

A Plasma Gasification Waste to Energy Developer

Renewable Energy Clean Air Project (RECAP)

Presentation for the

***Local Solutions for a Sustainable Future
Conference 2010***



Grants to Political Subdivisions

Project Narrative

Koochiching: Renewable Energy Clean Air Project

2006 STATE APPROPRIATION REQUEST: \$10,000,000

AGENCY PROJECT PRIORITY: 1 of 1 (Koochiching County)

PROJECT LOCATION: International Falls (Koochiching county)

Project At A Glance

Renewable Energy Clean Air Project (RECAP): Koochiching County is requesting \$10 million to design, construct, and equip a new Plasma Torch Gasification facility in International Falls for the purpose of converting municipal solid wastes (MSW) that would otherwise go to landfills into energy.

Project Description

Koochiching County is requesting \$10 million in state funding to design, construct and equip a new Plasma Torch Gasification facility to be located in International Falls for the purpose of converting municipal solid wastes (MSW) that would otherwise go to landfills into energy in the form of steam or electricity and a non-leachable slag to be use for road aggregate, tile or rock wool. This waste-to-energy conversion process has far fewer environmental consequences than either landfilling or incineration.

Even though Minnesota is one of the leading states in recycling its MSW, the state is still dumping over two million tons a year of MSW into landfills throughout Minnesota, Iowa, and Wisconsin. The rate of recycling appears to have reached a plateau in the range of 45 to 50% of Minnesota's total MSW. The percentage of the total MSW going into landfills has increased from 18% 10 years ago to 36% today. This cannot be sustained. Landfills will reach capacity and any new ones will be opposed due to increasing stress on the existing landfill infrastructure throughout the state.

A solution is needed to eliminate MSW from going into landfills while using the MSW for a productive, economic purpose without harming the environment. The solution is Plasma Torch technology. This technology will

eliminate the MSW that is not recycled and turn this renewable resource ("Urban Gold") into energy.

By subjecting MSW to the Plasma Torch, a heat source that is hotter than the surface of the sun, the organic materials in the MSW gasify into basic gases such as hydrogen and carbon monoxide, and the inorganic materials in the MSW are vitrified into a molten slag or igneous rock. The gas can be used to produce steam or electricity and the molten slag can produce products such as road aggregate, tile, road pavers, or rock wool.

The key to the technology is the Plasma Torch. The torch produces controlled lightning. Lightning is a form of plasma found in nature. When MSW is exposed to temperatures above 7,000 C° it quickly gasifies or produces a vitrified material. This process all occurs within an oxygen-deprived environment inside the gasification vessel. It is important to note that there is no burning involved in the plasma gasification process. This simple fact provides an emission advantage over traditional thermal pyrolytic processes. In the p dioxins produced. (F low temperature them result of the elevated are formed. The resul landfill, and energy is e

Plasma Torch facilities
The facilities are mod day. The footprint of t feet. The total site acres.

The project in Koochi MSW per day. The seven days per weel projected to be betwe 150 to 200 pounds of the steam will be use net five MSW of electr

