PLASMA PROCESSING OF MSW AT COAL-FIRED POWER PLANTS

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Plasma MSW Processing System Schematic
PLASMA PROCESSING OF MSW AT COAL-FIRED POWER PLANTS

Concept

• Collocate MSW plasma processing plants (in modules of 1,000 TPD) with existing operational coal-fired power plants.
• The amount of coal supplied to a plant will be reduced, proportionate to the thermal output of the MSW plant.
• The hot gaseous emissions from the plasma plant afterburner system will be fed directly into the coal plant combustion chamber to supplement the combusted coal gases.
• The combined plasma and coal gaseous emissions would produce steam and power equal to the normal coal plant generating capacity.
• MSW would replace large volumes of coal for power generation in a very efficient, cost-effective and environmentally cleaner operation.
PLASMA PROCESSING OF MSW AT COAL-FIRED POWER PLANTS
# Typical Power Plant Air Emissions

<table>
<thead>
<tr>
<th>Fuel</th>
<th>CO₂</th>
<th>SO₂</th>
<th>NOₓ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal (1)</td>
<td>2249</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>Oil (1)</td>
<td>1672</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Natural Gas (1)</td>
<td>1135</td>
<td>0.1</td>
<td>1.7</td>
</tr>
<tr>
<td>MSW Incineration (1)</td>
<td>2988</td>
<td>0.8</td>
<td>5.4</td>
</tr>
<tr>
<td>MSW Plasma Gasification (2)</td>
<td>&lt;1900</td>
<td>&lt;1.0</td>
<td>&lt;2.0</td>
</tr>
</tbody>
</table>

(1) Based on EPA Data  
(2) Based on Empirical Data
PLASMA PROCESSING OF MSW AT COAL-FIREDPOWER PLANTS

Power Plant Advantages

• More efficient coal combustion
  – Significantly higher combustion chamber temperatures from the MSW plasma process
• Significantly cleaner air emissions
  – Cleaner coal combustion gases
  – Cleaner MSW process gases
  – Will help meet the year 2018 requirements of the Clear Skies Act
• Significant cost savings
  – Reduced coal requirements
  – Reduced coal ash landfill requirements
  – Reduced cost for MSW process gas
  – Reduced pollution control equipment needs
    • Cleaner air emissions from the MSW plasma process
• Applicable to existing and planned coal-fired power plants
• Equally applicable to petroleum-fired power plants
• MSW plasma processing technology available today
  – Geoplasma, LLC
PLASMA PROCESSING OF MSW AT COAL-FIRED POWER PLANTS

MSW Processing Advantages

• Plant capital costs reduced by over 50%(1)
  – Utilize power plant boiler, generation and emission control systems
• More than 50% more electrical energy from MSW gases
  – Large coal-fired generation systems are more efficient (~35%) than smaller generation systems for MSW alone (~20%)
• Significantly lower operating costs
  – Use of power plant systems reduces number of MSW-associated systems
• Salable solid residue
  – Gravel, sand, aggregate for concrete, asphalt and concrete pavers
• Cost-competitive with landfill tipping fees throughout most of U.S.
• Need for landfills is eliminated

(1) Geoplasma, LLC estimated costs
PLASMA PROCESSING OF MSW AT COAL-FIRED POWER PLANTS

Summary

By 2020, if all MSW was processed by plasma at coal-fired power plants (1 million TPD), MSW could:

• Supply about 5% of U.S. electricity needs
• Replace about 140 million TPY of coal
• Eliminate about 15 million TPY of coal ash going to landfills
• Provide significantly cleaner coal plant air emissions
• Support the goals of the Clear Skies Act
# YEAR 2020
## SELECTED RENEWABLE ENERGY SOURCES

<table>
<thead>
<tr>
<th>Source</th>
<th>Quads (10^{15} BTU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Processed MSW(^{(1)})</td>
<td>0.90</td>
</tr>
<tr>
<td>Geothermal(^{(2)})</td>
<td>0.47</td>
</tr>
<tr>
<td>Landfill Gas(^{(2)})</td>
<td>0.12</td>
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<tr>
<td>Solar(^{(2)})</td>
<td>0.09</td>
</tr>
<tr>
<td>Wind(^{(2)})</td>
<td>0.05</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Assumed 1 million TPD  
\(^{(2)}\) Extrapolated from 1999 statistics
Capital Costs: Incineration vs Plasma Gasification Facilities

Cost ($millions) vs Capacity (tons/day)

Incineration-Only and Waste-to-Energy (WTE) Facilities
- Incineration-Only
- Incineration-WTE
- Plasma Stand-Alone WTE
- Plasma/Coal Plant WTE

(Note: Plasma Costs are Geoplasma LLC Estimates)