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### PLASMA RESOURCE RECOVERY TECHNOLOGY – CONVERTING WASTE TO ENERGY AND VALUABLE PRODUCTS

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#### ABSTRACT

Plasma Resource Recovery (PRR) is a revolutionary technology that can treat virtually any type of waste by combining gasification with vitrification. Vitrification produces inert slag that can be used as a construction material. Gasification produces a fuel gas containing carbon monoxide (CO) and hydrogen (H<sub>2</sub>), used for cogeneration of electricity and steam. The plasma fired eductor which is the core technology of the PRR system is presently being used commercially on a cruise ship at a scale of 5 TPD. The capabilities of the PRR technology have been demonstrated in a pilot plant, at a rate of up to 2 TPD of various types of waste. Because of the high intensity of the plasma flame and the reduced amounts of gases produced in a gasification system, compared to traditional combustion systems, the PRR system is typically very compact. As such, the PRR technology opens the door for a decentralized, small scale approach to waste management.

#### INTRODUCTION

The Plasma Resource Recovery System proposed by PyroGenesis is used to convert municipal solid waste (MSW), industrial waste and even hazardous waste into commercially valuable products, including gaseous fuel for the production of electricity, gravel for construction and metal for recycling. For large systems, the economic value of the products is usually sufficient to cover most of the system's operating costs, making the system competitive with landfill and incineration options.

The PRR technology has been demonstrated technically on the pilot scale at PyroGenesis and shown to easily meet the most stringent emission requirements [1]. A similar technology is now used commercially (a 5 TPD Plasma Arc Waste Destruction System) by Carnival Cruise Lines for the treatment of waste generated onboard large ships. The first system has been installed onboard one of Carnival's cruise ships, the "Fantasy" and has been in operation since October 2003. The technology for shipboard use has been developed in

collaboration with the US Navy since 1998, with the objective of installing it onboard the next generation of aircraft carriers [2-6].

The novel approach of the PRR technology is that it combines the advanced processes of gasification and vitrification in one single system. Gasification is the process of reacting the organic fraction of the waste with water and a limited amount of air to produce a synthesis gas containing mostly carbon monoxide (CO) and hydrogen (H<sub>2</sub>). The synthesis gas produced is cleaned and used for the production of electrical energy using gas engines. Hot water and steam can also be produced by the engines as required and be used for various purposes such as heating or cogeneration of electricity and steam. Vitrification is the process of melting all the inorganic fraction of the waste to produce a metal alloy and an environmentally safe glassy slag that is suitable for use as a construction material. As a result, the system produces virtually no secondary wastes.