TVRC

THERMAL VOLUME REDUCTION & CONVERSION™

•Innovative ***waste-to-energy*** technology combining a thermal volume reduction system coupled with PEAT's proprietary plasma-arc gasification/vitrification system called ***Plasma Thermal Destruction & Recovery (PTDR)***

•***Maximizes electricity*** generation

•***Minimizes residual*** by-product treatment with no secondary pollution

•All feedstock represents a ***100% waste diversion***, eliminating the need for landfill disposal and/or further processing.

•High ***volume*** and ***weight*** reductions

•***Eliminates pre-sorting*** of waste feedstocks

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With the TVRC technology all waste streams are converted into electricity or useable end-products – I call that *zero waste, the holy grail for waste disposal.*

- Joseph Rosin, PEAT Chairman

Technology Overview

The thermal volume reduction system (TVR) consists of five major subsystems:

- *Waste storage arrangement*
- *Feeding system*
- *High temperature reactor/boiler and energy recovery system*
- *Flue gas cleaning system*
- *Ash handling system*

The feeding subsystem includes several hydraulic actuators that control the feedrate for various sections of the high temperature reactor/boiler. Each hydraulic actuator is controlled by the process control system. The control system then adjusts each hydraulic cylinder stroke and speed, as result, the waste feedrate is optimized.

Waste processing occurs in a high temperature (over 850°C) reactor/boiler via a reciprocating grate system consisting of high alloy steel casing grates (thus air cooling is sufficient). Each high temperature reactor/boiler (offered in 250 TPD modules) is capable of producing approximately 50 tons/hour of steam (450° C) at 3.82 MPa (assumed calorific value of 2,800 kcal/kg). During processing, municipal solid waste (MSW) is moved along the three sections of the grated area. The first section dries the MSW, while the second section oxidizes the MSW and the third section cools the remaining material to reduce the temperature of the ash and allows the system to recover some residual heat. The heat generated is converted into electricity via an energy recovery system consisting of a steam generator (boiler with 75% efficiency), steam turbine, power generator, water treatment system and heat exchanger.

Any fly ash generated in the thermal volume reduction system is transferred to a PTDR System where it is melted and reformed into a vitrified matrix product. Applications for this vitrified matrix product include roadbed/fill construction and concrete aggregate.

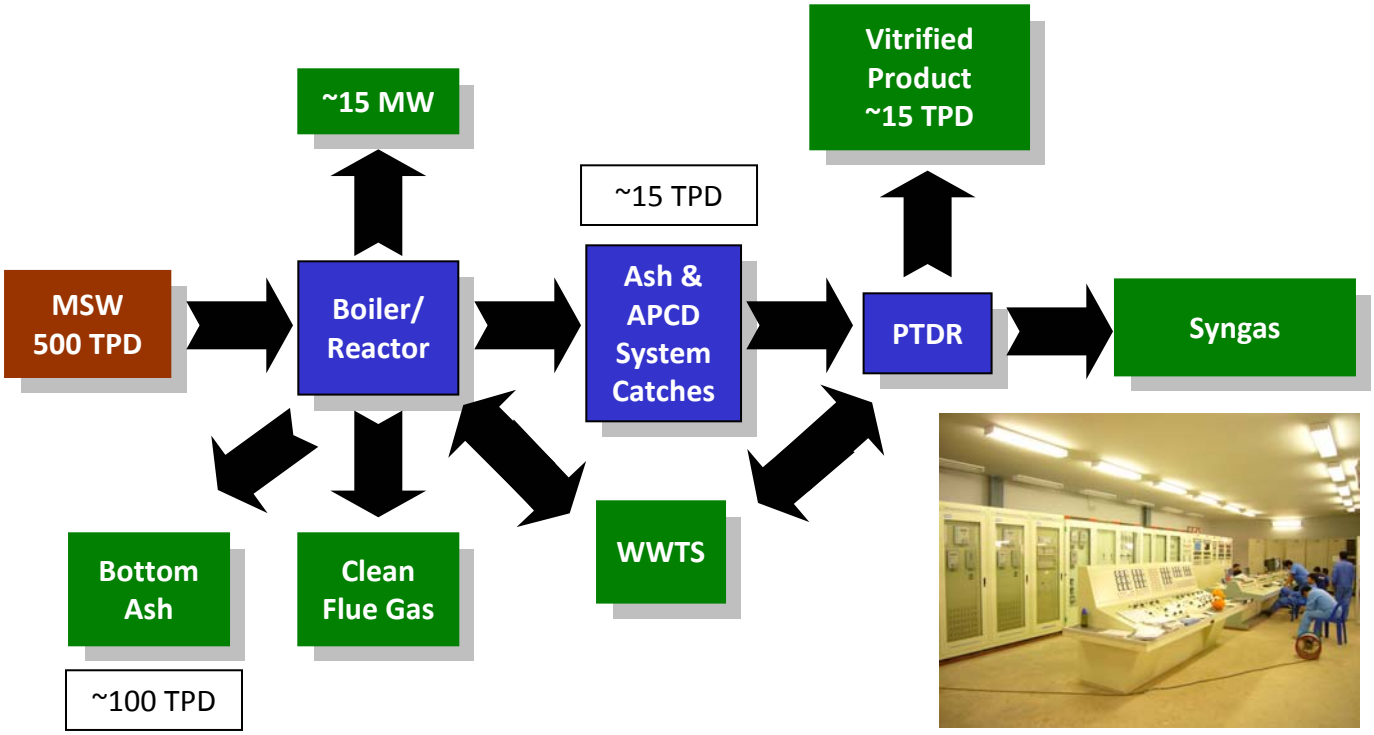
The PTDR System consists of 6 major subsystems:

