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Presentation Notes

29 October 2004

To: **States of Jersey - Shadow Scrutiny Panel**

Re: **High Temperature Plasma Gasification & In-Vessel Composting**

From: **Verno Limited**

Attending from Verno Limited:

Ivan Richardson	Company Director
John Brooks	Company Director
Hilary Stone	Lecturer in Environmental Law, Brunel University, Centre for Environmental Research and associate & advisor to Verno Limited

Background to presentation:

The States of Jersey are determining a solid waste strategy with a view to implementing a range of measures including the adoption of the waste hierarchy and the necessary replacement of the current mass burn incinerator.

We have been invited to present details of technology solutions which are generally known as gasification and composting but are more accurately called;

1) advanced high temperature plasma gasification

and

2) in-vessel composting

We propose two parts to the discussion with questions at the end.

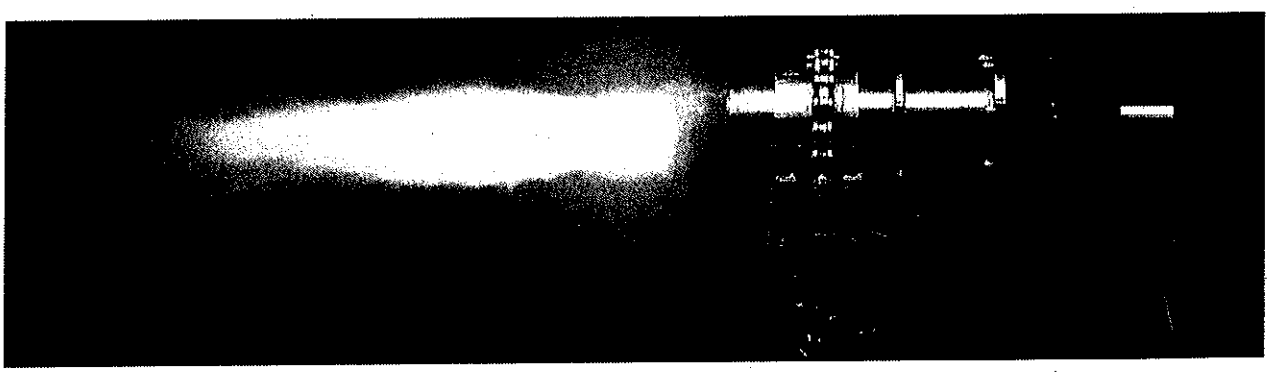
We will attempt also to address points raised in the Draft Solid Waste Strategy as we go through.

We have included a copy of our brochure with these documents and so rather than use the time discussing the company we propose to go straight into a discussion of the technology in relation to Jersey in general and the Draft Solid Waste Strategy in particular.

Firstly a bit about plasma gasification as background.

1) Advanced High Temperature Plasma Gasification

Plasma gasification can treat successfully a wide range of waste streams and has the capacity to convert even the most difficult to treat waste into energy and re-usable products.



High temperature plasma gasification is a thermal process which has been in use for over twenty years. The process involves the conversion of complex organic molecules (in both the liquid and solid state) to a simple plasma-converted synthesis gas (syn-gas) and a benign vitreous or granular bottom melt.

The gases produced are flammable and can therefore be used as fuel to generate energy in the form of electric power.

The syn-gas can be used to produce a very clean energy using the new generation of fuel cells without the need for combustion.

Emissions and leachibility standards are rigorous, making high temperature plasma gasification one of the cleanest thermal waste treatment technologies available.

It was reported to the International Thermal Treatment Technologies Conference last year that: "In most cases, the emissions data (from plasma gasification) were from one to three orders of magnitude below the EPA MACT (US Environmental Protection Agency, Maximum Achievable Control Technology) standards. DRE (Destruction and Removal Efficiency) results exceeded 99.9999% for all RCRA (Resource Conservation and Recovery Act) hazardous chemicals in the feed.", this is effectively a clean to air technology.

Vitreous output

Plasma gasification systems have many more attributes which can knit closely with many of the recommendations made in the Solid Waste Strategy and supported by The Jersey Environment Forum.

For instance:

It is a genuine waste to energy system

> 200 tonne per day of Mixed Solid Waste can produce 1,360 million BTU of syngas per day. Syngas can be used to power reciprocal engines to generate electricity. Reciprocal engines can generate 700 kWh of electricity from the syngas produced from the gasification of 1 metric tone of waste. The system requires 350 kWh of electric consumption to process 1 metric ton of waste. This is equal to 140 MWh of power production per day for a 200 t/day system plasma gasification a net electricity generator of over 70 MWh a day. However we recommend that the sny-gas to delivered directly to fuel cell power generation plant for a cleaner and more sustainable, future proof and efficient process in turn.

