Summary of Qualifications

Westinghouse Plasma Gasification Technology

August 2012

Confidential Information

Westinghouse Plasma Corporation

a division of Alter NRG Corp.

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1. Executive Summary

At Westinghouse Plasma Corp ("WPC"), our Vision is "**To provide the leading technology platform for converting the world's waste into clean energy for a healthier planet**." We are working to make landfills obsolete and to replace incineration as the primary process for thermally treating waste.

We are well on our way. WPC's technology operates in three reference plants and two new commercial plants, including a 1000 tonne per day municipal waste plant, are under construction. A WPC plasma gasification plant is more efficient and more environmentally friendly than a state of the art incineration plant.

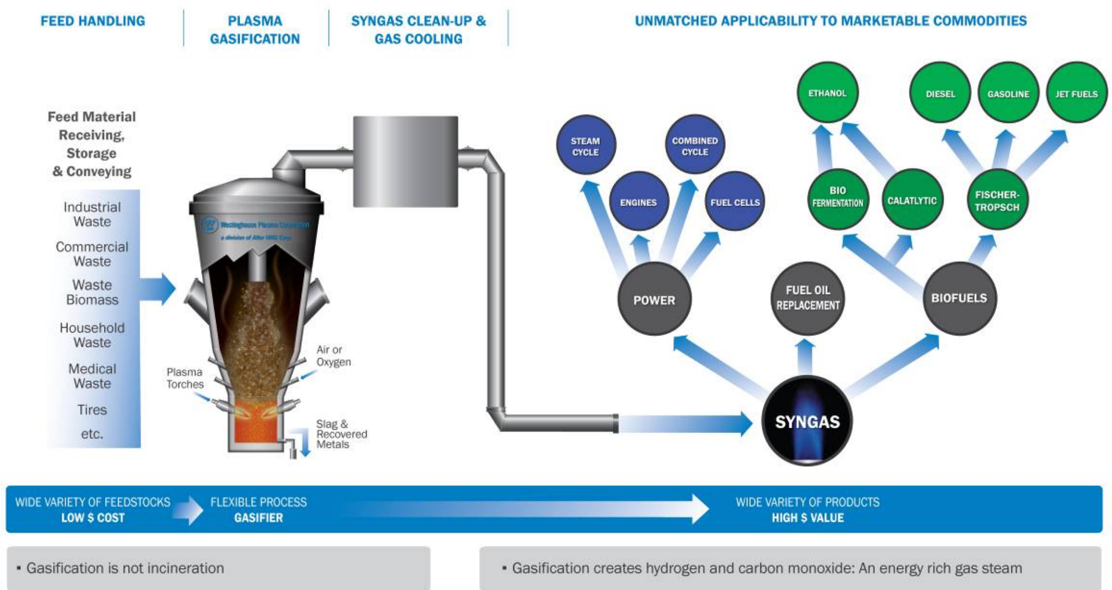
In the remainder of this document, we present in detail the qualifications of WPC and the merits of WPC's plasma gasification technology.

2. List of Abbreviations

Air Products	Air Products and Chemicals, Inc.
Alter	Alter NRG
APCI	Air Products and Chemicals, Inc.
ATT	Advanced Thermal Treatment
Cd	Cadmium
Cl	Chlorine
CO	Carbon Monoxide
CV	Calorific Value
EPC	Engineer, Procure and Construct
H_2	Hydrogen
Haz Waste	Hazardous Waste
Hg	Mercury
HRSG	Heat Recovery Steam Generator
IPGCC	Integrated Plasma Gasification Combined Cycle
JWRF	Japan Waste Research Foundation
Kaidi	Wuhan Kaidi Holding Investment Company Ltd.
kPag	Kilopascal gauge
kWh	Kilowatt hour
MEPL	Maharashtra Enviro Power Ltd.
MJ	Megajoule
MWh	Megawatt hour
Nm^3	Normal meter cubed
O_2	Oxygen
Pb	Lead
ROC	Renewable Obligation Certificate
S	Sulphur
tpd	Tonnes per Day
tpa	Tonnes per Annum
WESP	Wet Electrostatic Precipitator
WPC	Westinghouse Plasma Corporation
Zn	Zinc

3. Introduction

Westinghouse Plasma Corp provides technology to convert a wide variety of waste streams into a clean syngas which can be further converted into other forms of energy.



Our plasma gasification technology is used globally in three commercial facilities which process municipal waste, hazardous waste and sewage sludge. Air Products and Chemicals (“Air Products”), a Fortune 500 industrial gas company, has purchased a plasma gasifier from Westinghouse Plasma Corp for use in the 1000 tonne per day (300,000 tonnes per annum) plant they are constructing in Northeast England.

Our plasma gasification solution is ideally suited for a number of waste streams including:

- Municipal solid waste
- Commercial waste
- Industrial waste
- Petrochemical waste
- Medical waste, and
- Incinerator Ash

The clean syngas produced by our plasma gasification solution can be converted into a wide variety of energy products including:

- Electricity, through gas turbines, reciprocating engines and in the future, fuel cells
- Heat and steam, and

- Liquid fuels including:
  - Ethanol
  - Jet Fuel
  - Diesel and Naptha
  - Methanol
  - Propanol

Our vision is to provide the leading technology platform for converting the world's waste into clean energy for a healthier planet.

We are the clear leader in the plasma gasification market by virtue of the three commercial plants that use our technology. No other plasma gasification company has technology that is used commercially to process significant amounts of waste.

It is our goal to displace incineration as the most common method to thermally process waste, not only due to the economic benefits associated with higher efficiencies and higher value end products but also because of the environmental benefits. Plasma gasification is destined to become the best available technology for the treatment of waste.

Westinghouse Plasma Corp is a wholly owned subsidiary of Alter NRG, a Canadian company listed on the Toronto Stock Exchange (trading symbol NRG).

Westinghouse plasma gasification technology is the key enabling technology for converting waste into valuable energy products.

4. Introduction to Plasma and Plasma Gasification

4.1. What is Plasma?

At the most rudimentary level, plasma is just very high temperature thermal energy. In nature, plasma is produced by lightning when it superheats the air around the lightning bolt converting the air to plasma with a temperature of about 20,000 °C. Because plasma behaves differently than the three common states of matter; solid, liquid and gas, plasma is sometimes referred to as the fourth state of matter.

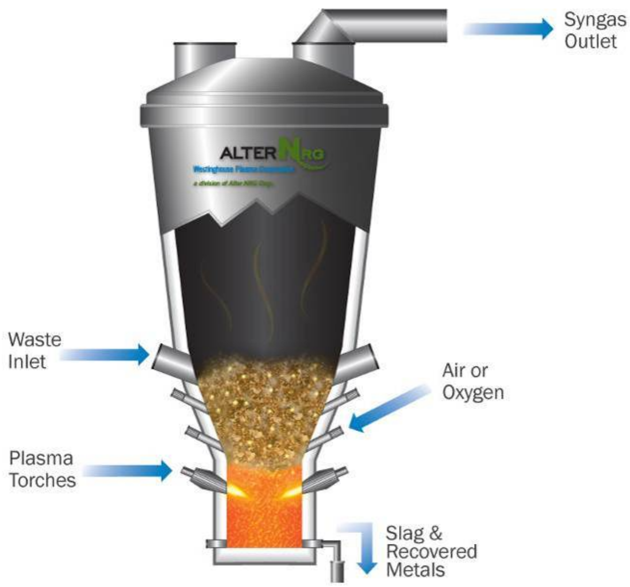
Westinghouse Plasma Corp creates plasma with its plasma torch systems. We create electric arcs, similar to lightning, inside our torches and push air through the arcs to create plasma. The plasma, with temperatures close to 5000 °C, is controlled and directed into our gasifier.

Plasma torches are sophisticated devices but their purpose is simple – they are high temperature heating devices.

4.2. What is Plasma Gasification?

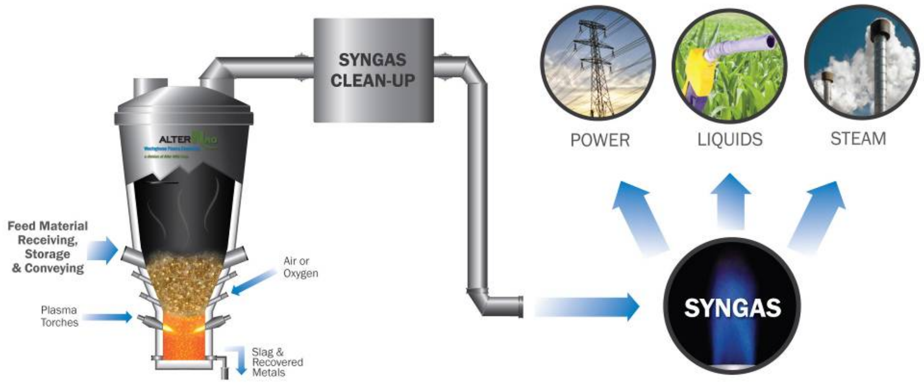
A plasma gasifier is an oxygen starved vessel that is operated at the very high temperatures achievable with plasma. Because the environment inside the vessel is deprived of oxygen, feedstock that is processed in the gasifier is not combusted. Rather, the heat breaks the feedstock down into elements like hydrogen and simple compounds like carbon monoxide and water. The gas that is created is call synthesis gas or "syngas".

