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PLASMA ARC GASIFICATION FOR SOLID WASTE DISPOSAL UPDATE ON ST. LUCIE COUNTY, FLORIDA PROJECT

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ABSTRACT

Plasma arc gasification is an emerging technology for generation of renewable energy and other by-products from a variety of waste. This bold technology is under development in a number of locations around the world, although it is too early to fully know if the technology is technically feasible and economically viable on a truly heterogeneous municipal waste stream like that found in the U.S.

Plasma arc technology in the United States in other applications dates back approximately 40 years when it was utilized by NASA to test heat shield materials for spacecraft. In 1989, plasma arc technology was used in an iron melting furnace in Defiance, Ohio (USA). Plasma arc gasification has been used in municipal solid waste destruction since 1999 in Japan for destruction of solid waste and automobile shredder residue. Plasma arc gasification heats waste materials to temperatures in excess of 10,000 degrees Fahrenheit (°F) to break the molecular bonds and gasify the materials. This liberates the energy potential of the waste materials and melts the residue to an inert, glass-like slag, which may be used as an aggregate in construction and manufacturing operations. If this market can be developed, it will significantly reduce the need for landfill disposal in the future.

St. Lucie County, Florida (USA), is in the process of negotiating with a developer for the construction of a plasma arc gasification facility that will process 1,000 tons per day of municipal solid waste. The facility may be the first large scale solid waste plasma arc processing facility in the United States. Camp Dresser & McKee is assisting St. Lucie County to negotiate the agreements for this project. The project is expected to be privately financed, so the County will not be putting any money at risk.

In this paper, we will describe the plasma arc technology, present its historical applications, and discuss the St. Lucie project from initial conception to its current status.

1. INTRODUCTION

Whether it is in the form of household trash and garbage, or in the residues of industrial and commercial processes, waste is produced by all of us each day. According to the Environmental Protection Agency, in 2006 the United States alone generated about 251 million tons of municipal solid waste (MSW) or garbage every year which equates to each person generating over 4.6 pounds of solid waste per day [1]. Approximately 138 million tons is sent to landfills [1]. The United States creates and landfills over 300 million tons of construction and demolition debris (C&D), MSW and other waste streams per year.

In the late nineteenth century, continuing through the twentieth century, many processes were developed to recover the energy locked up in waste materials and return that energy to displace virgin fuels. Waste to energy combustion facilities proliferated and they were demonstrated to be a safe means of waste disposal and renewable energy generation.

In the late twentieth century and now continuing into the early twenty-first century, a process of using plasma arc gasification technology to liberate the energy potential of municipal solid waste has been developed and is gaining momentum. Plasma arc gasification technology may help advance the development of renewable energy, beneficial reuse of byproducts from waste, and reduce the need for landfill disposal upon successful commercial demonstration.

2. PLASMA ARC GASIFICATION

First, what is plasma? Plasma is often called the “Fourth State of Matter”, with the other three being solid, liquid and gas. A plasma is a distinct state of matter containing a significant number of electrically charged particles, a number sufficient to affect its electrical and chemical properties. To put things in perspective, low temperature plasmas are estimated to constitute more that 99 percent of the visible universe.

Plasma arc technology was developed and employed in the metal industry during the late 1800s to provide extremely high heat for heating, melting, cutting, and welding of metals. During the early 1900s, plasma heaters were used in the chemical industry to manufacture acetylene fuel from natural gas. This application remains the largest (150 megawatt) plasma heated industrial plant in the world, located in the Chemische Were Huls plant, Marl, Germany [3].