It is more efficient than Energy from Waste incineration/steam turbine systems

It does not produce toxic bottom ash and fly ash (in fact it can treat or remediate these hazardous wastes into completely safe usable materials)

It is a compact modular system which can be implemented over time in response to growing or reducing waste arisings

It is a safe, easy to operate and reliable technology

It can treat hazardous and clinical waste without modification

It can treat sewage and harbour sludge without modification

It can treat shredded car and lorry tyres – recovering valuable energy in the form of syn-gas and high-grade stainless steel for recycling

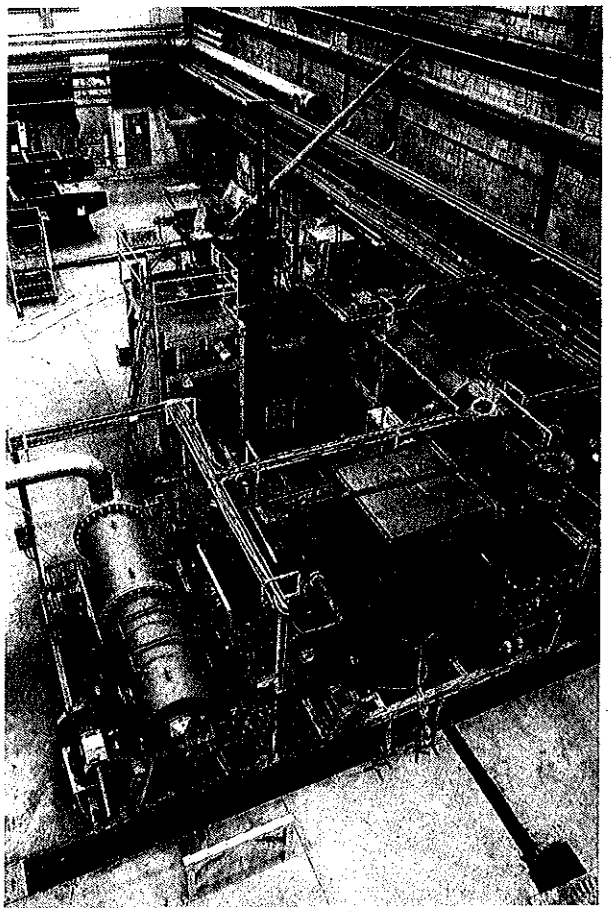
It will take all residual waste resources and convert these to useful commercial products

It can be a distributed system – that is to say - being modular it can be set up in more than one location which reduces;

- traffic movements
- noise and other nuisance
- environmental impact
- treat waste closer to source

It is a compact system – requiring little more than 6500 sq. ft. for a 200 tonne per day twin system

A design and build programme can fit within the States timeframe to replace the current mass burn incinerator by 2008



Plasma Gasification plant

Subject to detailed feasibility the capital and operating costs will be confidently below that of the current generation of mass burn incineration EfW plants available in Europe

In conclusion:

Plasma Gasification is

- Safe, reliable and easy to operate
- Modular – can be modified as waste arsings grow or reduce
- Flexible - can treat wide range of wastes incl. sewage sludge/ hazardous
- Environmentally sustainable – all waste converts to a usable output
- Complimentary with the waste hierarchy
- Lower capital & operational cost
- Sustainable, acceptable & B.P.E.O.
- Design & build can fit with Jersey timetable

Now we can move to cover in-vessel composting

2) **In-Vessel Composting**

In the Draft Solid Waste Strategy under Management Summery in 6) it states,

"...funding for the provision of new facilities;

> Urgently for composting, as this not only promotes sustainability, but also reduces the quantity requiring disposal"

It is correct to place a high emphasis on a composting system to treat the biodegradable fraction. And given Jersey's unique horticultural industries the prospect of returning quality compost soil improver back into the system seems to be an ideal arrangement.

The Wasteology In-Vessel Composting System is clamp-based system;

- Modular - single unit 15m x 8m x 2.5m contains 180 tonnes biodegradable matter
- Capacity – added Alfabloc wall units fit side-by-side with existing units
- Low cost – simple design & maintenance formula
- Reliable – solid construction based on Alfabloc Instant Walling System
- Retractable roof system – retains bio-aerosols and excludes vermin & keeps scavengers out
- Simple to operate – can treat 40,000 tonnes per annum with only three operational staff
- Conforms to all Defra rules including the Animal By-Products Regulations (2003)
- Complete pathogen kill at temperatures of 60c and above over two days repeated
- On-site and remote temperature monitoring
- Unique ground level ducting produces even aerobic activity throughout
- Tested system – the first to be Defra licensed in the UK
- Delivery within ten weeks.