2006-2011 Minnesota Capital Budget

Presented by
Governor Tim Pawlenty
to the 84th Legislature

Executive Summary

January 17, 2006





Utashinai

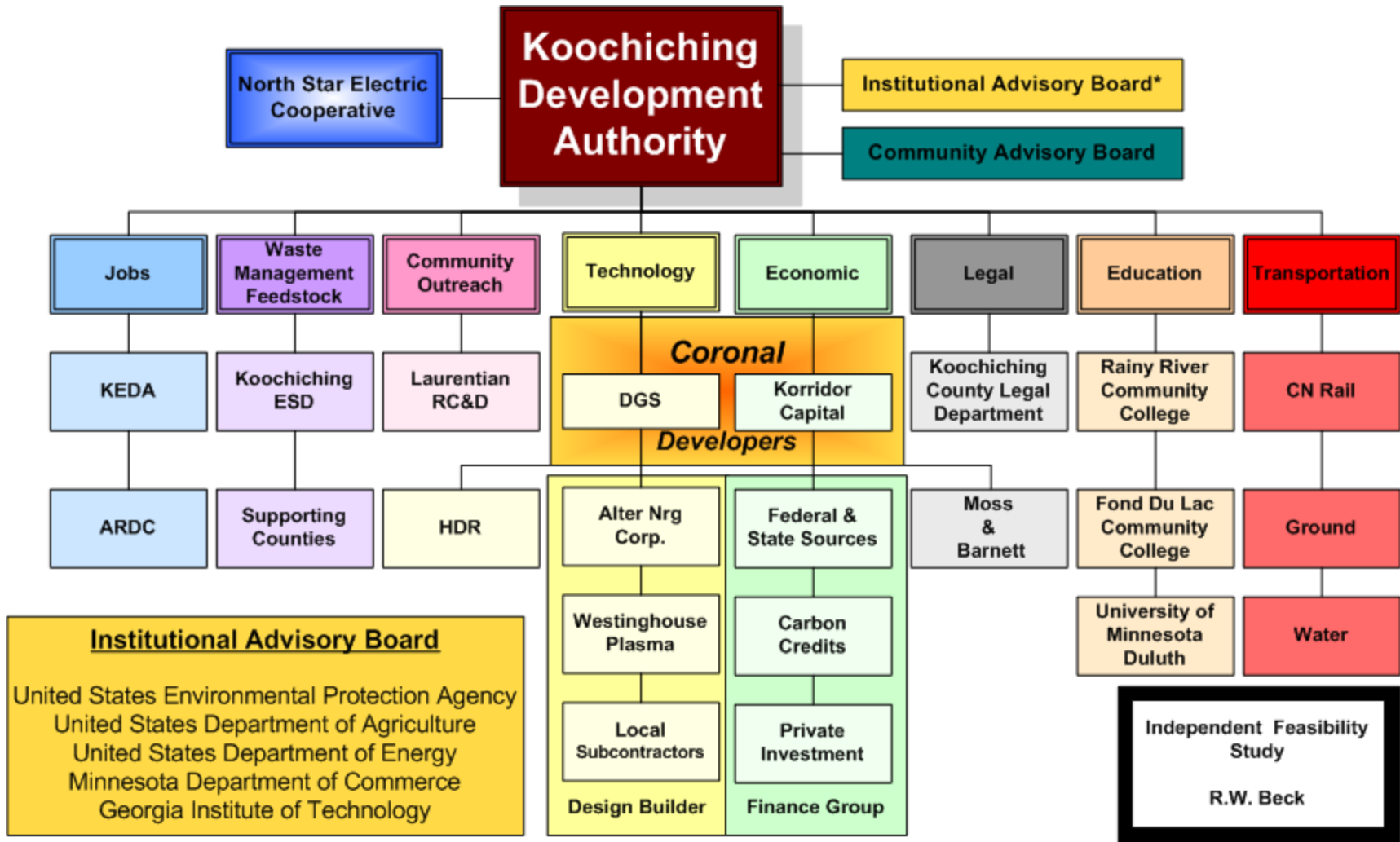


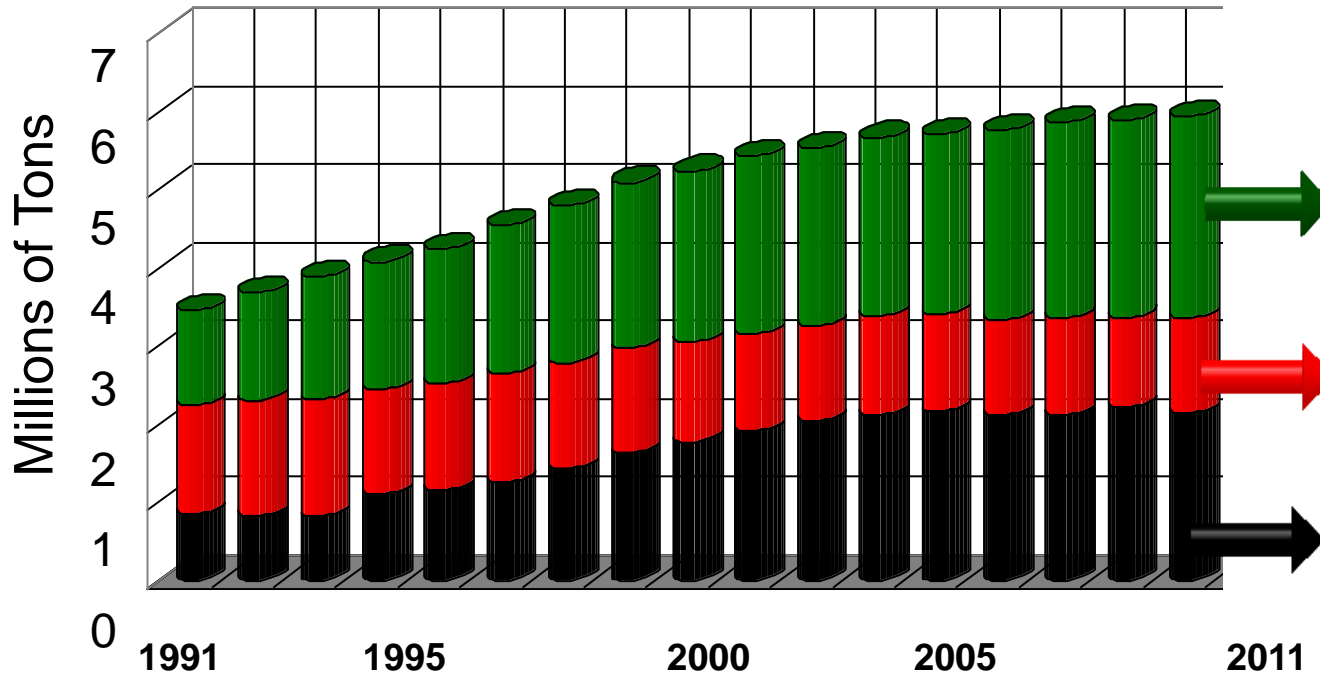
Mihama Mikata

- ✦ Two (2) Japanese Plasma Facilities
- ✦ Designed for Municipal Solid Waste (MSW), Auto Fluff (ASR) & Sludge
- ✦ Meets all Japanese environmental standards; exceeds USEPA environmental standards
- ✦ Utashinai commissioned 2003; Mihama Mikata commissioned in 2004
- ✦ **CORONAL** one of 5 U.S. companies to tour and evaluate Japanese functioning plasma gasification facilities



