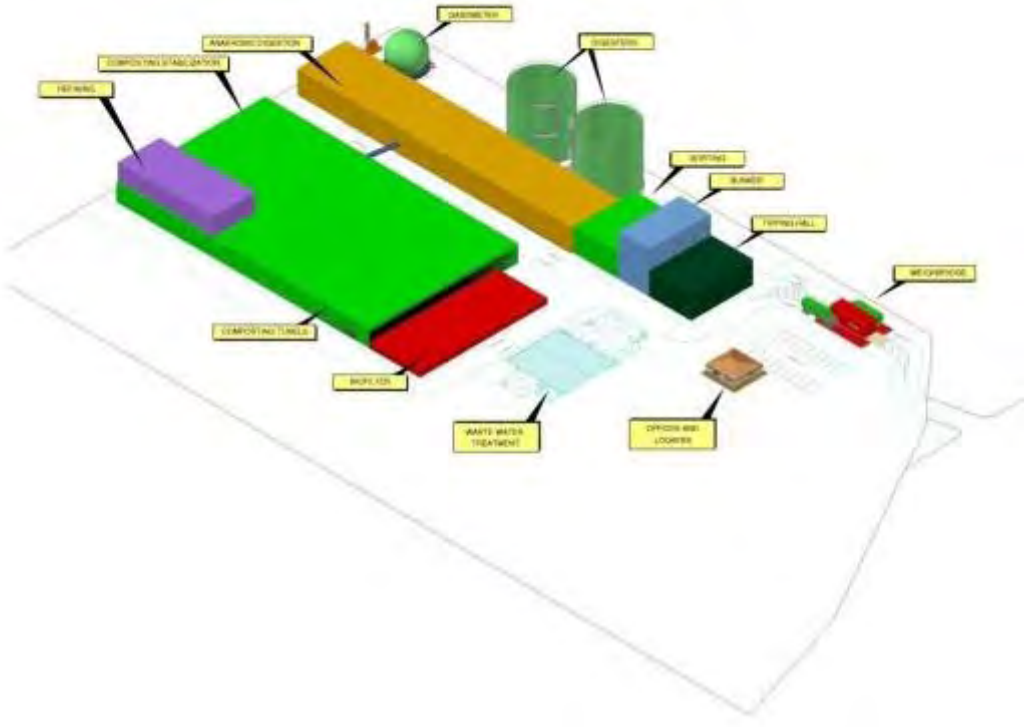
STRABAG Facility
Lemgo, Germany
50,000 TPY Screened Organics from MSW, Yard Waste and Biosolids; 2000

STRABAG Facility
Valladolid, Spain
600 TPD Mixed MSW, 2002



STRABAG Anaerobic Digestion
Proposed Layout for Palo Alto Facility

Company (Technology)	**Valorga International, a subsidiary of URBASER (Valorga)**
Source Material	Food Scraps, Yard Trimmings, Biosolids
Type of Anaerobic Digestion	Dry, mesophilic, single stage
Location and Size of Selected Reference Facilities	Zaragoza, Spain (450,000 TPY; treating mixed MSW operating since 2008) Las Dejedas, Spain (500,000 TPY, treating mixed MSW; operating since 2009) La Paloma, Spain (255,500 TPY, treating mixed MSW; operating since 2002)
Number of Plants in Commercial Operation	The RFI response lists four reference plants in Europe.
Preprocessing Requirements	Preprocessing typically includes separation of recyclable materials, size reduction and screening to result in a suitable biodegradable organic fraction.
Technology Description	The Valorga RFI response states that yard trimmings will not be anaerobically digested. They will be used as structural material in the aerobic composting process. The incoming food scraps will be shredded, mixed with biosolids, diluted, heated, and inoculated before being introduced into the digester. The weight and moisture content of the incoming material is measured, and, if necessary, dilution water (recycled from the process) is added to the material to achieve the desired solids content of 31% to 33%. The material is then heated by steam injection, and mixed with a small amount of digested material to inoculate it with anaerobic microorganisms. The prepared material is pumped into the digester. The digester is a vertical concrete tank with a concrete inner wall extending vertically across two-thirds of the digester diameter. Prepared material is pumped into the digester on one side of the inner wall, and digested material is extracted from the other side of the inner wall. This feature prevents short circuiting and ensures sufficient residence time in the digester. During digestion, pressurized recirculated biogas is injected into the floor of the digester, mixing the digesting material. This pneumatic mixing is used in lieu of mechanical mixing. The material moves into the digester, around the inner wall, and out of the digester in a plug flow fashion. The residence time in the digester is about 25 days. Biogas and digested material are extracted from the fermenter for additional treatment and storage.
Products	Biogas or electricity and digestate. The biogas may be used to generate electricity or cleaned and sold as fuel. The digestate is dewatered by a sieve and by centrifuges. The dewatered digestate is combined with the yard trimmings as structuring material and is further aerobically processed to produce a cured compost product. The dewatering liquid which is separated from the digestate is recycled back to the digesters.



Valorga Process Diagram
Palo Alto Concept

Zaragoza, Spain Valorga Facility (450,000 TPY)
Anaerobic Digestion of Organic Fraction of Mixed MSW

Barcelona, Spain Valorga Facility (244,000 M-T / yr)
Ecoparc II
Mixed MSW
Electricity
2004

CR&R AD Project

Approximately 50,000 tpy AD plant, source separated food and green waste, located in Perris, California. Fully permitted at 3,000 tpy MRF/Transfer facility on a 52-acre site. Construction start, Summer 2013, Operations anticipated in late 2014

CR&R CNG Fleet and Fueling Station