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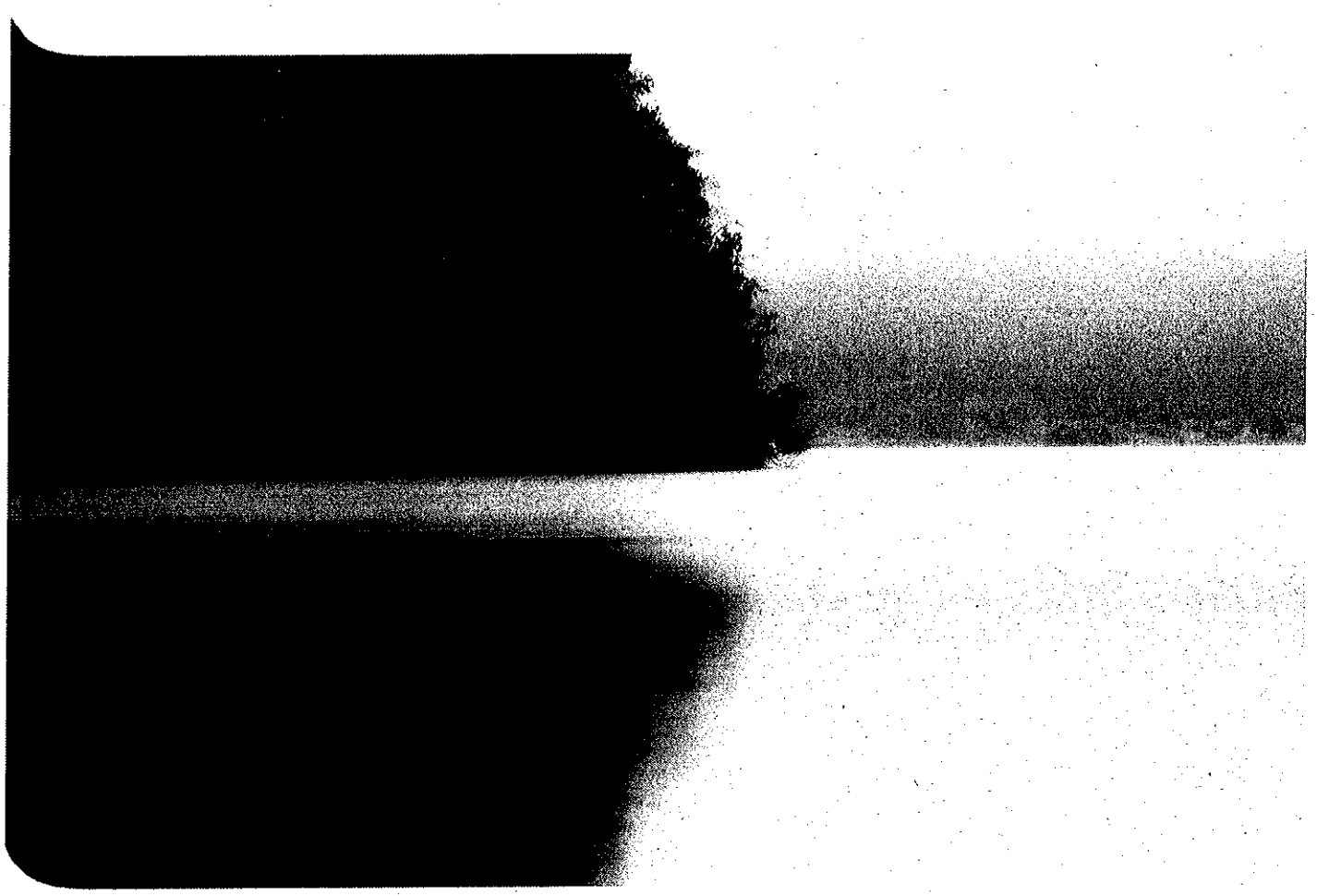
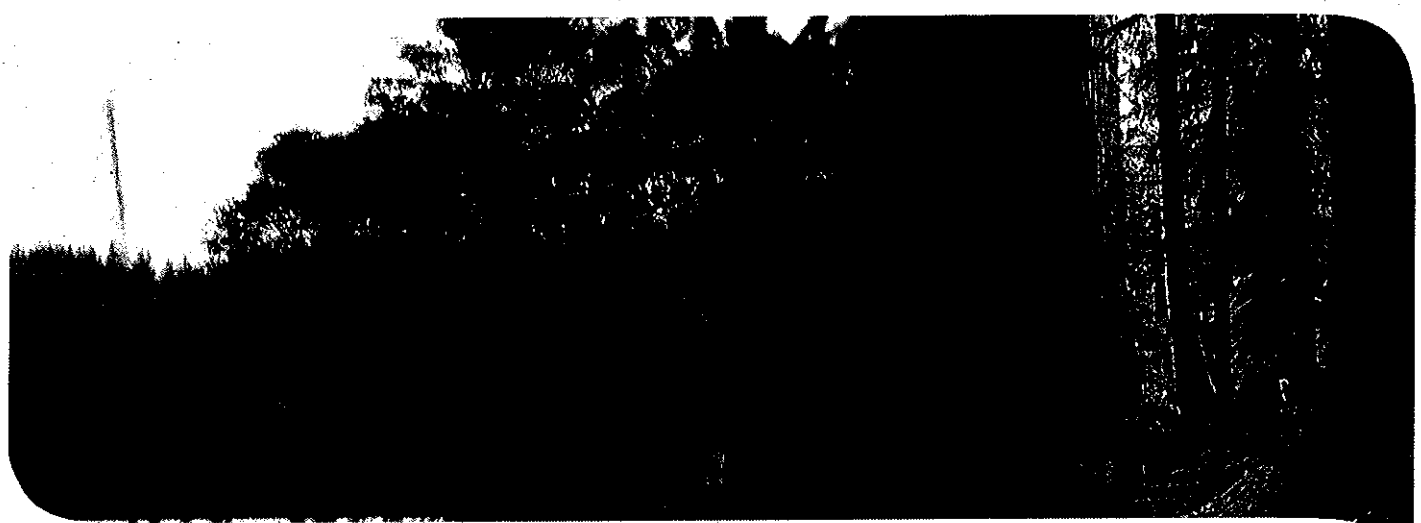
Waste to Energy System

