Transformation of Waste into Syngas using Plasma Gasification for the Production of Energy or Biofuels
Our Vision
To provide the leading technology platform for converting the world’s waste into clean energy for a healthier planet

Primary Market is Energy from Waste
- Our strength is being able to convert almost any waste stream (incl. municipal, commercial, industrial, petrochemical, and medical) into syngas
- Most of our customers are currently choosing to make power and heat
- We are probably not the best solution for a clean biomass plant

Strategic Partnerships
WHAT IS PLASMA?

- Plasma is highly ionized or electrically charged gas
- An example in nature is lightning - capable of producing temperatures exceeding 7,000° C
- An ionized gas is one where the atoms of the gas have lost one or more electrons and has become electrically charged

Our plasma torch systems create the intense heat inside our plasma gasifier
PLASMA TECHNOLOGY IS A KEY ENABLING TECHNOLOGY

FEED HANDLING | PLASMA GASIFICATION | SYNGAS CLEAN-UP & GAS COOLING | UNMATCHED APPLICABILITY TO MARKETABLE COMMODITIES

Feed Material Receiving, Storage & Conveying

- Municipal Solid Waste
- Industrial Waste
- Waste Biomass

Plasma Torches
Air or Oxygen
Slag & Recovered Metals

WIDE VARIETY OF FEEDSTOCKS
LOW $ COST
FLEXIBLE PROCESS
GASIFIER
WIDE VARIETY OF PRODUCTS
HIGH $ VALUE

- Gasification is not incineration
- Gasification creates hydrogen and carbon monoxide: An energy rich gas steam

Westinghouse Plasma Corporation
a division of Alter NRG Corp.

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www.westinghouse-plasma.com
PLASMA GASIFICATION – PAST AND FUTURE

PAST

STEAM CYCLE POWER

PRESENT

IGCC/RECIP POWER

SYNGAS CLEANUP

FUTURE

ETHANOL
FISCHER-TROPSCH LIQUIDS
PROPANOL

BIOFUELS

HYDROGEN SEPARATION

FUEL CELLS
REFINERY
VEHICLES

UTASHINAI, JAPAN
PUNE, INDIA
TEES VALLEY, UK
FUEL CELLS
EVOLUTION: FROM DEMO…TO COMMERCIAL…TO INDUSTRIAL…

WESTINGHOUSE PLASMA PROJECTS

PILOT PLANT
U.S.
48 TPD

YOSHII, SYNGAS &
MIHAMA MIKATA
JAPAN
24 TPD

UTASHINAI
JAPAN
22 P TPD

PUNE
INDIA
78 TPD

TEESSIDE
UK
950 TPD
(PERMITTED)

DEMO
SMALL COMMERCIAL
MSW + SLUDGE

COMMERCIAL
MSW + ASR

COMMERCIAL
HAZARDOUS

INDUSTRIAL
MSW

GASIFIER EVOLUTION

1st
2nd
3rd & 4th
ALTER NRG PLASMA GASIFICATION HAS MATERIAL COMMERCIAL ADVANTAGES

• Minimal feedstock preparation
  – Typically a basic pre-sorting of recyclables and a one stage shredding of the material

• Handles a wide range of feed compositions
  – Blend any number of solid or liquid feedstock’s
  – Ability to blend feedstocks reduces project feedstock risk and significantly increases project economics

• High reliability
  – Operates in rugged industrial applications
  – Over 500,000 hours and 20 years of industrial use on the plasma torches

• Superior Environmental Footprint
  – Vitrified Slag is inert/non-leaching and is being used as a construction aggregate
  – Air emissions significantly below legislated limits
# WESTINGHOUSE PLASMA vs INCINERATION

<table>
<thead>
<tr>
<th>Feedstock Flexibility</th>
<th>Westinghouse Plasma Gasification</th>
<th>Incineration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Ability to mix feedstocks such as</td>
<td>• MSW and other common waste streams</td>
</tr>
<tr>
<td></td>
<td>– MSW</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Industrial Waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Commercial &amp; Industrial Waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Hazardous Waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Tires Waste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>– Biomass Fuels (such as wood waste)</td>
<td></td>
</tr>
</tbody>
</table>

| 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 Steam cycle                     | • Process Steam        |
|                           | • Power via Combined cycle or Reciprocating Engines |                     |
|                           | • Power via Fuel Cells (future)              |                     |
|                           | • Process Steam                              |                     |
|                           | • Liquid Fuels (ethanol, bio-diesel)         |                     |
|                           | • Hydrogen                                   |                     |
|                           | • Fertilizer Compounds                       |                     |