Most feedstocks, including municipal solid waste, contain both organic and inorganic components. The organic components are converted into syngas. The inorganic components, like glass, metal and concrete, are melted inside the reactor and flow out of the bottom as a non-toxic vitrified molten slag which can be used safely as aggregate. A more detailed and technical description of the gasification and vitrification processes is given in Section 8.

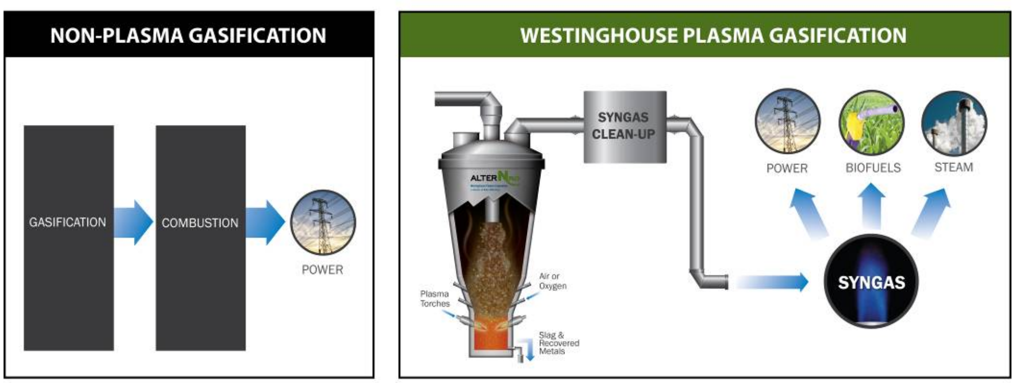


The heat from the plasma torch systems and the relatively long residence time in the gasifier ensures complete destruction of the feedstock and allows for the processing of high moisture feedstock or feedstock containing high levels of inert materials like glass and metals.

The syngas created in the gasifier, which contains dust (particulates) and other undesirable elements like mercury, undergoes a clean-up process to make it suitable for conversion into other forms of energy including power, heat and liquid fuels. The syngas clean-up process is tailored to meet the requirements for each project. But in most cases, especially where MSW is the feedstock, the syngas clean-up will include particulate removal, sulphur removal and mercury/heavy metals removal.



Plasma gasification differs from non-plasma gasification in one key area – temperature. Non plasma gasifiers typically operate between 800 and 900 °C. The temperatures inside Westinghouse Plasma's gasifier reach over 3000 °C. The syngas exits the gasifier at 950 °C. The slag flows out of the gasifier at 1650 °C. The higher temperatures inside our plasma gasifier result in the complete destruction of tars, something that is not achievable with non-plasma technologies. It is not feasible to remove tars downstream of the gasifier and therefore the utility of the syngas produced by non-plasma gasifiers is very limited. It can be burned immediately but it cannot be conditioned for use in gas turbines, reciprocating engines or for conversion into liquid fuels.



A more thorough comparison of Westinghouse Plasma Gasification technology versus incineration and other gasification technologies is shown in Section 5.

In summary, the Westinghouse Plasma Gasifier enables the conversion of difficult feedstocks like municipal solid waste into a clean syngas that is suitable for use in sophisticated equipment like high efficiency gas turbines or next generation liquid fuels technologies. In the near future, we expect to power fuel cells with syngas from our gasifier.

Westinghouse Plasma Corp has expertise in both plasma torch systems and plasma gasification.

5. Westinghouse Plasma Gasification – History and Commercial Experience

5.1. History of Westinghouse Plasma Corporation and Westinghouse Plasma Technology

Westinghouse Plasma Corporation's plasma technology was developed over a period greater than 30 years and with over $100 million in Westinghouse R&D funding. The WPC technology was initially developed in collaboration with NASA for use in the Apollo space program to simulate space vehicle re-entry conditions of over 5,500°C (10,000°F). Between 1983 and 1990, Westinghouse and the Electric Power Research Institute (EPRI) developed a reactor using plasma for reclaiming fragmented scrap metal. Between 1988 and 1990, Westinghouse extended the plasma cupola technology for the treatment of hazardous wastes including contaminated landfill material, PCB-contaminated electrical hardware, transformers and capacitors, and steel industry wastes.

In the mid 1990s WPC in cooperation with Hitachi Metals completed an R&D program and pilot testing program to confirm the capability of the plasma cupola to treat municipal solid waste (MSW) and other waste materials to produce a syngas which could be used in a power plant for the production of steam and electricity. A series of tests were completed at the WPC Plasma Center in Madison, Pennsylvania using a variety of feed materials and at varying moisture contents. The success of these tests provided the technical basis for the design and installation of a pilot scale 24 ton/day MSW gasification plant in Yoshii, Japan.

Hitachi Metals and WPC's combined efforts culminated in the demonstration to the Japanese government that the Yoshii WTE facility was capable of using plasma energy to reliably and economically gasify waste materials for energy production. In September 2000, The Japanese Waste Research Foundation awarded a process certification of the technology and the Westinghouse Plasma Gasifier was born.

Lessons learned at Yoshii were applied to full scale facilities in Mihama-Mikata and Utashinai Japan, which both began commercial operation in 2002 and 2003 and continue operating today. The experience gained at the two Japanese facilities was used to create the next generation gasifier which was commissioned in 2009 by SMSIL in Pune, India. That facility treats hazardous wastes from over 40 different industries.

More recently, Air Products purchased a plasma gasification reactor from Westinghouse for Air Products' 1000 tonne per day plant to be built in Northeast England.

Figure 5.1 illustrates the commercial history of Westinghouse Plasma Corp technology.