Team Structure





50% Recycling
Projected

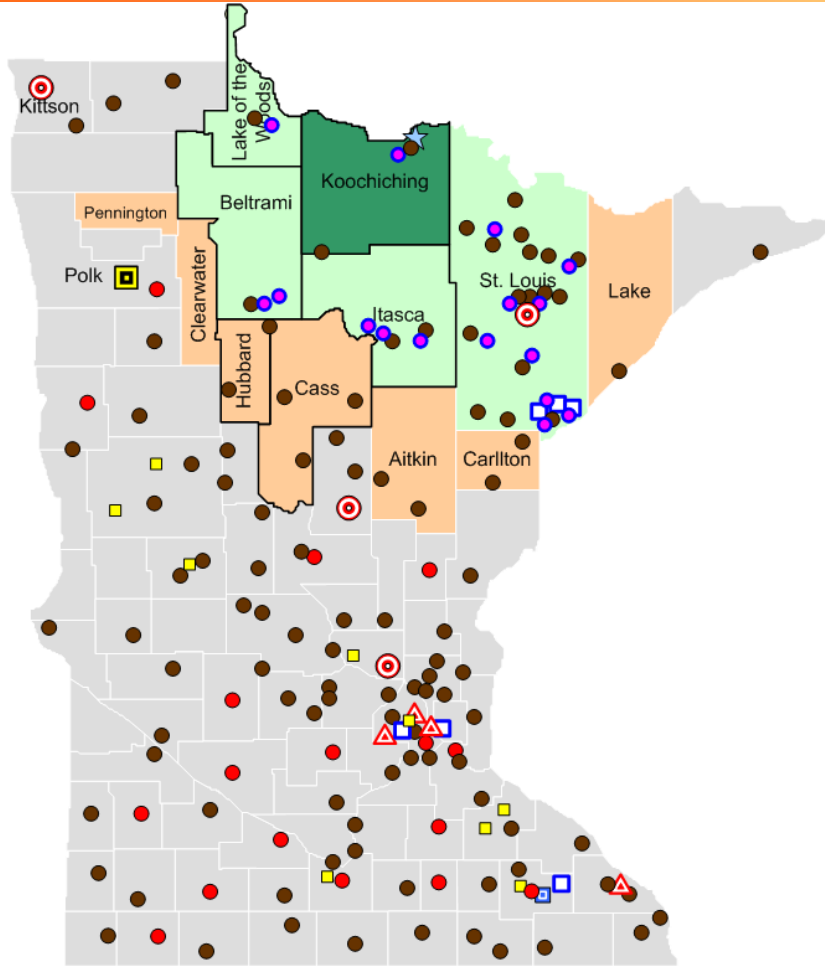
Roadmap Goal
20% to 35% Waste to Energy

15 Million Tons
to landfills &
Composting

MPCA Roadmap goal is to increase
Waste to Energy Capacity 2.5 million tons goals



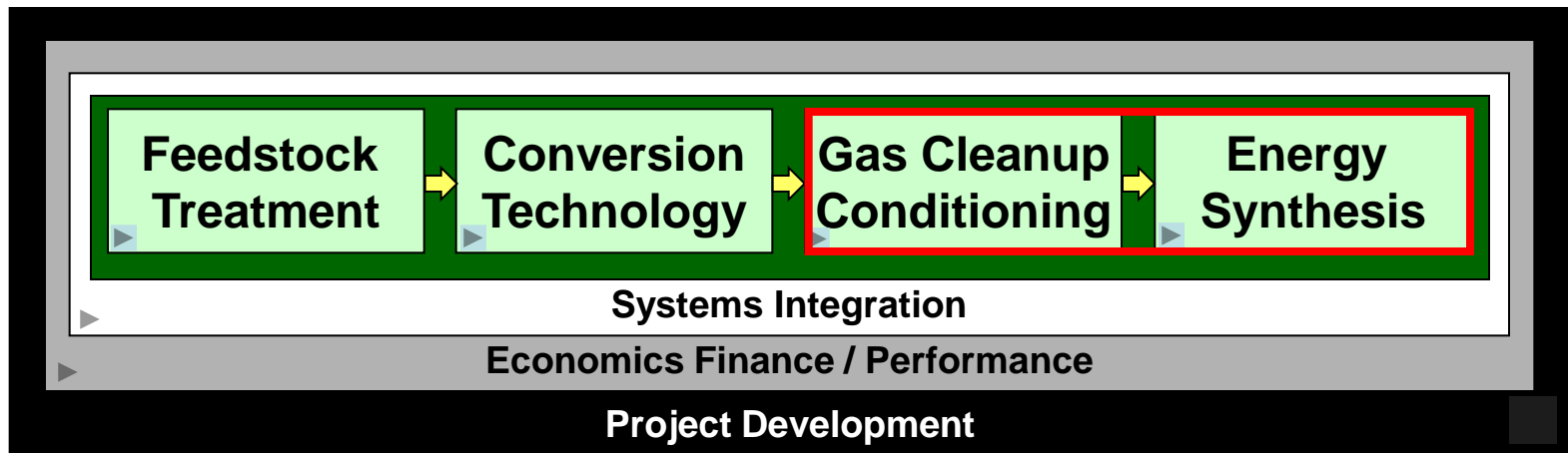
