Producing Usable Fuel from Municipal Solid Waste

Opportunity
Refuse disposal is a matter of increasing concern for municipalities and state governments. As existing landfills become filled to capacity, and new landfills become more costly to site, it has become critical to develop alternative disposal methods. Some of the refuse that is presently being landfilled has the potential to provide considerable quantities of energy and thereby replace conventional fossil fuels. Another environmental concern is the problem of the emissions associated with combustion of traditional fossil fuels. The Clean Air Act Amendments of 1990 significantly restrict the level of sulfur dioxide (SO2) and nitrogen oxides (NOx) emissions permissible as effluent from combustion facilities. To address both of these concerns, Argonne National Laboratory, under sponsorship of the U.S. Department of Energy (DOE), has developed a means of producing fuel from municipal solid waste that can be co-fired with coal to supplement coal supplies and reduce problematic emissions.

Description of Work
Argonne conducted full-scale co-fired combustion tests on-site in 1987 in the Argonne spreader-stoker unit. Approximately 600 tons of binder-enhanced, refuse-derived fuel (RDF) pellets were blended with high-sulfur coal at 10, 20, 30, and 50 percent, on a Btu-content basis. Test burns were conducted over eight weeks and included extensive flue-gas sampling and analysis. Further tests were conducted in partnership with the National Renewable Energy Laboratory (NREL) and three industrial partners: Otter Tail Power Company, Eden Prairie Recycling (EPR), and XL Disposal Corporation. Tests were also conducted at Otter Tail’s Big Stone Fossil Plant in South Dakota, a 440-MWe cyclone-fired combustor. Approximately 1,200 tons of RDF pellets were fabricated by EPR and XL for testing. Researchers analyzed air emissions, ash residues, and fuel composition and combustion performance for coal firing alone and for a mixture of coal and RDF pellets, up to 15 percent by weight. Data from this project will be used to develop operating, technical, and financial information for the use of RDF pellets as fuel in cyclone, suspension-fired, or small spreader-stoker-fired combustors. They will also be used to help state regulatory agencies evaluate methods to permit and monitor commercial co-combustion units and will provide a database for manufacturers. As part of the project, the participants also identified barriers that could inhibit commercial implementation of this technology.

Benefits
As a result of full-scale co-fired combustion tests conducted at Argonne, the U.S. Environmental Protection Agency (EPA) has established a 30 percent weight limit on burning of RDF pellet-coal mixtures, without requiring users to re-permit their boilers. This action provides a powerful incentive to potential users. Data from the Otter Tail tests allowed project participants to develop a thorough understanding of reductions in flue gas emissions and reductions in heavy metal concentrations in ash residues, as a result of RDF co-firing with coal. This technology received a 1989 R&D 100 Award and the 1990 Federal Laboratory Consortium Award for Excellence in Technology Transfer.
DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.
and the University of North Texas have jointly applied for two patents, as a result of this work. ARCH Development Corporation has negotiated licensing of the pellet-making process to Catrel, Inc.

**Design Concept**
Municipal solid waste is separated into recyclable items, such as glass, metals, plastics, and refuse. The combustible fraction is combined with a binding additive and formed into cylindrical pellets. Approximately 150 candidate additives were investigated for economic and other factors. Lime (calcium hydroxide) was identified as the most useful and economically attractive binder. The use of lime as a binder makes it possible to store the fuel pellets for months and have them remain intact during handling. The lime also provides a scrubbing function, combining with sulfur in the coal and decreasing $SO_2$ emissions.

**Current Status**
Present research efforts are focused on pulverizing the RDF pellets so this fuel can be burned in pulverized coal boilers, either as a co-firing fuel with pulverized coal or alone. Other work is ongoing with several Fortune 500 companies to examine the potential for using industrial waste as the source for fuel pellets. To promote commercialization of this technology, Argonne is working with others to set up a trade association for waste-to-energy fuel manufacturers, equipment vendors, and potential users.

**For More Information, Contact**
Oscar O. Ohlsson
Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

**DISCLAIMER**
This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.