WESTINGHOUSE PLASMA PROJECTS

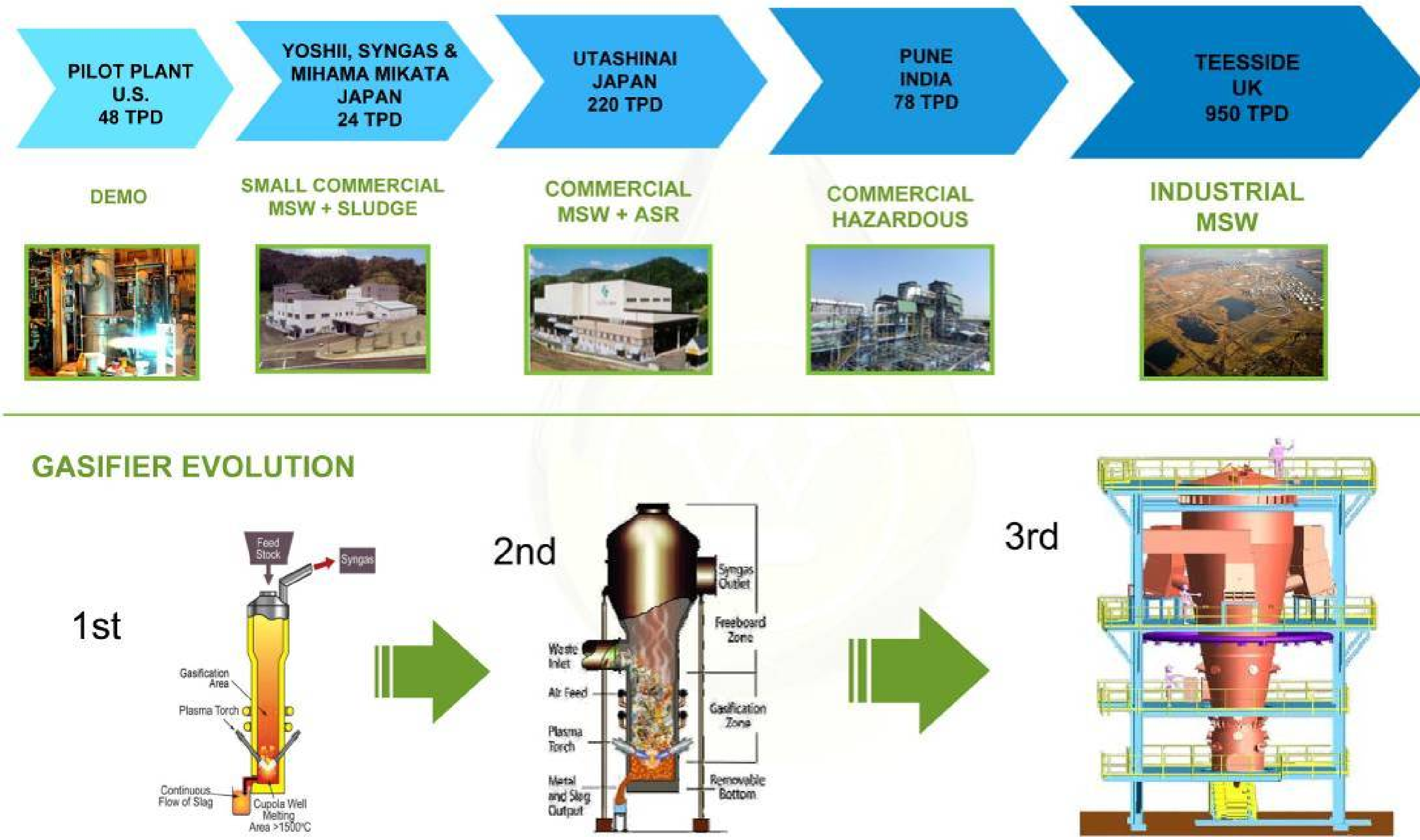


Figure 5.1 – Commercial History of Westinghouse Plasma Corp

In December of 2011, Wuhan Kaidi Holding Investment Co., Ltd. (Kaidi) began construction of a new technology park in Wuhan, China. The facility includes a 150tpd plasma gasification demonstration facility purchased from WPC. Kaidi anticipates that the facility will commission in late 2012 and will process biomass for conversion to power and liquid fuels

5.2. Commercial Installations

Westinghouse Plasma technology is used in three commercial operating facilities. It is being installed at two further facilities. Table 5.1 below provides a summary of each facility. A more detailed explanation of each plant is given in the following Sections.

	Operating Facilities			New Facilities	
	Mihama-Mikata	EcoValley	Maharashtra Enviro Power Ltd (MEPL)	Tees Valley Renewable Energy Facility	Sunshine Kaidi Energy Park
Location	Mihama, Japan	Utashinai, Japan	Pune, India	Tees Valley, England	Wuhan, Hubei, China
Owner		Hitachi, Muni and Territory Gov'ts	SMSIL	Air Products	Wuhan Kaidi
Capacity (tpd)	24	220	72	1000	150
Feedstock	20 tpd – MSW 4 tpd – sewage sludge	MSW	Various Hazardous Wastes	Sorted MSW	Mixed Wood Waste
Commissioning Date	2002	2003	2009	2014	Q4 - 2012
Output and Configuration	Heat - Boiler	Power - Boiler	Power - Boiler	Power – Combined Cycle	Ethanol - Catalytic

Table 5.1 - Summary of Operating Facilities and New Facilities

Mihama-Mikata, Japan

The Mihama-Mikata plant processes 20 tpd of MSW from the towns of Mihama and Mikata. It also processes four tpd of sewage sludge. The syngas is used to produce heat which is then used to dry the sewage sludge so it can be gasified.

All of the slag from the Mihama-Mikata plant is used beneficially as aggregate for concrete or paving stones.

The plant consistently meets it emissions requirements.

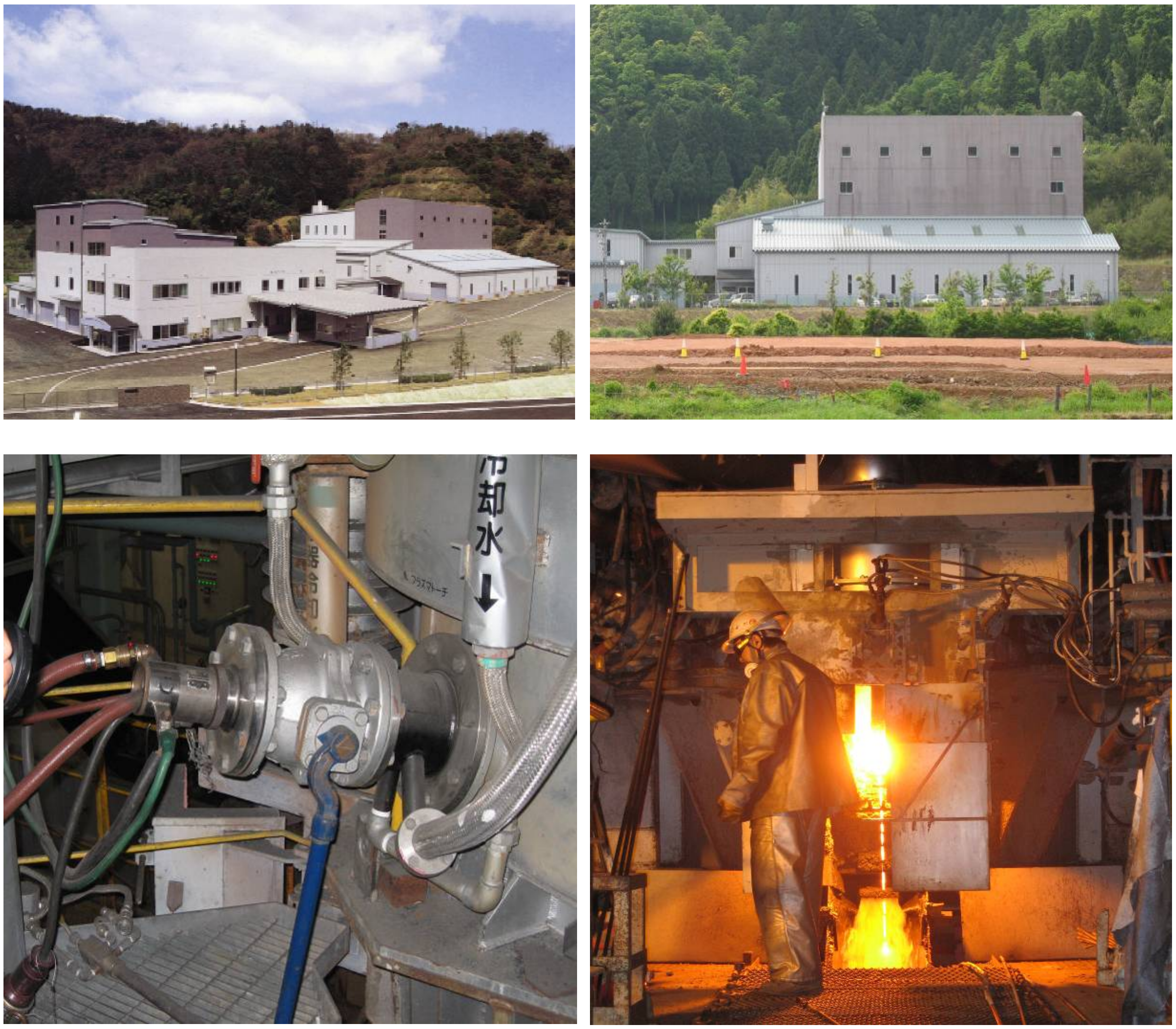


Figure 5.2 – Mihama Mikata Plasma Gasification Plant

EcoValley – Utashinai, Hokkaido, Japan

The EcoValley plant, which is located near the small town of Utashinai in a rural area on the island of Hokkaido, can process up to 220 tpd of pre-sorted MSW. The plant has two gasifier trains each capable of processing 110 tpd.

The plant currently operates at less than capacity due to a shortage of available feedstock.

WPC has been fortunate to have access to the operational data and operating staff of the plant. Hitachi Metals, the operators of the plant, modified and optimized the gasifier over the first several years of its operation. This commercial experience has been incorporated into the next generation gasifier design begin offered by WPC and purchased by Air Products. By comparison, WPC's competitors are struggling to build their first reference plants.

The plant consistently meets it emissions requirements.

Figure 5.3 – EcoValley Plasma Gasification Plant

MEPL, Pune, India

The MEPL plant processes hazardous wastes from over 30 industries in India. The owner of the plant, SMSIL, is a partner of WPC and together the companies offer plasma gasification into the Indian market.

Like the EcoValley plant, WPC has access to the operational data and the operating staff at the plant. SMSIL also makes the plant available to certain WPC customers for pilot tests and optimization tests. It is access to this type of information that allows WPC to accelerate the optimization of its technology – another advantage WPC has over its competitors.

Figure 5.4 – MEPL Hazardous Waste Plasma Gasification Plant

5.3. Demonstration Plants

WPC Commercial Demonstration Plant – Madison, Pennsylvania, USA

Westinghouse Plasma Corp owns and operates a demonstration facility located near Madison, Pennsylvania, USA. The demonstration reactor was built in 1984 and has been the home for countless gasification tests.

Our demonstration plant is a critical element for the successful completion of projects for customers and provides Westinghouse Plasma Corp another advantage over its competitors. We have the capability to gasify the feedstocks that our customers plan to process at their projects. The gasification tests provide valuable information about syngas and slag composition that help customers make decisions about the balance of plant design. The tests also provide information necessary for customers to obtain environmental permits. Air Products conducted a series of tests at our Madison demonstration plant in support of their Tees Valley Renewable Energy Facility.

