Conversion of Municipal Solid Waste into Clean Energy Products Using the InEnTec Plasma Enhanced Melter®

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Outline

• PEM® Technology Description
• Project Review
  – S4 Energy – Columbia Ridge
• Future Commercialization
• Summary
S4 Energy Solutions, LLC

- Originally 50/50 JV: combined an environmental services leader (WM) with a proven technology leader (InEnTec)
  - JV formed to integrate and commercially deploy gasification and other technologies to produce flexible, clean energy using waste feedstocks
  - JV was formed in February 2009
- WM converts to become one of InEnTec’s largest shareholders in October 2011
  - S4 now wholly owned subsidiary of InEnTec
InEnTec MSW Gasification Technology
PEM Overview
Clean Syngas Key to Value Added Products

PYROLYSIS

LOW TEMPERATURE GASIFICATION

Updraft Gasifiers
Fluid Bed Gasifiers
Fixed Bed Gasifiers

HIGH TEMPERATURE GASIFICATION

Entrained Flow Gasifiers
Some Fixed/Fluid Bed Gasifiers

DOWNDRAFT GASIFICATION

PLASMA ASSISTED GASIFICATION

TEMPERATURE

TARS

Clean Syngas Key to Value Added Products
Clean Syngas Key to Value-Added Products

Syngas (CO + H2) Options

- Power Generation: Gensets and/or Turbines
- Electrical Power and Steam
- Catalyst
- Hydrogen
- Ethanol, Mixed Alcohols
- Methanol
- Oleine
- Waxes, Gasoline
- Oxochemicals
- Ammonia
- Synthetic Natural Gas
- Synthetic Diesel
- Fuels and Chemical such as Ethanol and Methanol

Feed Stock: Solid or Liquid Waste

Gasification Reactor

Synthesis Gas (syngas)

Vitrified Slag/Metal Ingots

Biochemical Process

Catalyst

Chemistry

Power
Columbia Ridge Facility, Arlington, Oregon

Status
- Construction started August 2010
- Construction completed April 2011
- Commissioning May through November 2011
- Commercial pilot operations began December 2011

Plant Capability
- Commercially hardened design
- Feedstock capacity of 25 tpd of high carbon waste (e.g., medical, ASR, high plastic MSW etc.)
- Initial operations will not include conversion of syngas into product
- Facility to convert syngas to a hydrogen product which will be added in the near term
S4 Columbia Ridge Facility, Arlington, Oregon
Process Flow

Partial Quench → Particulate Filtration System → Full Quench
Particulate recycled back to PEM

Heat Exchanger → Sulfur Removal → Carbon Bed → Mercury Beds → Syngas to Products
Raw MSW Feed
Shredded MSW
S4 Columbia Ridge Facility, Arlington, Oregon
Operations Data

InEnTec Inc.
InEnTec Columbia Ridge - Biomass & MSW Processing

Syngas Efficiency
Feed Efficiency
Efficiency Goal
Total Mass

13-Jul
14-Jul
15-Jul
16-Jul
17-Jul
18-Jul
19-Jul
20-Jul
21-Jul
22-Jul
23-Jul
24-Jul
25-Jul
26-Jul
27-Jul
28-Jul
29-Jul
30-Jul
31-Jul
1-Aug
2-Aug
3-Aug
4-Aug
5-Aug
6-Aug
7-Aug
8-Aug
9-Aug
10-Aug
11-Aug
12-Aug
13-Aug
14-Aug
2012

100%
95%
90%
85%
80%
75%
70%
65%
60%
55%
50%

900,000
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0

Mass Processed

(100,000)
• CR plant has been demonstrated at full processing capacity
• Sustained online efficiency has been demonstrated at over 91%
• Syngas quality exceeded expectations
• The PEM system at Columbia Ridge landfill demonstrated robust processing of heterogeneous MSW waste materials
• Initial gasification facilities will be small, focusing on high value waste streams
• Full scale (5x), modular system is designed; capacity is 125 tpd of feedstock
• Larger facilities will be multiples of the base 125 tpd system and may incorporate 25 tpd systems targeting waste specific demands
• In larger facilities, gasification island is only 10 to 15 percent of total facility cost
Commercial Scale (125 tpd) PEM Design
Summary

Several commercial PEM systems have been built

InEnTec’s Columbia Ridge plant will be one of the first commercial systems in the US to convert municipal solid waste into useful products using plasma gasification

InEnTec has multiple projects under development

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