Integrated Waste Management Solutions



Verno Limited

Verno's principal focus is the delivery of proven technological solutions for the treatment and management of waste resources. The company works closely with appropriately skilled partners, consultants and agencies to implement integrated waste resource management programmes with sustainable waste to energy systems at their core.



Introduction

Worldwide, the vast bulk of waste currently goes to unsustainable disposal destinations such as landfill and incineration. These are historically poor solutions that arose from the ancient practice of dumping and burning rubbish. Regulation and best practice are already having a significant impact on these methods. Advanced high temperature plasma gasification systems are where science and technology meet the 21st century requirement for a sustainable waste solution. Plasma gasification systems are clean to air, they do not generate residual toxic ash and they produce energy from waste in a safe and environmentally sound process.

Advanced high temperature plasma gasification is a proven technology at the leading edge of thermal treatments. It has moved from research and development into full commercial application.

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Background

Verno is an environmental services business. Our purpose is to promote an integrated approach to waste resource management including waste reduction, segregation at source, recycling, re-use, composting and waste to energy systems. Combining widely accepted methods of waste resource management with advanced high temperature plasma gasification systems is the key to a sustainable and integrated waste resource management programme.

Plasma gasification can treat successfully a wide range of waste streams and has the capacity to convert even the most difficult to treat waste into energy and re-usable products. High temperature plasma gasification is a thermal process which has been in use for over twenty years. The process involves the conversion of complex organic molecules (in both the liquid and solid state) to a simple plasma-converted synthesis gas (syn-gas) and a benign vitreous or granular bottom melt. The gases produced are flammable and can therefore be used as fuel in processes or applications where appropriate. The *syn-gas* can be reformed to produce clean energy via hydrogen fuel cells without the need for combustion.

Emissions standards are rigorous, making high temperature plasma gasification one of the cleanest thermal waste treatment technologies available: *"In most cases, the emissions data (from plasma gasification) were from one to three orders of magnitude below the EPA MACT (US Environmental Protection Agency, Maximum Achievable Control Technology) standards. DRE (Destruction and Removal Efficiency) results exceeded 99.9999% for all RCRA (Resource Conservation and Recovery Act) hazardous chemicals in the feed."* [1]

[1] From a paper presented to the, International Thermal Treatment Technologies 2003 Conference, titled, "Waste Gasification - Test Results From Plasma Destruction of Hazardous, Electronic and Medical Wastes"