Another customer, Coskata, the owner of a technology that converts syngas to ethanol, recently completed two years of successful testing at our demonstration plant. WPC gasified both wood waste and municipal solid waste to create syngas which Coskata subsequently converted to ethanol.

Our demonstration plant includes downstream gas cleaning equipment and state of the art, real-time gas composition monitoring. There are three distinct feeding systems through which almost any solid or liquid can be fed into the gasifier. WPC has predictive modeling capability, which includes the balance of plant, through VMG simulation software.

WPC has gasified a wide range of feedstocks at its demonstration plant including:

- Municipal solid waste
- Refuse derived fuel
- Construction and demolition waste
- Hazardous waste, including PCB contaminated waste and harbour sediment sludge
- Waste water sludge
- Waste wood and clean wood chips
- Bagasse
- Excavated landfill material
- Tires
- Auto Shredder Residue (also know as auto fluff)
- Heavy oil
- Incinerator ash

WPC continues to refine its core plasma torch and gasification technology based on the results obtained at its demonstration plant and the experience at operating facilities.

Demonstration Plant

Bulk Sack Feed System

Thermal Oxidizer

Wet Electrostatic Precipitator

Control Room

Demonstration Plant Tours and Presentations

The process block flow diagram for the demonstration plant is shown in Attachment 1.

Japanese Commercial Demonstration Plant - Yoshii

Based on the success of their joint development efforts with WPC, Hitachi Metals built a 24 tpd commercial demonstration plasma gasification plant in Yoshii, Japan in 1999. Hitachi Metals operated the plant for one year on municipal solid waste and obtained a certification from the Japan Waste Research Foundation (JWRF).

The JWRF certification and its English translation are shown in Attachments 2 and 3.

Hitachi Metals leveraged the success of the Yoshii plant into the two commercial plants at Mihama-Mikata and Utashinai, Japan.

5.4. Facilities under Construction

Tees Valley Renewable Energy Facility

Air Products has commenced the construction of the Tees Valley Renewable Energy Facility and will be starting construction in the near future. Air Products has purchased the gasifier for the plant, a G65, from WPC and commissioning is planned for 2014. WPC will deliver the gasifier to the site in early 2013.

The facility will process 1000 tpd of pre-sorted MSW and produce electricity through a combined cycle power island configuration. A combined cycle power island is the combination of a gas turbine(s), a heat recovery steam generator and a steam turbine and is considered the most efficient technology for converting gas to power.

The facility will employ sophisticated syngas clean-up technology to ensure the syngas meets the demanding specifications of the gas turbines.

The emissions from the power island will be very similar to those from a traditional natural gas fired combined cycle power plant. Air Products has received its environmental approval from the UK government.

Air Products' business plan includes the development of at least four more facilities similar to the Tees Valley plant.

Site Location for Air Products Tees Valley Plant – NE England

Tees Valley Gasifier Fabrication In Progress






Wuhan Kaidi Wood Waste Plant

In December of 2011, Wuhan Kaidi, a very large Chinese energy company, began construction of a new technology park in Wuhan, China. The facility includes a 150tpd plasma gasification demonstration facility purchased from WPC. Kaidi anticipates that the facility will commission in late 2012 and will process biomass for conversion to power and liquid fuels

Kaidi's business plan includes building numerous facilities of capacities greater than 800 tpd of biomass.

Wuhan Kaidi Site Location

5.5. Third Party Verification of Westinghouse Plasma Gasification Technology

Westinghouse plasma gasification technology has been reviewed and endorsed by independent industry experts as a technically robust and environmentally superior waste conversion technology. A summary of six reviews is given below.

Company	Credentials	WPC Review Results
R·W·BECK	R.W. Beck is a group of technically based business consultants serving public and private infrastructure organizations worldwide	RW Beck reviewed WPC's plasma gasification technology for power plant retrofit and MSW applications and identified no major technical challenges and opined that "the plasma technology appears to be a sound method of gasifying organic feedstocks and producing fuel gas compatible with boiler combustion" and "the review did not identify major design issues."
ENSR | AECOM	ENSR, a division of AECOM, is a global provider of environmental and energy development services	ENSR – AECOM completed an engineer's review that verifies WPC's assumptions of emissions from a 750 tpd MSW Plasma Gasification Combined Cycle WTE facility will be below emission limits for North America. The report confirms that processing waste through plasma gasification results in "emission levels substantially below mass burn processes."
amec	AMEC provides scientific, environmental, engineering and project management support in more than 30 countries	AMEC/BDR completed Design Basis Memorandums that included complete process flow diagrams and CAPEX estimates for three different facility configurations: combined cycle, steam cycle and syngas.
Golder Associates	Golder Associates provides civil/geotechnical and environmental consulting services worldwide	Golder reviewed emissions data from Utashinai and Mihama-Mikata and confirmed that the existing plants operate below their regulated emissions limits in Japan, as well as below North American Standards

SHIMADZU	Shimadzu Techno Research is an analytical research service provider in the health, environment and product and material testing markets	Shimadzu Techno Research tested slag from the Mihama Mikata plasma gasification facility in Japan. The results of this study showed that this vitrified slag composition is considered inert and does not contaminate soil or drinking water.
Juniper	Juniper Consultancy is recognized as one of the leading independent analysts of emerging technologies in the waste management field	Juniper conducted a thorough review of the Westinghouse Plasma Gasification technology and the technology in application at the Mihama-Mikata and Utashinai WTE facilities. Juniper recognizes these facilities as "the only commercial plasma gasification facilities in the world processing MSW." Juniper acknowledges the Alter NRG/Westinghouse Plasma Gasification technology as more proven than direct competitors and views Alter NRG as becoming a world leader in the design and supply of plasma-based systems.

Westinghouse Plasma Corp's continues to build on its commercial experience in order to improve its product offering and to minimize technical risk for its customers.

6. Comparison of WPC Plasma Gasification to Other Waste Treatment Options

6.1. Benefits/Advantages of Westinghouse Plasma Gasification Technology

Optimize Gate Fee (tipping fee) Revenue and Energy Output Revenue

Unlike the typical incineration technology which can process only MSW and similar feedstocks, a WPC plasma gasifier can process almost any feedstock including both solids and liquids. Plus it can process a blend of feedstocks. Project owners can optimize their revenue streams by determining the correct mix of feedstocks based on calorific value and gate fee.

And, as long as there is some flexibility built into the feedstock handling systems, plasma gasification facility owners can change feedstocks over the life of the plant to take advantage of feedstocks with higher gate fees.

In many markets, plasma gasification, especially in combination with gas turbines and/or reciprocating engines, qualifies for green energy incentives. In the UK, Air Products will receive two Renewable Obligation Certificates (ROCs) for every MWh produced at the Tees Valley facility.

Reduce Start-up and Operational Risk

WPC is installing its fourth generation gasifier at Air Products' Tees Valley project. The issues normally associated with the operation of first generation technology have been experienced and solved. Most of WPC's direct competitors have not yet installed their technology into their first commercial facility. WPC's experience during the commissioning and operations at previous installations, like the Hitachi Metals EcoValley plant in Japan, will result in a shorter commissioning period and higher availability for customers during the first years of operation.

WPC will continue to gain commissioning and operational expertise at the Tees Valley facility and Kaidi's plant once those plants become operational.

Reduce Permitting Time and Expense

WPC's technology, in a combined cycle or reciprocating engine application, will meet all the requirements of the EU's Waste Incineration Directive, as evidenced by Air Products' receipt of an environmental permit from the UK government's Environment Agency. Plus, the technology qualifies as Advanced Thermal Treatment (ATT) and thus receives preferential treatment over non-ATT technologies like incineration.

Superior Environmental Performance

The environmental benefits of a plasma gasification facility include:

- Lower emissions
- Beneficial use of biproducts and a reduction in the amount of material that ultimately must be landfilled
- Lower greenhouse gas footprint

Each is explained in detail in the following sections.

Lower Emissions

A plasma gasification combined cycle power plant or reciprocating engine plant is completely different than an incineration plant from an emissions perspective. Where incineration technology literally burns MSW to create energy, WPC's technology uses extreme heat to break down the MSW to its molecular constituents including hydrogen and carbon monoxide, the two building blocks of syngas. In a combined cycle or reciprocating engine application, syngas is cleaned up to a specification similar to natural gas. It is this clean syngas that is burned in a gas turbine or reciprocating engine to make power. Emissions from this sort of plant will be very similar to a natural gas fired power plant.

See Table 6.3 for a comparison of emissions between a plasma gasification combined cycle power plant and an incineration plant.

Syngas, after clean-up can meet the following specifications. More stringent specifications can be met if necessary.