- *Solid waste feeding system*
- *Plasma Reactor*
- *1,200 kWe Plasma graphite electrode System with an Insulated Gate Bipolar Transistor power supply*
- *Gas Cleaning & Conditioning System*
- *Syngas Accumulation and Utilization System*
- *Induced Draft Fans*

The PTDR technology uses heat generated by plasma electrodes or torches in an oxygen starved environment to process the inorganic fly ash. The vitrified matrix product is the result of operating temperatures above the melting temperature of the mineral matter in the fly ash. Under these conditions in the PTDR reactor, non-volatile metals and metal oxides bind together in molten form until it is cooled via natural heat loss or via a pool of water, where it would fracture and granulate. This matrix is primarily made of silicon dioxide (SiO_2), aluminum oxide (Al_2O_3) and calcium oxide (CaO).

Any organic portion of feedstocks are pulled apart to their basic levels (dissociated), then, depending on the composition of the waste stream, a controlled (stoichiometric) amount of oxygen (either in the form of steam or pure oxygen) is added to reform the dissociated elements of the waste into a synthesis gas ("syngas"), consisting mainly of Carbon Monoxide (CO) and Hydrogen (H_2). This process is commonly referred to as plasma gasification. The system derives its energy from plasma heat, thus wastes with little or no calorific value can be effectively and efficiently treated.

TVRC Process Overview



In the above example, 500 TPD of unsorted MSW is processed in the high temperature boiler/reactor, while the 15 TPD of fly ash (3% of MSW processed) is converted into the input for construction materials. Approximately 15 TPD of remaining capacity is available in the PTDR system to treat other feedstocks such as hazardous or industrial waste. The bottom ash generated (around 20% of quantity processed in the high temperature reactor/boiler) is collected and provided and/or sold as cement aggregate.

Environmental Advantages

- **Converts potentially hazardous ash into construction materials**
  - ***Approximately 5,000 metric tons per year of vitrified product***
- **Maximum energy generation from MSW – Alternative to fossil fuels**
  - ***Over 15 MW generated from 500 TPD of MSW***
- **Minimal water consumption and wastewater generation**
  - **Onsite system to recycle effluent generated by either system**
- **Reduces Greenhouse Gas Emissions**
  - ***Approximately 95,000 MTCE estimated (based on above scenario)***
- **Avoids generating harmful air emissions**
  - **Significant investment in gas cleaning & condition to meet USA & EU standards**

PEAT International

- *Founded in July 2001*
- *Global leader for plasma-arc gasification systems*
- *Sizes available from 1 – 30 metric tons per day*
- *Six PTDR systems installed to date in four countries*

Recent Project Experience: TVR

Facility	Commission Date	Approx. Size (TPD)	Size (MW)
Luzhou, Lu'an Anhui	2011	1,500	42
Shengyi, Huizhou Guangdong	2011	1,180	33
Liren, Lu'an Anhui	2011	1,465	41
Qixiang, Xiaoxian Anhui	2011	1,600	45
Dolin, Binyang Guangxi	2011	1,215	34
Der, Kaiyuan Liaoning	2011	1,600	45
Wulian, Shaoguan Guangdong	2011	1,465	41
Tianlan II, Chengdu Sichuan	2011	1,465	41
Tianlan I, Chengdu Sichuan	2011	1,465	41
Bamailong Hengshui, Hebei	2011	1,400	39
S. Kichai Wood Panel, Thailand	2011	2,000	55

230 TPD Tao Yuan (Taiwan) Waste Destruction Plant

Recent Project Experience: PTDR

Shanghai, China

In late 2010, a PTDR-100 system was commissioned in Northern China for a large oil refinery to treat petroleum sludge and other related waste streams. After completing its demonstrations, this plant was installed permanently in Shanghai, where it is currently being commissioned for commercial medical waste treatment.

In 2010, a PTDR-100 system was commissioned at a commercial R&D foundry. Locating and permitting a system in California - the most stringent air emission state - illustrates the minimal environmental footprint associated with the PTDR technology.

Sacramento, CA / USA

Taichung, Taiwan

In 2008, a PTDR-100 system was commissioned in Gujarat, India. The system processed a wide range of solid waste streams, including hazardous waste, medical waste, industrial waste and pharmaceutical waste. The system was re-commissioned in Taichung, Taiwan in 2011.