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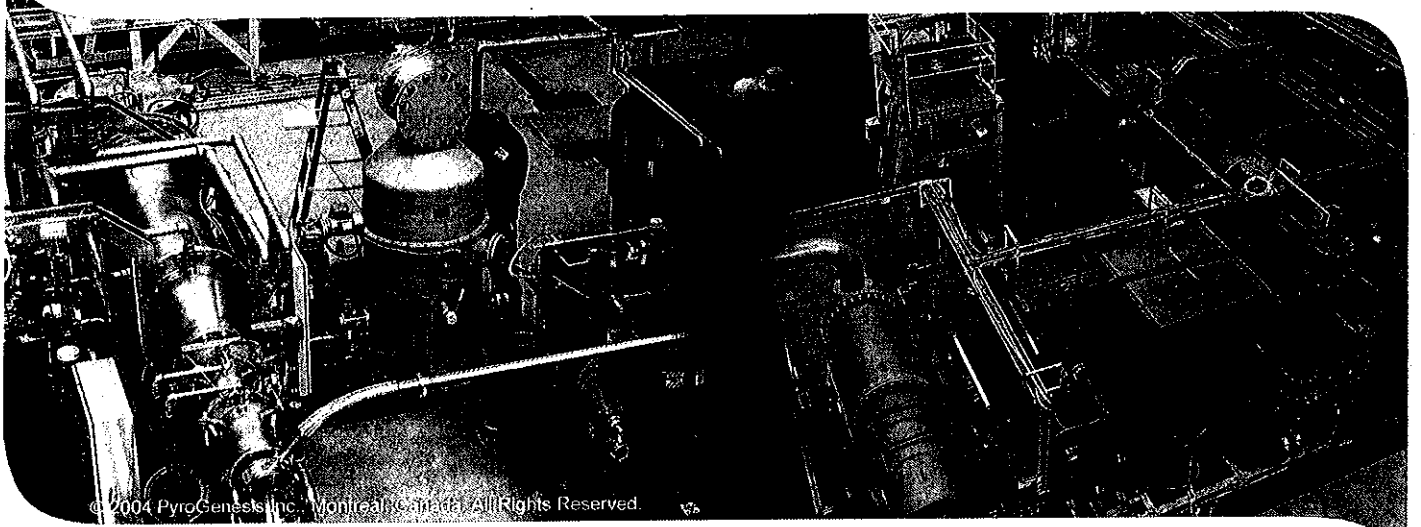
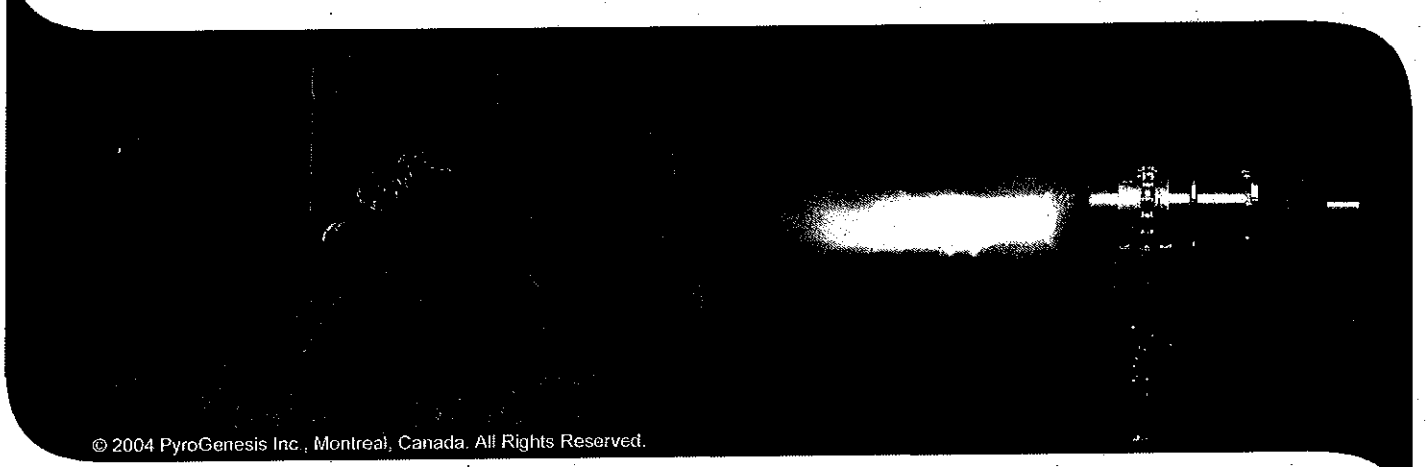
The process



In plasma gasification systems, waste is fed via an injection manifold system or airlock feed station to a plasma reactor vessel where it meets the plasma generated heat at temperatures greater than 1,600 ^{0}C (2,900 ^{0}F). The heat causes the organic compounds in the waste to dissociate at the molecular level into very simple gas molecules such as hydrogen, carbon monoxide, carbon dioxide, methane and water vapour.

The plasma gasification system is powered by electricity which produces a constant intense energy release within an insulated process chamber. The plasma itself is a gas that has been ionised so that it becomes an electrical conductor. The plasma discharged within the process chamber reaches extremely high temperatures and converts any material (including the full range of MSW, clinical wastes, asbestos material, PCBs, hazardous and toxic wastes) into a basic molecular state.

The technology is computer controlled, robust and able to operate around the clock.