	Specifications
Sulphur	< 200 ppmw
Alkali Metals	< 1 ppmw
Volatile Metals	< 1 ppmw
Halogens	< 1 ppmw
Particulate Matter	< 20 ppmw
Syngas Calorific Value	7-12 MJ/Nm^3

Table 6.1 – Syngas Specifications after Clean-up

ENSR/AECOM, a global energy and environmental development services company, provided the following assessment….

WPC's 750 tpd WTE plasma gasification facility "will result in **substantial renewable energy production** from post consumer waste streams that would normally have to be land filled, while providing state-of-the-art emission control of:

- Sulphur dioxide (SO_2)
- Acid gases such as hydrogen chloride (HCl) and hydrogen fluoride (HF)
- Oxides of nitrogen (NOx)
- Mercury (Hg)
- Particulates (PM, PM_{10} and $PM_{2.5}$) including non-mercury heavy metals
- Volatile organic compounds (VOC) including dioxins, furans and poly-aromatic hydrocarbons

"These **emissions will be substantially lower** than traditional mass burn or refuse derived fuel processes commonly used in the waste to energy industry. Diversion of MSW from solid waste landfills (where the potent greenhouse gas methane is formed) will result in substantial net decreases in greenhouse gas emissions as CO_2 equivalent. Since the proposed organic feed stocks are post consumer waste streams, the project represents a renewable and sustainable clean energy resource."

Beneficial Byproducts vs. Bottom Ash and Flyash

A WPC gasification plant produces vitrified slag as a byproduct. The slag is inert and safe to use as aggregate or in other applications. Slag will not contaminate soil or drinking water. Slag from the Mihama Mikata plant has been tested against several standards including JLT-46, NEN-7341 and TCLP analysis. These tests were conducted by two independent laboratories Shimadzu Techno-Research Inc. and ALS Laboratory Group. The results show that the Mihama-Mikata slag components are below the test detection limits and the slag is considered non-leaching. Below is a chart showing some of the results from the JLT-46 tests:

Non Leaching Vitrified Slag: Mihama Mikata Slag JLT-46 Results				
Heavy Metal	Units	Method Detection Limit	Average Measured Value of Slag	JLT-46 Limit
Arsenic	mg/L	0.001	< 0.001	0.01
Cadmium	mg/L	0.001	< 0.001	0.01
Chromium VI	mg/L	0.005	< 0.005	0.05
Lead	mg/L	0.001	< 0.001	0.01
Mercury	mg/L	0.0001	< 0.0001	0.005
Selenium	mg/L	0.001	< 0.001	0.01

Notes:
1) mg/L – parts per million
2) JLT -46 performed by Shimadzu Techno Research Inc. on Mihama Mikata slag samples.

Table 6.2 – Results of JLT Slag Tests

One hundred percent of the slag from the Mihama Mikata plant is used as aggregate for concrete products.

A WPC plasma gasification plant also produces particulate which is removed from the syngas downstream from the gasifier. However, the particulate can be recycled back into the gasifier for destruction and therefore does not become a byproduct that needs to be disposed of.

Instead of slag, incineration plants produce bottom ash and flyash. The flyash requires special disposal and in many jurisdictions is considered hazardous waste.

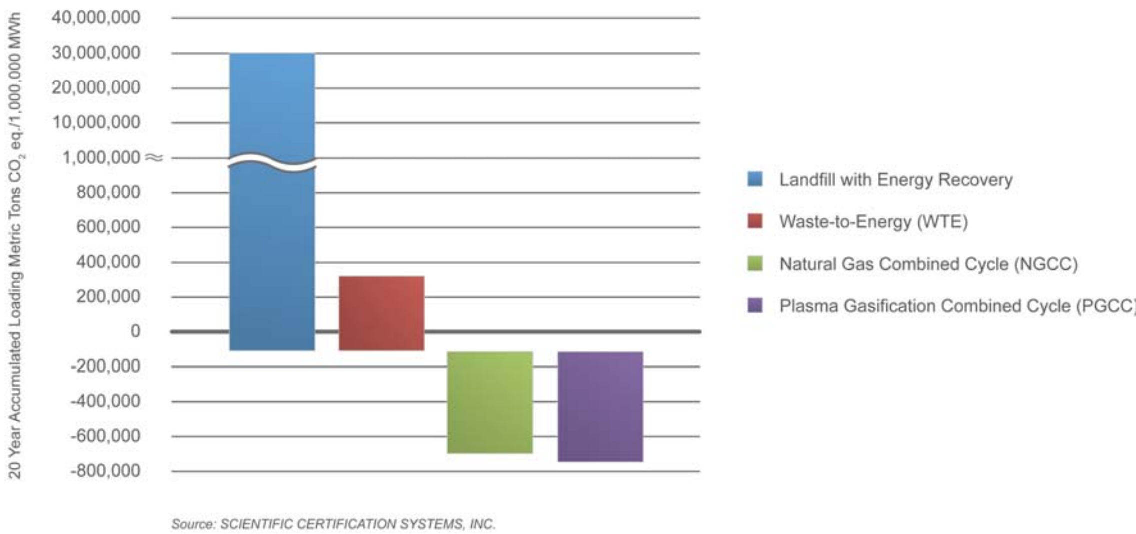
Assuming that particulate is recycled back into the gasifier, only about 2-4% of the material introduced into a WPC plasma gasification plant needs to be sent to landfill. In comparison, about 20% to 30% of the waste processed in an incinerator must be sent to landfill.

Lower Greenhouse Gas Footprint

Scientific Certification Systems ("SCS"), an independent consultancy, produced a report in 2010 that compared the lifecycle greenhouse gas emissions of a plasma gasification combined cycle power plant with the emissions from a state of the art incineration facility and a landfill with energy capture facility.

In their report SCS states

> "The results of this analysis show that the Plasma Gasification Combined Cycle ("PGCC") system provides the lowest greenhouse gas emissions of the evaluated systems for waste disposal". Figure 6.1, from the SCS study, shows a comparison of the greenhouse gas emissions from the three scenarios plus the greenhouse gas emissions from a state of the art natural gas fired combined cycle facility.
> The SCS study also concluded that the lifecycle greenhouse gas emissions were almost equivalent to the state of the art natural gas combined cycle power plant.
>
> Reduced emissions, reduced amounts of solid wastes that need to be landfilled and reduced greenhouse emissions – plasma gasification has better environmental performance in all areas."



Notes:
1) Twenty year accumulated GHG loading for four power generation options.
2) Results compared on a basis of 1,000,000 MWh.
3) Northeast Power Coordinating Council region. Zero on Y-axis represents average greenhouse gas emissions from power plants per 1 million MWhs in the region.

Figure 6.1 – Results of SCS Lifecycle Greenhouse Gas Emissions Study

6.2. Comparison of Westinghouse Plasma Gasification to Other Thermal Treatment Alternatives

Comparison to Incineration

Table 6.3 details the numerous benefits of Westinghouse plasma gasification versus incineration for the treatment of MSW.

	Westinghouse Plasma Gasification	Incineration
Feedstock Flexibility	Ability to mix feedstocks such as • MSW • Industrial Waste • Commercial & Industrial Waste • Hazardous Waste • Tires Waste • Biomass Fuels (such as wood waste)	MSW and other common waste streams
Fuel Created	Syngas (Carbon Monoxide and Hydrogen)	not applicable
End Product Opportunities	• Replacement Fuel for Natural Gas and Fuel Oil • Power via Steam cycle • Power via Combined cycle or Reciprocating Engines • Power via Fuel Cells (future) • Process Steam • Liquid Fuels (ethanol, bio-diesel) • Hydrogen • Fertilizer Compounds	Power via Steam cycle Process Steam
Overall Plant Efficiency	Combined Cycle Process: 1 tonne of municipal solid waste is capable of creating 1000 kWh of power via combined cycle configuration	Steam Cycle Process: 1 tonne of municipal solid waste generates between 500-650 kWh of power
Emissions	Combined Cycle Process: • Nitrogen Oxide (NOx): <36 ppmvd • Sulfur Dioxide (SO2): <1.05 ppmvd • Mercury (Hg): <1.4 µg/dscm²	• Nitrogen Oxide (NOx): 110-205 ppmvd • Sulfur Dioxide (SO2): 26-29 ppmvd • Mercury (Hg): 28-80 µg/dscm²
Dioxins and Furans	High operating temperature (>1000°C) in conjunction with an oxygen starved environment destroys any dioxins/furans that may be present in the feedstock, and eliminates the potential for the creation of dioxins/furans. Rapid syngas cooling via water quench prevents de-novo synthesis of dioxins and furans.	The presence of oxygen, chlorine, and particulate creates the right conditions for the formation of dioxins and furans.