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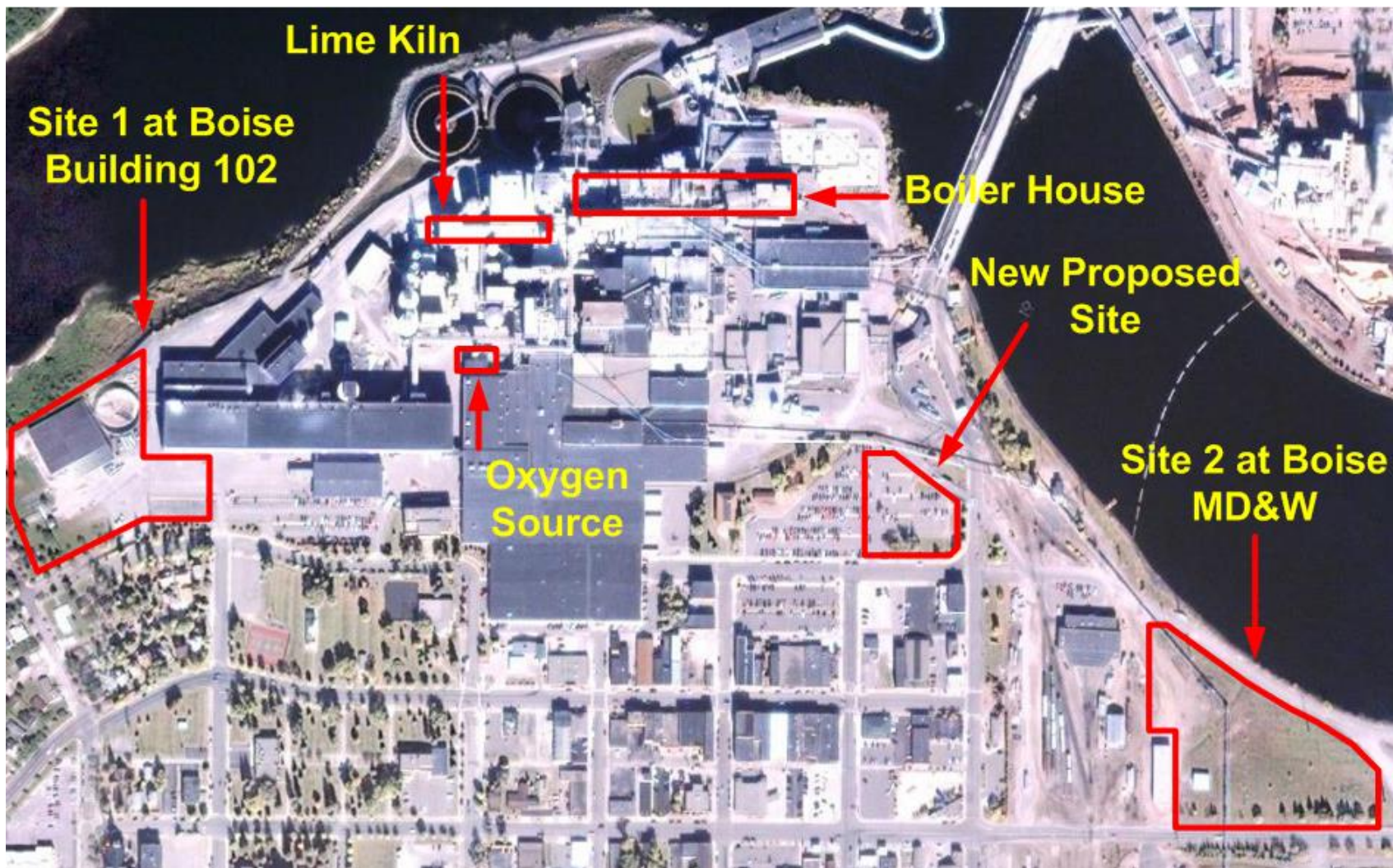
- Incineration ● Open ● Closed ● Transfer Site
- Regional Incinerator ● Key Regional Landfills
- ★ International Fall MN ▲ Autoclaves
- Mayo Incinerator ■ Major Hospitals

