

## Technology Description and Performance History for the Pittsfield Resource Recovery Facility

### Introduction

Located in the heart of the beautiful Berkshires (Pittsfield, MA), the Pittsfield Resource Recovery Facility (Facility), a modular resource recovery (WTE) facility, began operations in 1981.

In January 1994, Energy Answers led an investor consortium to acquire the Facility. As part of its original contract with the City of Pittsfield, Energy Answers also assumed the management and closure of the City ash landfill, and operation of the community drop-off facility, which accepted a wide range of materials that were recycled, composted or reused. In 2005, to assist the City with its recycling efforts, Energy Answers constructed a Recycling Center which facilitated a more economical transportation system to a state-owned Material Recovery Facility in Springfield, MA.



Since 1994 and until October 2007, Energy Answers was responsible for all aspects of the Facility's operation and management. In October 2007, Energy Answers sold the Facility, along with other operating assets, to Covanta Energy Corporation in order to focus upon the pursuit of development opportunities worldwide. Nevertheless, Energy Answers still maintains numerous Resource Recovery patents, such as the Pioneer Plus™ next generation technology improvements, many of which were developed at and incorporated into the Facility.

*[The following description of the Facility, as well as its technology and operation, only pertains to the term of Energy Answers' ownership and operation thereof. Energy Answers cannot verify, and makes no claim as to, current conditions or operations at the Facility.]*

### Community Acceptance

Energy Answers believes that resource recovery facilities can work with communities to promote and implement a truly integrated waste management system. Under Energy Answers' term of ownership and operation, the Facility was instrumental in creating and encouraging recycling programs for automotive and household batteries, fluorescent light bulbs, button batteries, mercury-bearing wastes and other recyclable materials. It also served as a center for community recycling efforts, accepting various recyclable materials for bulk shipping to area recyclers.

The Facility also implemented a comprehensive Material Separation Plan, which included four programs:

- Public education;
- Reduction of mercury-bearing wastes;
- Reduction of household hazardous wastes; and
- Reduction of common lead and cadmium bearing waste.

Public education plays a very important role in successfully managing municipal solid waste (MSW). The Facility provided tours and presentations to many different groups such as elementary and college students, scout troops, City officials, etc. The goal of the education program was to help residents of all ages and backgrounds better understand their role, and resource recovery's role, in integrated waste management.

### **Facility Specifications**

The Facility commenced commercial operations in February 1981, making it one of the first modern resource recovery facilities to operate in the United States. The Facility was the first to utilize the Enercon combustion technology, and implemented many modifications and upgrades over the years. Although the Facility is over 27 years old, waste throughput and steam generation records remained very high, verifying the sound design of the Facility, and providing a solid and reliable foundation to build upon in the future.

The Facility operated 24 hours per day, 7 days per week, 365 days a year, with the exception of a cold iron outage scheduled on average every two years. The combustors were separately taken off line annually for planned maintenance. The heat recovery trains were separately taken off line quarterly for cleaning and planned maintenance. While under Energy Answers' management, the Facility's annual availability was greater than 90%. A staff of thirty two (32) full-time and two (2) part-time employees operate the Facility.

The Facility's performance has been stellar in the areas of throughput, environmental, and health and safety standards. See *Table 1* for Historical Operating Results during the time that Energy Answers owned and operated the Facility.