By-product	Inert, non-hazardous and non-leaching glassy slag salable as an aggregate building product or rock wool Most particulate recovered during cleaning of the syngas is recyclable	Hazardous fly ash and scrubber residues plus incinerator bottom ash

Table 6.3 – Westinghouse Plasma Gasification vs. Incineration

Comparison to Other Plasma Gasification Technologies

	Westinghouse Plasma Gasification	Other Plasma Technologies
Commercial Reference Plants	Three commercial references. Two others under construction.	Most have no commercial reference plants.
Operational Experience	Greater than ten years	None, except that some competitors have experience at small demonstration plants
Demonstration Plant	Yes, up to 50 tpd	Some competitors have a demonstration plant. Some are at lab scale. Some do not have a demonstration plant.
Plasma Gasifier Design	Simple single vessel design	Most competitors employ a multi-step design.
Plasma Torch Technology	30 years experience. Developed and owned by Westinghouse Plasma Corp.	Must be purchased. No expertise in plasma torches.
Scale	Up to 1000 tpd in a single vessel. Continuous feeding.	Up to 150 tpd for some competitors. Some competitors use batch feeding.

Table 6.4 – Westinghouse Plasma Gasification vs. Other Plasma Technologies

Comparison to Non-Plasma Gasification Technologies

The benefits of Westinghouse plasma gasification versus non-plasma gasification technologies are quite similar to the benefits or our technology versus incineration.

	Westinghouse Plasma Gasification	Non-Plasma Gasification Technologies
Syngas Quality	Tar free syngas suitable for clean-up to specifications required by gas turbines, reciprocating engines, liquid fuel technologies and fuel cells.	Syngas must be immediately combusted before being cleaned.
Feedstock Flexibility	Ability to mix feedstocks such as • MSW • Industrial Waste • Commercial & Industrial Waste • Hazardous Waste • Tires Waste • Biomass Fuels (such as wood waste)	Limited ability to process waste streams other than MSW. Lower temperatures limit feedstock flexibility
End Product Opportunities	• Replacement Fuel for Natural Gas and Fuel Oil • Power via Steam cycle • Power via Combined cycle or Reciprocating Engines • Power via Fuel Cells (future) • Process Steam • Liquid Fuels (ethanol, bio-diesel) • Hydrogen • Fertilizer Compounds	Power via Steam cycle Process Steam
By-product	Inert, non-hazardous and non-leaching glassy slag salable as an aggregate building product or rock wool. Most particulate recovered during cleaning of the syngas is recyclable	Similar to incineration - hazardous fly ash and scrubber residues plus bottom ash.

Table 6.5 – Westinghouse Plasma Gasification vs. Non-Plasma Technologies

Westinghouse Plasma Corp technology will increase revenues, decrease operational risks and provide superior environmental performance versus other technologies. We are the only company with commercial reference plants – three with two more under construction.

7. Gasifier Models and Gasifier Plant Capacities

7.1. Westinghouse Plasma Gasifier Models

WPC has three standard sizes of plasma gasifiers. Table 7.1 shows the typical capacity and other information for each model.

Gasifier Model	Feedstock	Capacity (tpd)				Syngas Produced (Nm^3/hr)	Dimensions (meters)			
		Air Blown		Oxygen Blown			Top Dia.	Bottom Dia.	Vessel Height	Installed Height[3]
		Low	High	Low	High					
G65	MSW	540	620	1000	1000	65,000	9	4	24	30
	Haz Waste	430	720	830	1000					
W15	MSW	120	140	240	290	15,000	6	2.5	15	18
	Haz Waste	100	160	190	300					
P5	MSW	40	50	80	100	5,000	4	2	10	13
	Haz Waste	30	50	60	100					

Notes:
1) MSW calorific value (C.V.) range: 9.3 - 14.0 MJ/kg (4000 - 6000 Btu/lb) HHV basis
2) Hazardous waste C. V. range: 14.0 - 23.3 MJ/kg (6000 - 10,000 Btu/lb) HHV basis
3) Ground level to syngas exit flange. Ductwork height excluded as it is project specific.

Table 7.1 – Gasifier Specifications

7.2. Energy Production by Gasifier Model

WPC technology can be used in facilities that produce electricity, liquid fuels, heat or syngas to replace fossil fuel. Table 7.2 provides some representative examples of the energy output that can be expected from a WPC gasification plant processing MSW

Gasifier Model	Capacity (tpd of MSW)	Syngas Produced (NM^3/hr)	Syngas Chemical Energy, HHV (GJ/yr)	Combined Cycle Power Plant (MW gross and net)	FT Liquids BPD / BPY	Fossil Fuel Replacement (bbls/year)
G65	1000	65,000	4,100,000	58 / 39	785 / 287,000	670,000
W15	290	15,000	976,000	14 / 9	188 / 68,000	160,000
P5	100	5,000	323,000	4.5 / 3	62 / 23,000	50,000

Notes:
1) Based on 14 MJ/kg (6000 Btu/lb) HHV Basis

Table 7.2 – Typical Energy Production by Gasifier Model

The actual outputs from a WPC gasification facility will depend on the specific feedstock being used and the actual configuration of the plant.

Gasifiers can be installed in parallel to create a plant with the capacity to suit any needs.

8. Westinghouse Plasma Corp Scope of Supply and Support Services

Westinghouse Plasma Corp's expertise is the plasma gasifier and its subsystems (more fully described in Section 9). WPC will design, fabricate and deliver the plasma gasifier to a customer.

While some customers will choose to purchase only the plasma gasifier from WPC, most customers want a complete solution. WPC, in concert with a global engineering, procurement and construction ("EPC") partner can design and construct a complete plasma gasification plant.

Each plasma gasification plant is unique. WPC, again in concert with an EPC partner, can assist its customers with technical and commercial support during the entire project development process. We can conduct feasibility studies in the early stages and we can provide more detailed levels of engineering (for example - Pre Front End Engineering Design and Front End Engineering Design) in latter stages. WPC also offers on-site commissioning support.

WPC has a talented and experienced technical team. Unlike our competitors, we have designed and commissioned plasma gasifiers. We know what it takes to properly support a customer that is investing tens or hundreds of millions of dollars.

WPC offers performance guarantees on the plasma gasifier. Our EPC partners can offer performance guarantees on complete plants.

9. Typical Plasma Gasification Facility

9.1. Introduction

This section provides a summary of the major process blocks that make up an integrated plasma gasification combined cycle (IPGCC) power plant that uses MSW as a feedstock. The Air Products Tees Valley Renewable Energy facility is configured as an IPGCC. As described earlier in this document, plasma gasification can be used to produce syngas which can be conditioned and then converted to liquid fuels or power through technology platforms like fuel cells or reciprocating engines. For all of those applications, the majority of the plant, that portion that is dedicated to processing waste and making clean syngas, will be quite similar

Figure 9.1 shows the process block flow diagram for an IPGCC plant.

9.2. Plant Process Summary

MSW is delivered to the plant receiving facility which will have several days of storage capacity. The other two materials, coke and flux, which are fed into the gasifier concurrently with the MSW are also delivered to the facility. The flux material is typically crushed limestone and its purpose is to promote proper slag flow within the gasifier. The coke forms a bed within the reactor. Coke usage is typically 1:25 on a mass basis versus the MSW. The amount of flux necessary can vary between 0:25 and 2:25 on a mass basis.

The three materials are metered onto a common charge conveyor which transports the feedstock to the gasifier. Depending on the size of the MSW, it may have to be shredded on site to a size less than approximately 15 cm before being put onto the conveyor.

Within the gasifier, the organic portion of the MSW is converted into syngas. The syngas is partially quenched with atomized water at the top of the gasifier prior to exiting the gasifier at a temperature of approximately 850 C through two nozzles.

The metallic and ash content of the MSW forms molten slag, which flows through the tapholes at the bottom of the gasifier. The slag is then quenched and granulated upon exiting the gasifier. The resulting vitreous granules are conveyed and loaded onto trucks for export to customers off-site.

The gasifier is equipped with Westinghouse plasma torch systems to ensure the internal temperatures in the reactor are sufficient to guarantee complete conversion or inorganic material to syngas and to melt all the inorganic material.