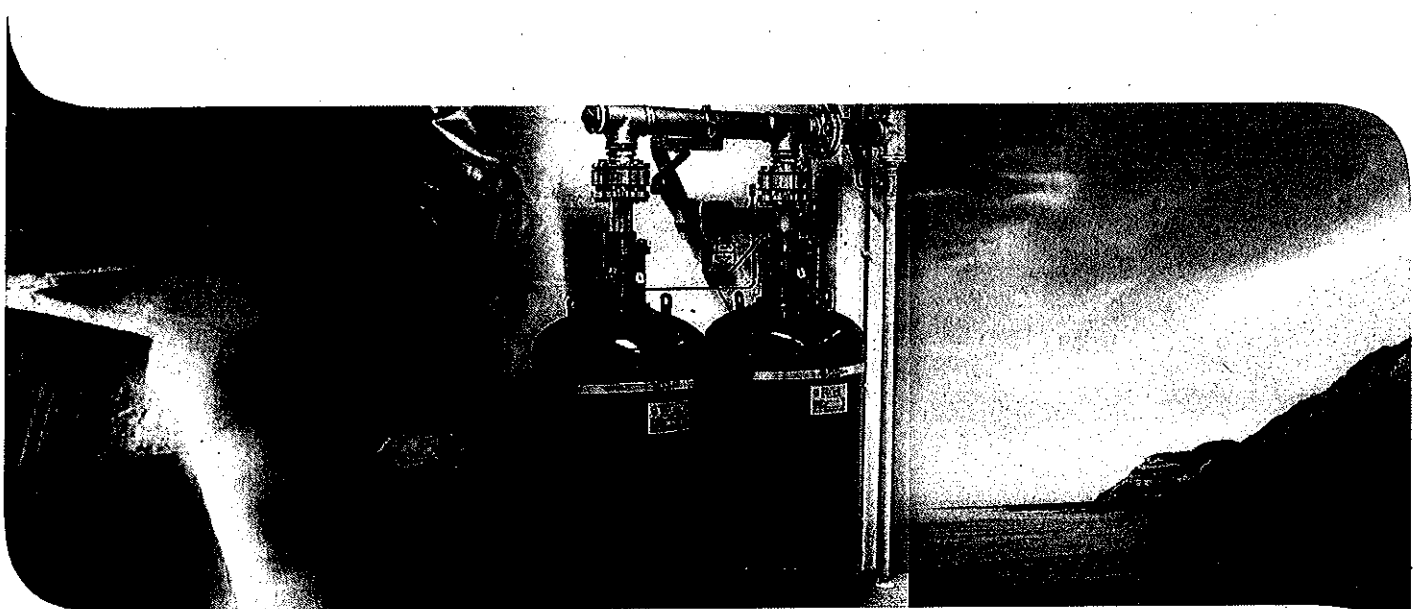
Output materials

Inorganic and particulate matter present in the input waste are melted down to a complex liquid silicate that flows to the bottom of the reactor vessel in the process. Any metals present also melt and flow to the bottom of the reactor vessel, where they either mix with the silicate or, if in large enough quantities, sink to the bottom as a separate layer.

The liquid melt is allowed to flow from the vessel to a water quench. Here, the melt product is cooled to a non-leachable, non-toxic glass-like vitrified mass or granular sandy material. Metals in sufficient quantity can be separately drawn off to ingots for recycling.

The gas exiting from the reactor chamber is cooled, scrubbed and cleaned of particulates in a bag house filter to produce a syn-gas of similar quality to natural gas.

The syn-gas has a low to medium calorific value and is suitable for use in power generation or can be reformed to power Hydrogen Fuel Cells. The non-toxic vitreous or granular bottom melt can be safely used as an aggregate.



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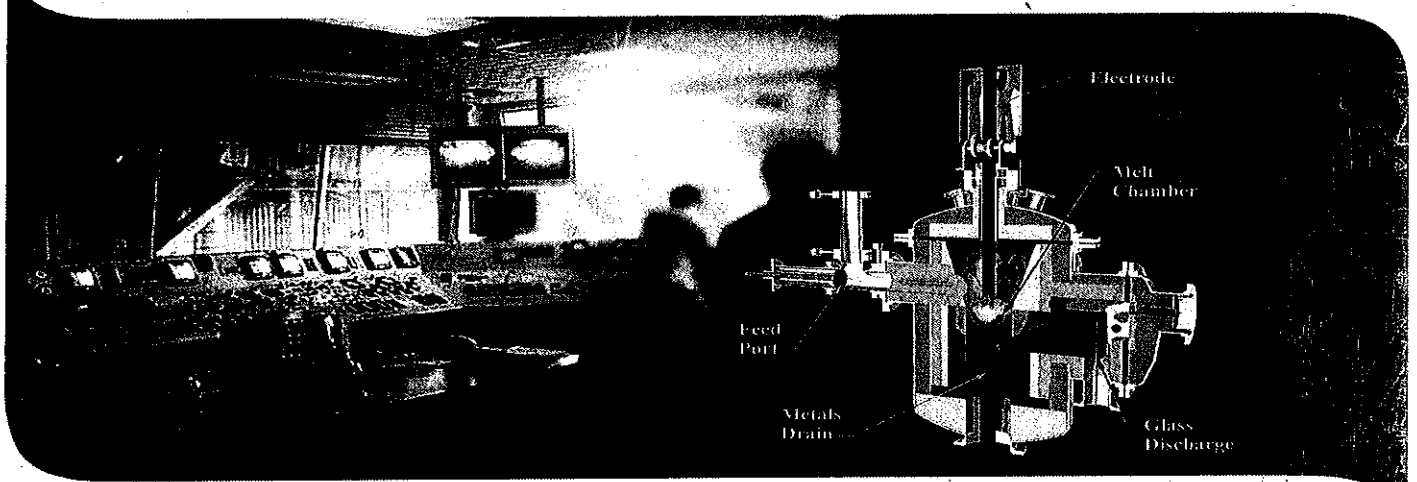
Advantages of plasma gasification