*Table 1*

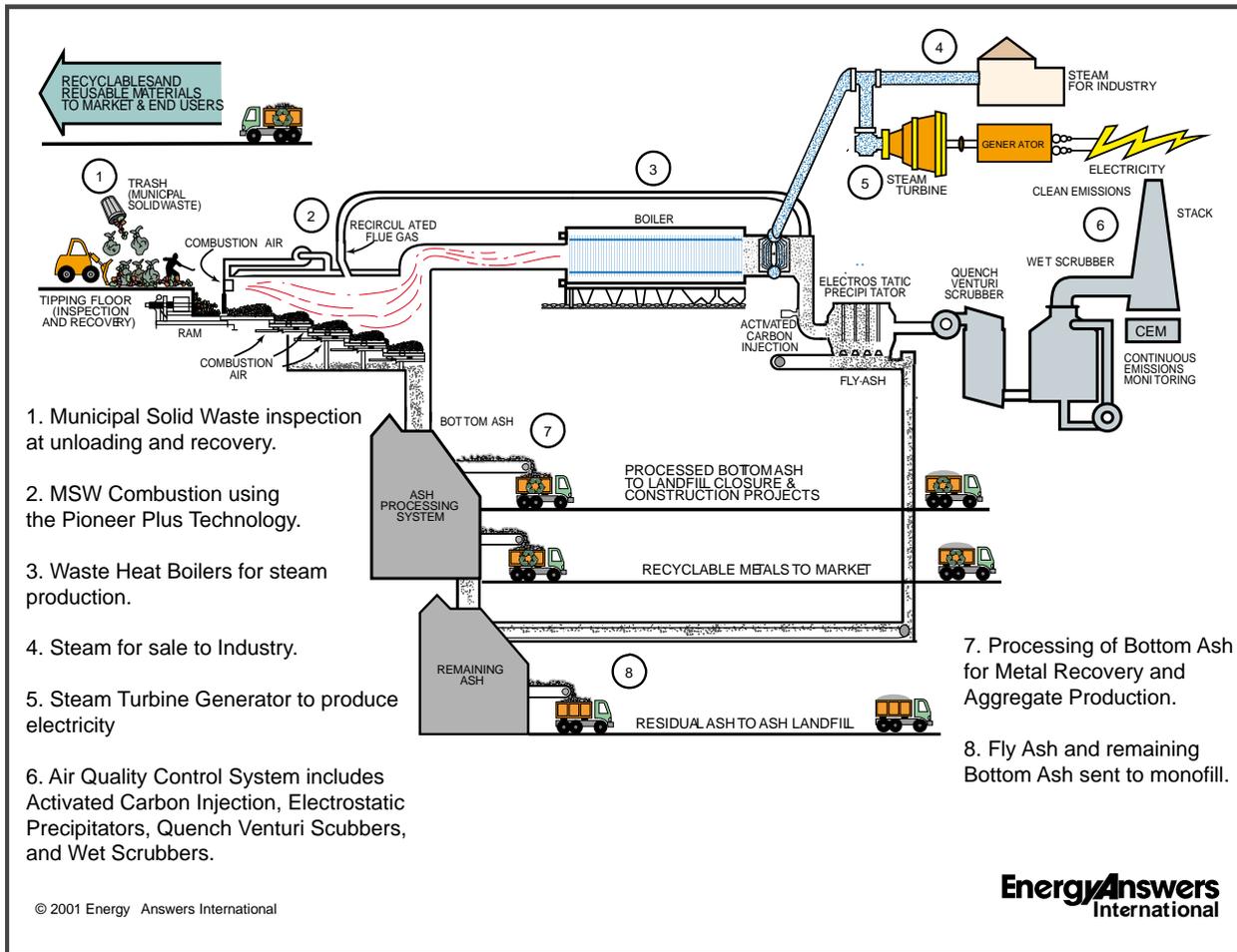
<b>PITTSFIELD RESOURCE RECOVERY FACILITY OPERATING PERFORMANCE 1994 - 2007</b>			
<b>Year</b>	<b>Waste Combusted tons/yr</b>	<b>Steam Made/Avail mm lb/yr</b>	<b>Steam Sold mm lb/yr</b>
<b>1994</b>	73,635	389	276
<b>1995</b>	72,977	410	281
<b>1996</b>	71,260	384	263
<b>1997</b>	78,372	429	272
<b>1998</b>	70,260	384	315
<b>1999</b>	77,082	419	321
<b>2000</b>	72,444	405	256
<b>2001</b>	70,820	387	207
<b>2002</b>	78,937	442	225
<b>2003</b>	79,700	426	216
<b>2004</b>	72,472	397	196
<b>2005</b>	75,255	420	211
<b>2006</b>	73,038	434	206
<b>2007</b>	76,359	465	NA