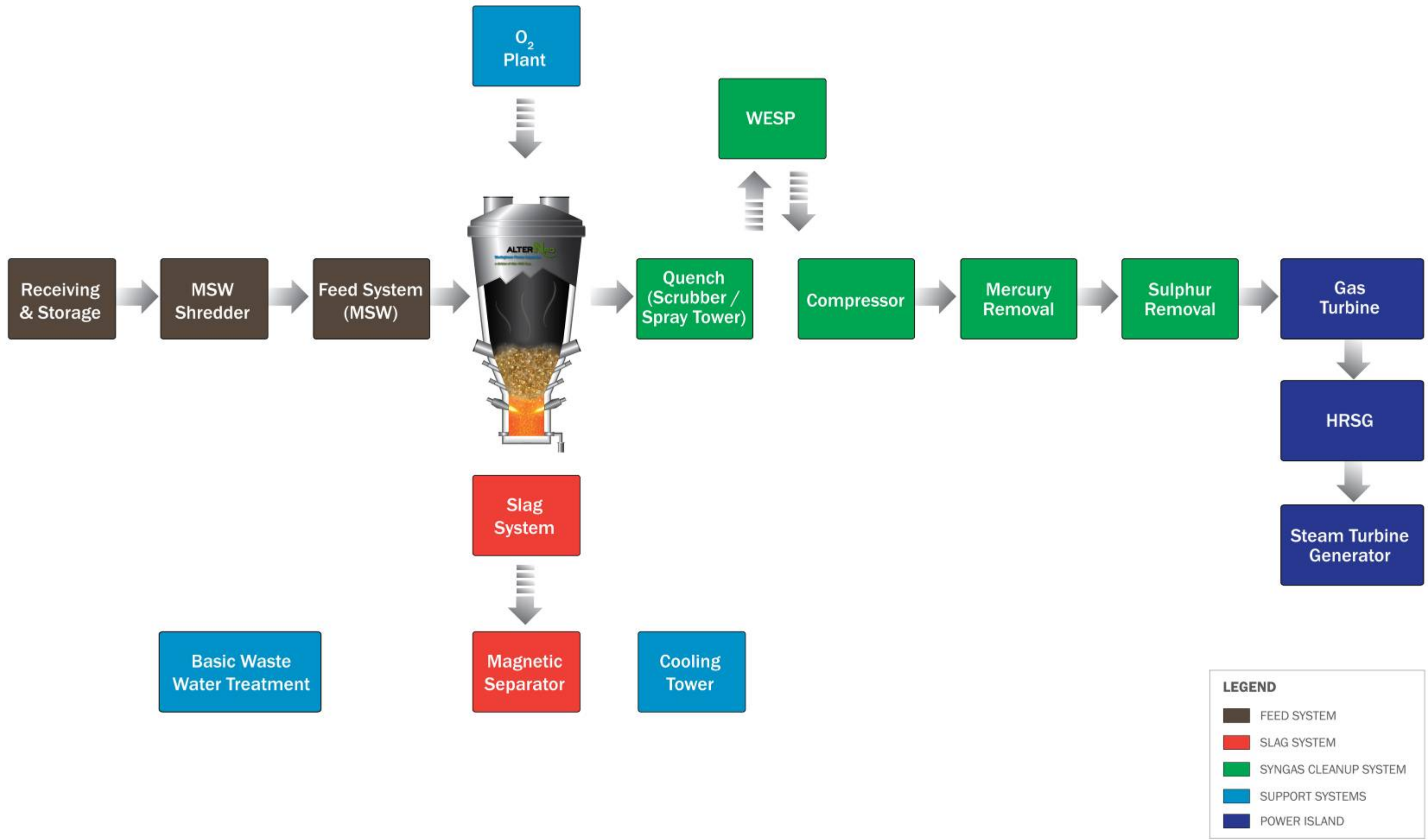


Figure 9.1 Process Block Flow Diagram for IPGCC Plant

Syngas is cooled through a caustic venturi quench and scrubber system and then proceeds through a wet electrostatic precipitator (WESP). The primary purpose of the venturi quench and WESP is to remove the particulate matter entrained in the syngas. The cooled and particulate free syngas proceeds through a series of syngas cleaning processes to remove chlorine, sulphur, lead, cadmium, zinc and mercury. Intermediate compression and cooling steps remove moisture from the gas.

The clean syngas is then compressed in a multi-stage compressor and fed into a gas turbine to produce electrical power. The turbine flue gas heat is recovered by a heat recovery steam generator ("HRSG"). The steam from the HRSG is combined and fed to a multi-stage steam turbine to generate power.

Alternately, the cleaned syngas can be used in reciprocating engines to make power or it can be converted to liquid fuels using a number of available conversion technologies.

9.3. Example of IPGCC Plant Inputs and Outputs

Figure 9.2 provides and example of the inputs and outputs of a 1000 tpd IPGCC plant that process MSW.

As shown in Figure 9.5, an IPGCC plant that processes 1000 tpd of MSW will produce about 49 MW of power. It will also produce about 250 tpd of slag that can be sold as aggregate. A further 20 tpd of coarse particulate is produced which can be recycled back into the gasifier. The remaining 20 tpd of fine particulate, which includes elements like cadmium and mercury must be properly disposed of. In other words, an IPGCC plant will convert 1000 tpd of MSW will produce only 20 tpd of residuals that require long term disposal. The other 980 tpd is converted into electricity and beneficial products.

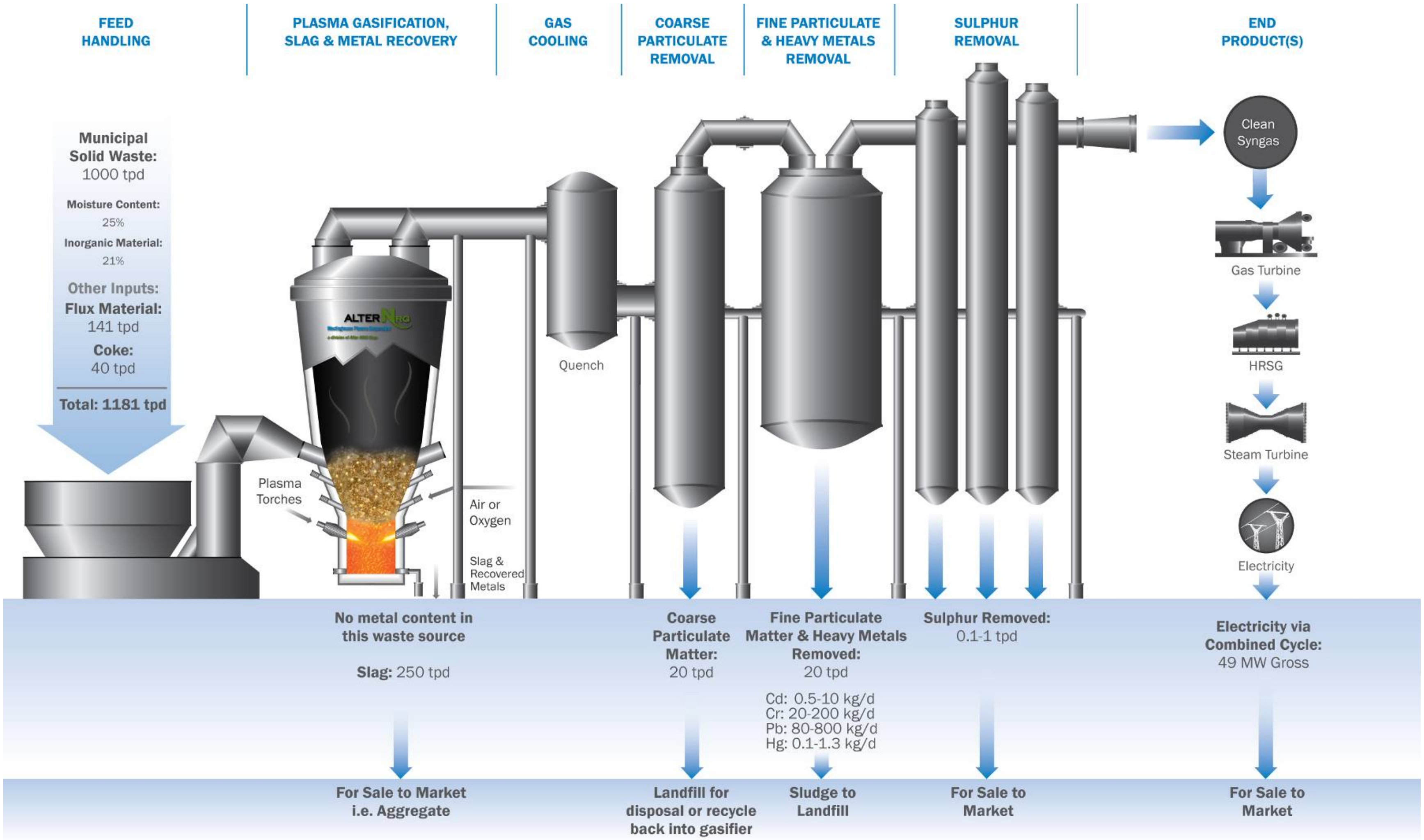


Figure 9.2 – Inputs and Outputs for 1000 tpd IPGCC Plant

10. Example Plant Economics

The economics of a plasma gasification plant are a function of numerous factors. WPC has created a proprietary economic modeling platform ("WPC Scoping Model") that we use to assist customers in the early stages of project development.