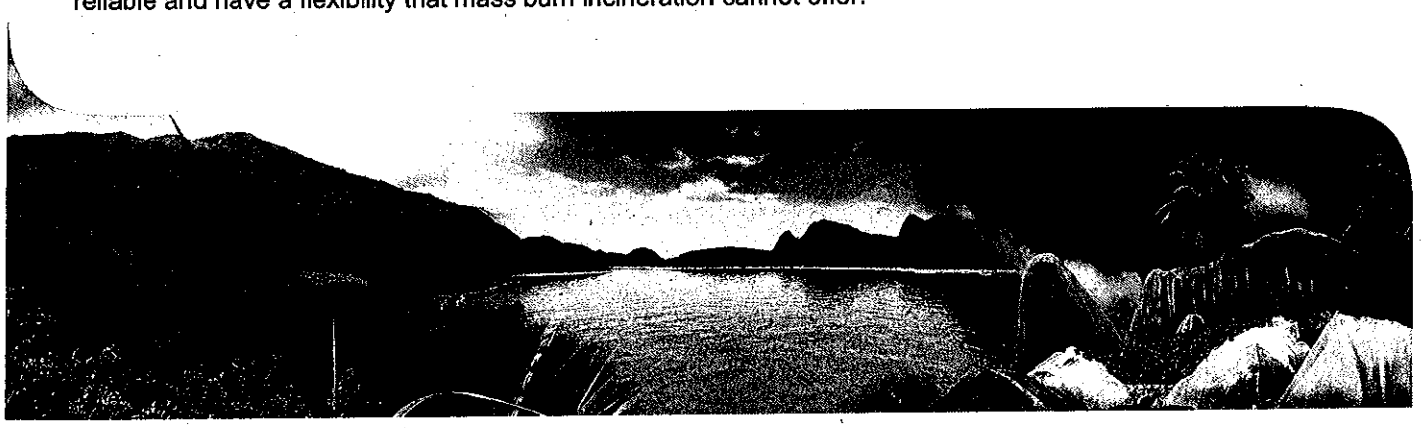


The key advantages of plasma gasification are:

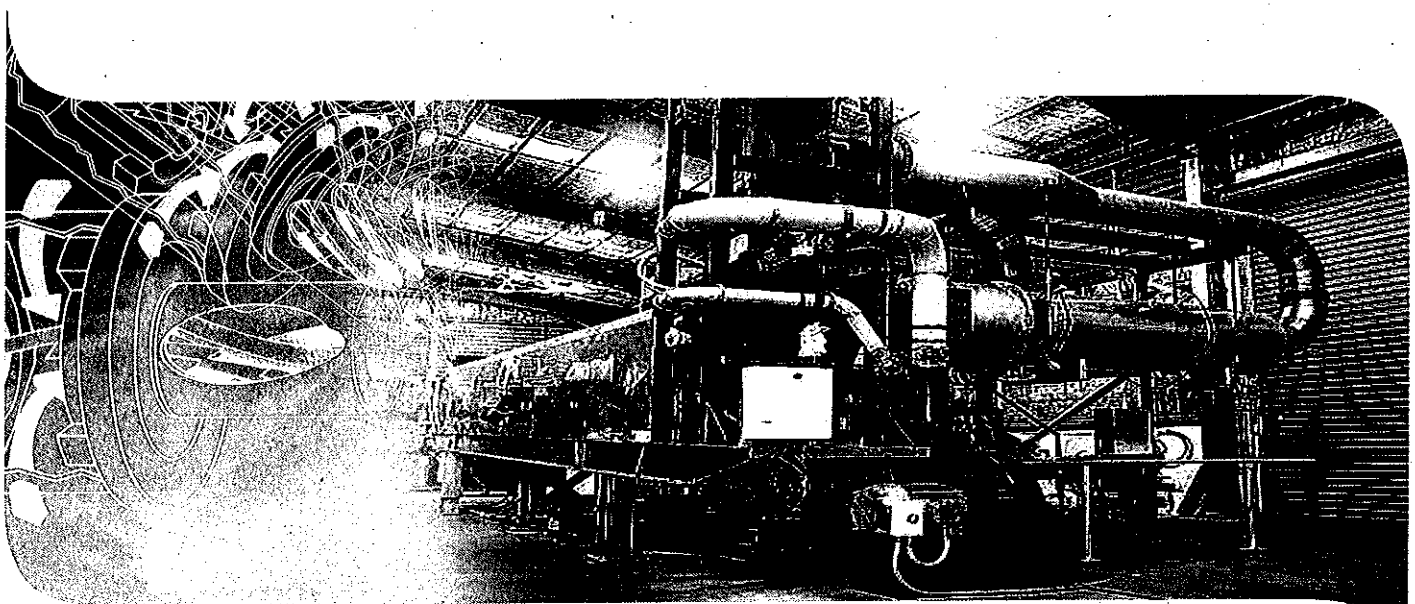
- It delivers an environmentally sound waste solution across the waste hierarchy, from general MSW to clinical and hazardous waste.
- The process does not produce hazardous bottom ash or fly ash.
- The facility is a switch-on/switch-off system it can be shutdown and started up at will.
- A plasma unit does not need to be brought up to temperature using expensive fuel oils unlike an incinerator.
- It does not need to be shut down for days or weeks for cleaning and maintenance.
- Plasma gasification is cost effective in relation to mass burn incineration.