While under the ownership and operation of Energy Answers, the Facility:

- Was recognized for promoting integrated waste management in Berkshire County;
- Participated fully in promoting and implementing waste reduction, reuse and recycling strategies;
- Received the American Society of Mechanical Engineer's Small Combustion Facility of the Year award in 2004 for being the best operated and maintained small municipal waste combustion facility in the United States. Award criteria included: success in reaching facilities goals; innovative and technical contributions to solid waste processing; environmental performance; health and safety performance; facility economics; and the facility's role in integrated waste management;
- Received the Safety and Health Achievement Recognition Program (SHARP) award through the Occupational Safety and Health Administration; and
- Voluntarily agreed to adhere to the Massachusetts Department of Environmental Protection's more stringent emissions requirements for large municipal waste combustors, despite being a small municipal waste combustor.

### **Process and Design Information**

The following Schematic Process Diagram highlights the process in which recyclable materials and energy were recovered from the Facility under Energy Answers' operation. Although this process was a highly effective system under Energy Answers' management, modifications may have been made by the current owner/operator and some processes may have changed.



MSW was delivered to the Facility in trucks. Vehicles were weighed on the truck scale, which generated a weight ticket for the driver and stored the information in a computerized database. The database generated daily, weekly and monthly reports for billings, MSW inventory management, and regulatory compliance. Trucks left the scale and proceeded to the waste handling area where they dumped either into the receiving pit or onto the tipping floor.

An overhead crane mixed waste in the pit and piled waste for short-term storage. A front-end loader moved and screened waste on the tipping floor, and then loaded waste into the municipal waste combustors. The tipping, storage and combustion facilities were located inside a large building, permitting air from the waste receiving and storage area to be drawn into the combustion process to minimize odors.

The Facility had three (3) modular mass-burn refractory lined combustors, each rated for 120 tons per day of MSW, two waste heat boilers, each rated at 34,000 pounds per hour of steam, and a state of the art air quality control system.

Energy Answers' operation of the Facility demonstrated that managing trash as a resource can be accomplished in an environmentally and economically sound manner. The Facility's metals and

aggregate recovery system also helped to minimize landfilling requirements associated with ash management.

## **Technology**

Each of the three municipal waste combustors had a primary and secondary combustion chamber, which operated in an excess air mode using a combination of fresh air and recirculated flue gas. The primary combustion chamber had five (5) progressively lower refractory lined hearths resembling steps. Municipal solid waste was fed into the first hearth and tumbled from step to step by the action of hydraulic rams. By the time the MSW reached the final step, the fifth hearth, only ash and other non-combustible materials such as glass, metal and stone remain. This material, collectively termed 'bottom ash,' was discharged into a water (i.e., ash) trough. The trough quenched the bottom ash and sealed the combustor from outside air. A drag chain conveyor, at the bottom of the trough, transported the bottom ash to the ash building. The ash was separated by a flexible membrane screen, and the undersized fraction was utilized at a landfill for sloping, grading and daily cover. The oversized fraction passed over a drum magnet for ferrous recovery. The recovered ferrous, which was approximately 6% by weight of the bottom ash, was sold as scrap. The nonferrous 'overs' were either re-burned or hauled off the site for landfill disposal.

Flue gas flowed from the primary chamber into the secondary chamber, where sufficient time and temperature were provided to assure complete combustion. Flue gas from the secondary chamber flowed into a common tertiary chamber, and then into one of the two heat recovery/air quality control systems.

Each of the two heat recovery systems consisted of a waste heat boiler with superheater, a steaming economizer and a trim economizer. Most of the steam was sold to Crane & Company. Excess steam was fed to a vent turbine to produce electricity for in-house needs.