The WPC Scoping Model allows customers to quickly assess the impact of changing numerous assumptions such as:

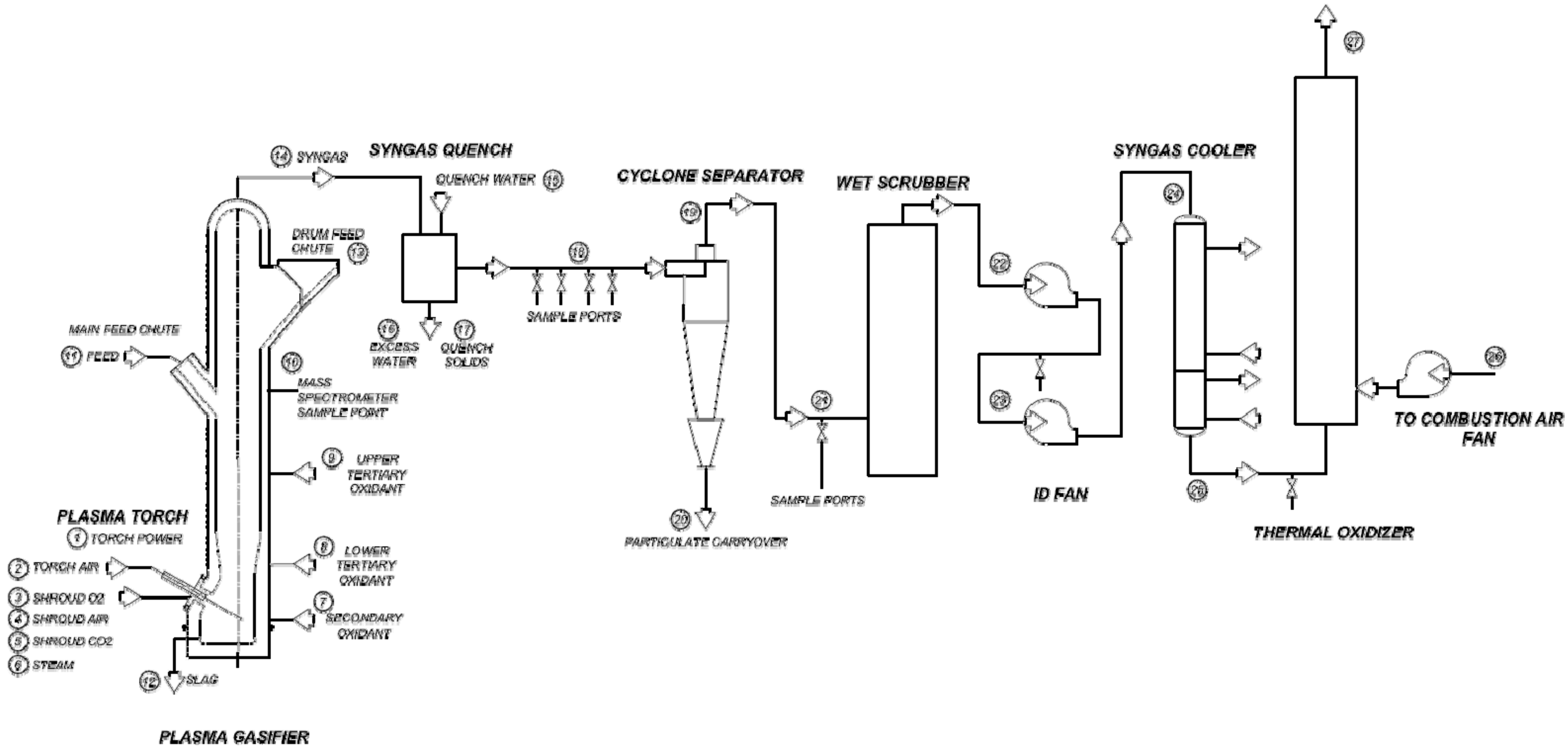
- Plant capacity
- Type of feedstock (MSW, RDF, tires, electrical waste, auto shredder residue, etc)
- Gate fees (tipping fees)
- Combinations of feedstocks and gate fees
- Power prices and/or liquid fuel prices
- Plant configuration (combined cycle, reciprocating engines, FT liquids, etc)
- Labour rates for plant staff
- Renewable energy incentives
- Interest rates
- Debt and equity levels
- Installation factors specific to a geography
- Contingency factor

The outputs from the WPC Scoping Model include:

- Estimated capital cost
- Estimated operating expenses
- Internal rate of return
- Return on equity

The WPC Scoping Model provides only indicative capital cost estimates and project returns. Its purpose is not to provide definitive costs and returns. It is a great tool for running "what-if analyses" in the early stages of project development.

Attachment 1 – Demonstration Plant Process Block Flow Diagram



Attachment 2 – Japanese Waste Research Foundation Certification (Japanese)

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JWRF

技術開発支援概要書

第　1　号

プラズマ式直接溶融炉によるごみ処理技術

（本技術の概要）
　本技術は、ごみをプラズマ式直接溶融炉内に投入し、プラズマ及びコークスを熱源として乾燥、熱分解、燃焼、溶融を一体の炉で行い、不燃物は溶融した後にスラグ及びメタルとして回収するものである。

（技術開発支援申請者）
　申請者　日立金属株式会社
　代表者　代表取締役社長　本多　義弘
　住　所　東京都港区芝浦１－２－１

　廃棄物処理技術開発支援事業実施規程に基づき、平成１１年７月３０日に受理した上記技術については、下記のとおり技術開発支援を終了した。

平成１２年９月１日

財団法人　廃棄物研究財団
理事長　山村 勝美

記

1　申請技術の特徴
　申請による本技術の主な特徴は、以下のとおりである。
(1)　幅広いごみ質に対応し安定運転が可能であること。
(2)　高温燃焼によりダイオキシン類の生成を抑制できること。
(3)　重金属類の溶出に問題のないスラグの回収が可能であること。
(4)　スラグ化率が高く飛灰量が少ないこと。

2　技術開発支援の範囲と前提
(1)　本技術は都市ごみの処理技術に適用する。
(2)　群馬県吉井町クリーンセンター敷地内に設置された２４ｔ／日×１系列の実証施設を技術開発支援の対象範囲とした。

3　技術開発支援の実施方法
　技術開発支援の実施に当たっては、実証試験の実施方法、データ等の整理の仕方、考え方等について指導助言を行い、また、申請者から提出された技術資料及び実証試験データを解析し、ヒアリングを行うなど、総合的に調査を行った。

4　技術開発支援の調査結果
　本技術は、適切にごみの処理を行うことができる技術であると判断される。
(1) プラズマ電力量制御により、幅広いごみ質に対応し安定運転が可能であると認められる。
(2) 溶融スラグは溶融固化物の再生利用に係る目標基準及び土壌環境基準を満足していると認められる。
(3) 本技術による排ガス処理後の排ガス性状は、煙突部でダイオキシン類濃度0.1ng-TEQ/m^{3}N以下が達成していると認められる（O_2 12%換算値）。
(4) スラグ化率が90%以上であると認められる。

5　技術開発支援の詳細
　別添の廃棄物処理技術開発支援調査結果報告書による。
　なお、報告書には、実用施設が円滑に設置管理されるよう安全性、耐久性、スケールアップ等に関し付帯事項を記している。

JAPAN WASTE RESEARCH FOUNDATION

Attachment 3 – Japanese Waste Research Foundation Certification (English Translation)

JWRF

Technology Development Support Certificate

No. 1

Waste Management Technology by Plasma Method Direct Melting Furnace

(Technology Outline)

This technology is summarized as disposing waste into Plasma Method Direct Melting Furnace; drying, pyrolizing, combusting, and melting in single unit furnace aided by plasma and coke as a heat source; then recycling slag and metal.

(Applicant: Hitachi Metals)

Representative: Yoshihiro Honda, President
Address: 1-2-1 ShibauraMinato-ku, Tokyo

Technology Development Support Certificate was awarded on July 30, 1999 as follows based by Waste Management Technology Support Regulations.

Date: Sept. 1,2000

By: Waste Research Incorporated Foundation   Director: Katsumi Yamamura

Description

1. Characteristics of this Technology
   (1) Possible to operate safely coping with various types of waste.
   (2) Can control the generation of dioxin through high temperature combustion.
   (3) Possible to recycle high quality slag arresting heavy metal within.
   (4) High slag production with minimum amount of fly ash.

2. Scopes and Premise of Technology Development Support
   (1) This technology is well adapted to MSW management.
   (2) 24t/day empirical facility at Yoshii Clean Center is the scope of subject for this certificate.

3. Implemental Method of Technology Development Support
   Foundation conducted comprehensive research such as guiding and advising with implemental method, data acquisition, and an approach to the problem, analyzing the technical test data.

4. Research Results
   It is judged that this technology is appropriate for waste management.
   (1) It is approved that this technology can safely operate coping with a wide variety of wastes by plasma power control.
   (2) It is recognized that this slag satisfied the Recycle and Soil Standard.
   (3) It is recognized that exhaust gas density at stack is below 0.1 ng-TEQ/m3 N (02, 12% conversion value)
   (4) It is recognized that the ratio from waste to slag is over 90%.

5. Details
   See attached Waste Management Technology Development Support Research Result Report. The report also includes the durability, scale-up, and safety in order to administer the facility smoothly.

Japan Waste Research Foundation