Smaller communities

For smaller populations and island communities and in certain special situations, landfill and mass burn incineration is not sustainable. However, advanced high temperature plasma gasification waste to energy systems can be scaled to provide a very complete solution. The extremely high temperatures allow almost any waste stream to be input to the system with appropriate preparation and system design. The systems are simple, reliable and have a flexibility that mass burn incineration cannot offer.



Historical use of plasma



Plasma has been used in the metallurgical industry for well over thirty years. For the past two decades, a plasma smelting process has been in continuous operation in the USA for the treatment and recovery of materials containing platinum used in motor exhaust catalytic converters. The technology is used to process 7 million pounds of catalytic converters annually, and recycles some 500,000 ounces of platinum and 15,000 ounces of palladium back into the industrial system each year.

There are a number of plasma facilities operating in various configurations around the world; in Australia, Canada, France, Italy, Japan, Korea, Malaysia, Spain, Taiwan, the U.K. and the USA.

The US Military have been operating plasma systems since the mid 1990s. The technology has been successfully applied to a variety of waste streams including: waste paint and solvents (at the Norfolk, Virginia, Naval Base); contaminated soils (at the Savannah River Site North Carolina, a former tritium and plutonium -239 production site) and obsolete munitions, chemicals and clinical waste (at the Hawthorne Ammunition Depot, Nevada, the largest facility of its kind in the USA).

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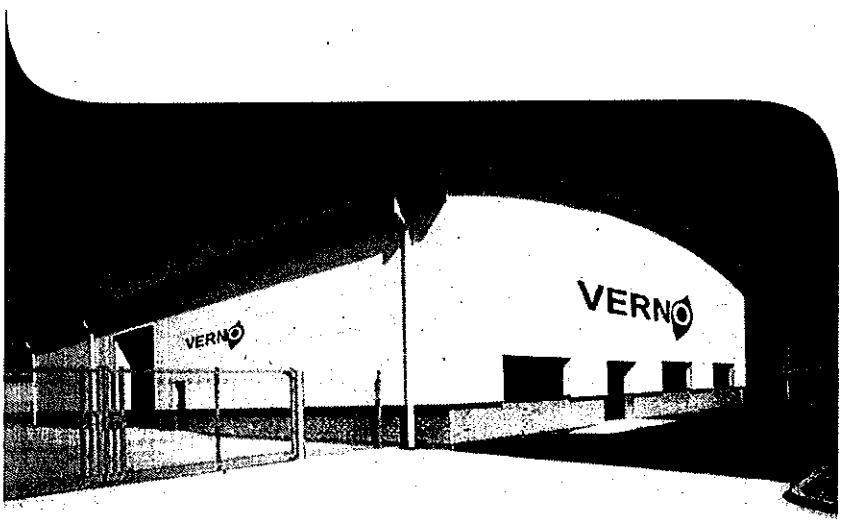
Planning, permits and physical requirements

Plasma gasification facilities typically occupy a much smaller footprint than similar capacity thermal processes, particularly mass burn incinerators. The physical size and the environmentally sound process help make the planning and permitting less problematic. The utilities and services required to operate a plasma gasification plant are typical of any industrial process.



Indicative construction of a plasma arc facility

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The next step

Verno provides a holistic approach to waste management, designing integrated waste resource management programmes including plasma gasification systems.

The company will perform a detailed feasibility study including an analysis of waste streams and the overall circumstances of the project. This exercise will include project specification, budgeting and financial modelling. Along with an integrated waste management strategy and implementation programme, a turnkey design and build specification will be drawn up for approval and implementation.

Please contact Ivan Richardson on +44(0)20 7288 8759 to discuss your requirements.