Each of the two air pollution control systems consisted of an activated carbon system to remove mercury, an electrostatic precipitator (ESP) to remove particulate matter, an induced draft fan, a venturi scrubber to further reduce flue gas temperature and remove particulate matter, and a wet scrubber with a demister to remove acid gases. Exhaust gas from each scrubber was combined and discharged to the atmosphere through a fiberglass reinforced plastic lined steel stack.

A portion of the flue gas, downstream of the economizer, was recirculated by the flue gas recirculation system. This system included a multi-cyclone to remove particulate matter, and provided cool, low oxygen (O<sub>2</sub>) content flue gas to the combustion chambers to inhibit the formation of nitrogen oxides (NO<sub>x</sub>) and slag.

Fly ash was collected from the multiclones and the ESPs via hoppers and conveyors. The fly ash was fed to a pug mill, conditioned with lime, and transferred in Super Sacks<sup>®</sup> for disposal in a Subtitle D landfill.

A continuous emission monitoring system (CEM) indicated performance relative to permit limits for SO<sub>x</sub>, NO<sub>x</sub>, and CO.

## Facility Modifications

The Facility was the only resource recovery facility in the U.S. modified with an air quality control system consisting of an ESP, a venturi scrubber, and a wet scrubber system to successfully meet the Best Available Control Technology requirements. The system had an outstanding environmental performance, and consistently achieved a remarkably high removal efficiency of SO<sub>2</sub> and HCl.

The Facility was among the few resource recovery facilities in the United States to employ a recirculated flue gas system, which inhibited the formation of NO<sub>x</sub> and slagging in the combustion chamber, and increased combustion efficiencies. As a result, the NO<sub>x</sub> emission levels were among the lowest in resource recovery facilities.

The Facility was the pilot facility for the eco/Tech Sludge Recycling System (SRS) developed by eco/Technologies, LLC, a subsidiary of Energy Answers International. The SRS was the first



successful system that injected and co-combusted a variety of liquid sludges in a solid fuel combustor. Previous industry attempts at co-combustion resulted in offensive odors while handling the material, incomplete burning of the sludge particles, and combustor operating difficulties. The system incorporated many important design innovations including steam atomization of the sludge to ensure complete combustion of the particles and modulation of the sludge feed rate to respond to changes in combustor primary temperature. The testing program not only resulted in positive results for sludge combustion but also indicated the potential for reduction in thermal NO<sub>x</sub> and particulate emissions.

Based on the success of the innovative pilot work at the Facility, the SRS was awarded U.S. Patent Number 6,279,493. A fully commercial SRS was installed at the Pioneer Valley Resource Recovery Facility in Agawam, MA, and has combusted tens of millions of gallons of liquid sludge, and fats, oils and greases (FOG) since start up in 2002.

For many years, in addition to the mandated 21H emission tests, the Facility conducted supplemental emissions tests to assure that process changes and modifications would not adversely impact the Facility's ability to operate within regulatory limits. Such changes included: three combustor operation to increase residence time thereby improving combustion efficiency; a reduction in secondary combustor temperature to minimize the need to burn fossil fuel to control temperature; and reconfiguration of the tertiary combustor to balance flue gas flow and control temperature.

In 2003, a major improvement to the under fire air system was developed and implemented at the Facility. The system automatically compensated for varying waste composition and bed depth, without the use of process sensors, thereby making this technology very effective and dependable. This system, along with other improvements developed and implemented over the years at the Facility, was incorporated at the Pioneer Valley Resource Recovery Facility, and would be incorporated in the next-generation Pioneer Plus<sup>TM</sup> technology for resource recovery facilities around the world.