| 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): 110-205 ppmvd |
|                         |   – Nitrogen Oxide (NOx): <36 ppmvd | • Sulfur Dioxide (SO₂): 26-29 ppmvd |
|                         |   – Sulfur Dioxide (SO₂): <1.05 ppmvd | • Mercury (Hg): 28-80 μg/dscm² |
|                         |   – Mercury (Hg): <1.4 μg/dscm² |              |

| By-product               | • Inert, non-hazardous and non-leaching glassy slag salable as an aggregate building product or rock wool | • Hazardous Fly Ash and Scrubber Residues |
|                         | • Most particulate recovered during cleaning of the syngas is recyclable | • Incinerator Bottom Ash |
APPENDIX
PLASMA GASIFICATION - FEEDSTOCK FLEXIBILITY

Westinghouse Plasma Corp gasification technology can:

• Process heterogeneous feedstock with minimal feed preparation
• Process high moisture and high inert content waste
• Blend solids, liquids and slurries
• Reduce dependence on one feedstock, optimize revenue based on available feedstocks
• Produce a tar free syngas – something most non-plasma gasification technologies cannot do

Westinghouse Plasma customers are currently processing or in the planning stages of processing the following feedstocks:

• MSW
• RDF/SRF
• Medical Waste
• Garbage dredged from river
• Paints/solvents
• Petrochemical waste - oil sludge
• Sewage waste
• Auto Shredder Residue
• Tires
• E-waste
• Biomass including wood chips, rice husks, bagasse, etc

• Construction and Demolition waste
• Petcoke flyash
• Spent ammunition
• Animal waste
• Meat processing plant waste
• Hazardous waste
• Cuttings from drilling activity
• Waste mined from landfill
• Waste coal or coal dust
• Pharmaceutical waste
• Forestry Industry waste (black liquor, paper sludge)
• PCB contaminated soil
PROVEN FEEDSTOCK FLEXIBILITY

Mihama-Mikata, Japan
• 24 tpd of waste to power
• MSW and waste water sludge
• Commissioned in 2002

Utashinai, Hokkaido, Japan
• 220 tpd of waste to power
• MSW and auto shredder residue
• Constructed in 2002, operational since 2003

Pune, India
• 72 tpd of hazardous waste to power
• Over 40 different hazardous waste streams blended
• Commissioned in 2009

Westinghouse Plasma Center
• 48 tpd Pilot Facility
• Completed over 125 tests, including a 2 year waste to cellulosic ethanol demonstration
• Over 40 different feedstocks tested, including MSW, hazardous, biomass, tires, medical, petrochemical, ash, liquids etc.
CONTINUOUS TECHNOLOGY OPTIMIZATION
WPC COMMERCIAL DEMONSTRATION FACILITY, PA, USA

- Up to 48 tpd pilot facility in Madison, Pennsylvania, USA
- Completed over 125 pilot tests to provide baseline information on various feedstock's
- Recently completed a 2 year commercial demonstration of the Coskata cellulosic ethanol technology
- WPC testing was a critical piece of the Air Products commercial facility design process
- State of the art, real-time gas composition monitoring
- Predictive modeling capability through VMG simulation software, including balance of plant
- Actively working on refining the core plasma torch and gasification technology
- Capability to test almost any feedstock
- Wide range of feedstocks tested, including:
  - Waste (municipal solid, refuse derived fuel, hazardous waste, construction and demolition waste)
  - Waste Water Sludge
  - Wood and Bagasse
  - Coal
  - Excavated Landfill Material (PCB disposal)
  - Tires
  - Auto Shredder Residue
  - Heavy Oil
  - Ash
“I welcome the progress that Air Products has made with its project to bring advanced gasification to the UK. Energy from Waste leads to considerable reductions in waste going into landfill, and makes an important contribution to the UK’s low carbon energy supply. This new technology will be an exciting addition to the energy from waste sector and I look forward to seeing the announcement of more of these projects.”

- Greg Barker, UK Energy and Climate Change Minister

“Air Products hopes to build up to five advanced gasification plants in the UK in the coming years, amounting to an investment of more than £1bn and with the potential to generate around 250 MW of electricity.”


“Today’s announcement makes clear the Government’s commitment to supporting long-term investment in the UK’s renewables industries.”