In 1996, the Facility was selected to host a demonstration test sponsored by the U.S. Department of Energy's National Renewable Energy Laboratory, and conducted through the American Society of Mechanical Engineers. The test was to determine the lowest emissions level achievable by temperature control of ESP inlet gas combined with the injection of Trona (a sodium-based acid gas control reagent) and PAC. The goals were to meet the EPA's December 19, 1995 Emissions Guidelines for small MSW facilities, and to determine if large MWC guidelines could be met for particulate matter, dioxins/furans, SO<sub>2</sub>, HCl and Hg, using a dry sorbent injection technology, with sensible heat removal for temperature control. The Facility took great pride in being selected as the host facility and successfully completed the required modifications and subsequent tests.

In 1990, the original emission control equipment was replaced with a more effective system which demonstrated exceptional performance, and met all State and Federal standards. The system was unique in the U.S. resource recovery industry in that it included an electrostatic precipitator followed by a condensing economizer and wet scrubber. In 2000, a carbon injection system was installed to



further reduce mercury emissions, and in July 2006, the condensing economizers were replaced with venturi-scrubbers designed for temperature and fine particulate control.

A vent turbine was installed in 2005 to serve internal power needs using excess steam not purchased by Crane & Company. The system was fully automated and consisted of a steam turbine, speed reducing gear and a generator.

## Management History

The Facility has been successfully operating since February 1981. Success is primarily measured in three areas. The first is health and safety. The Facility was recognized by the U.S. Occupational Safety and Health Administration, along with the Massachusetts Department of Labor and Workforce Development, as having met the stringent requirements of the Safety and Health Achievement Recognition Program. SHARP is an alternate voluntary compliance program for companies which have too few employees to fall within the Voluntary Protection Program. There are only a few resource recovery facilities in New England recognized by this program. SHARP status was first awarded to the Facility in March 2002, and was renewed since then.



The second area is environmental awareness and compliance. The design and layout of the combustion system assured a long residence time for combustion gases. The result was nearly complete combustion and very low carbon monoxide generation. The utilization of a wet scrubber for acid gas control typically results in HCl and SO<sub>2</sub> emissions below one (1) part per million. The recirculated flue gas system controls NO<sub>x</sub> emissions which were well below the permitted limit. Although the emissions limits have been tightened several times since start-up, the Facility has maintained an excellent record of regulatory compliance.

The third area is production, as measured by waste throughput and steam generation. Again, since start up, there was a gradual increase in throughput. Further, Energy Answers strove for improvement in all areas by embracing a synergistic approach to problem solving and system improvements. As an example, over the years, the combustion system was modified several times to improve operator safety, process reliability, and efficiency.

### **Environmental Performance**

The Facility is a Class II (i.e., small) resource recovery facility. However, primarily due to good design and operation, the Facility agreed to adhere to the Massachusetts Department of Environmental Protection emission limits for large MWC's as promulgated on August 25, 1998.

The Title V air permit issued to the Facility required frequent and extensive testing and monitoring of air emissions. The Facility was equipped with CEMs that record SO<sub>2</sub>, NO<sub>x</sub>, CO and other parameters. Wastewater from the process was treated and discharged to a local municipal treatment system. Discharge quality was consistently within acceptable limits.

The Facility had never been fined for any type of environmental violation, and was proactive in working with MADEP and the City of Pittsfield in creating and encouraging a variety of recycling programs.

### **Facility Economics**

The Pittsfield Resource Recovery Facility is a merchant facility, meaning that it is privately owned and operated, with third party arms-length contracts for waste disposal and a customer for the purchase of energy produced by the Facility. During Energy Answers' term of ownership and operations, the Facility was always financially sound, primarily through its contracts with the City of Pittsfield as the primary municipal contract customer for waste disposal, and Crane & Company as the energy customer.

In 2003, the Facility entered into a 10+ year extension of the steam contract with Crane & Company. Also, the City of Pittsfield approved and ratified a 10+ year extension of its contract for waste disposal at the Facility. These agreements were clear evidence of the continued economic viability of the Facility as compared to other available energy or solid waste disposal options, and an affirmation of the Facility's customer satisfaction.

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