- Nick Clegg, The UK Deputy Prime Minister
SUPERIOR ENVIRONMENTAL FOOTPRINT

Air Emissions and Slag leachate tests were independently undertaken and were significantly below legislative laws

<table>
<thead>
<tr>
<th>Heavy Metal</th>
<th>Unit</th>
<th>Method Detection Limit</th>
<th>Average Measured Value of Slag</th>
<th>JLT-46 Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arsenic</td>
<td>mg/L</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.01</td>
</tr>
<tr>
<td>Cadmium</td>
<td>mg/L</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.01</td>
</tr>
<tr>
<td>Chromium VI</td>
<td>mg/L</td>
<td>0.005</td>
<td>&lt;0.005</td>
<td>0.05</td>
</tr>
<tr>
<td>Lead</td>
<td>mg/L</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.01</td>
</tr>
<tr>
<td>Mercury</td>
<td>mg/L</td>
<td>0.0001</td>
<td>&lt;0.0001</td>
<td>0.005</td>
</tr>
<tr>
<td>Selenium</td>
<td>mg/L</td>
<td>0.001</td>
<td>&lt;0.001</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Notes: mg/L = parts per million (PPM)
JLT-46 performed by Shimadzu Techno Research, Inc., Kyoto Japan on Mihama-Mikata slag samples received from Kamokon
SYNGAS SPECIFICATIONS AFTER CLEANUP

After gas clean-up, Syngas production using Westinghouse Plasma Gasification technology can meet the following quality specifications:

<table>
<thead>
<tr>
<th>Component</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur</td>
<td>&lt; 200 ppmw</td>
</tr>
<tr>
<td>Alkali metals</td>
<td>&lt; 1 ppmw</td>
</tr>
<tr>
<td>Volatile metals</td>
<td>&lt; 1 ppmw</td>
</tr>
<tr>
<td>Halogens</td>
<td>&lt; 1 ppmw</td>
</tr>
<tr>
<td>Particulate</td>
<td>&lt; 20 ppmw</td>
</tr>
<tr>
<td>Syngas Calorific Value</td>
<td>7-12 MJ/Nm³</td>
</tr>
</tbody>
</table>

Most stringent specifications can usually be met.

Note: ppmw: Parts per Million by weight
3D MODEL OF PLASMA GASIFICATION FACILITY
CONCLUSIONS

Less Risk – The WPC solution is commercially proven and operating at scale
- Westinghouse Plasma has commercialized the world leading platform for converting difficult waste streams into energy rich syngas
- Westinghouse Plasma is commercially proven at scale with multiple reference facilities throughout the world
- Plasma gasification has been identified in many countries as the waste conversion technology of choice.

Transformation of waste into various “Back-end” products
- The Westinghouse Plasma Technology is able to process multiple waste streams, and create an energy rich syngas that is a key building block for many other products: Energy / Hydrogen / Ethanol / Fertilizers / Bio-Diesel

Environmentally Sustainable
- Proven non-leaching aggregate appropriate as a construction material
- Air emissions and slag leachate tests were independently undertaken and were significantly below legislative laws
- Valuable energy products can be created from the syngas

Economically Attractive
- Projects are economic in today's markets with returns in excess of 20%
- Westinghouse Plasma technology attracts preferential tipping fees and off take contracts in certain markets
WESTINGHOUSE PLASMA GASIFICATION TECHNOLOGY HAS BEEN REVIEWED AND ENDORSED BY INDEPENDENT INDUSTRY EXPERTS AS A TECHNICALLY ROBUST AND ENVIRONMENTALLY SUPERIOR WASTE CONVERSION TECHNOLOGY

<table>
<thead>
<tr>
<th>Company</th>
<th>Credentials</th>
<th>Review Highlights</th>
</tr>
</thead>
<tbody>
<tr>
<td>R.W. Beck</td>
<td>Group of technically based business consultants serving public and private infrastructure organizations worldwide</td>
<td>RW Beck reviewed Alter NRG’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 feedstock’s and producing fuel gas compatible with boiler combustion” and “the review did not identify major design issues.”</td>
</tr>
<tr>
<td>ENSR – AECOM</td>
<td>Division of AECOM, global provider of environmental and energy development services</td>
<td>ENSR – AECOM completed an engineer’s review that verifies Alter NRG’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.”</td>
</tr>
<tr>
<td>AMEC</td>
<td>Provides scientific, environmental, engineering and project management support in more than 30 countries</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 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 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.
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