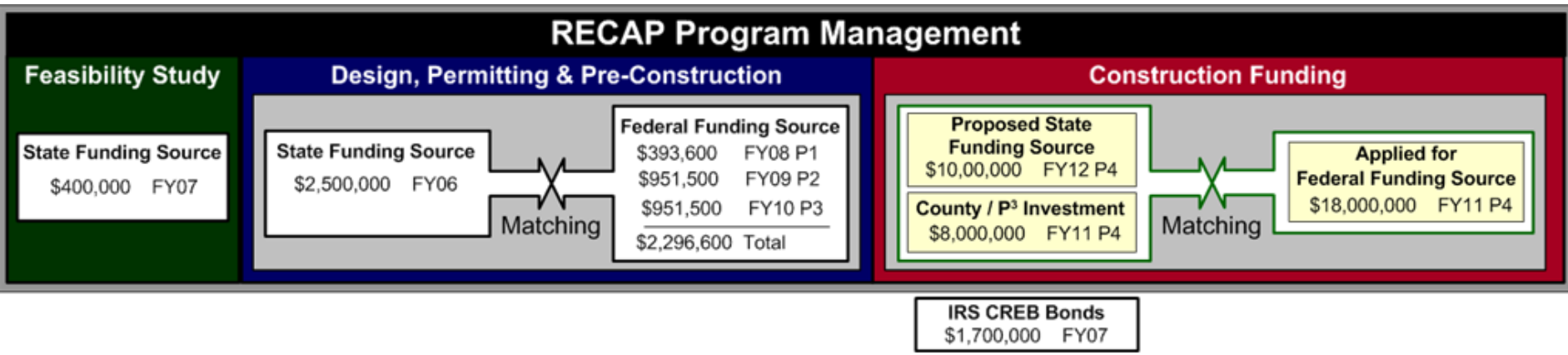
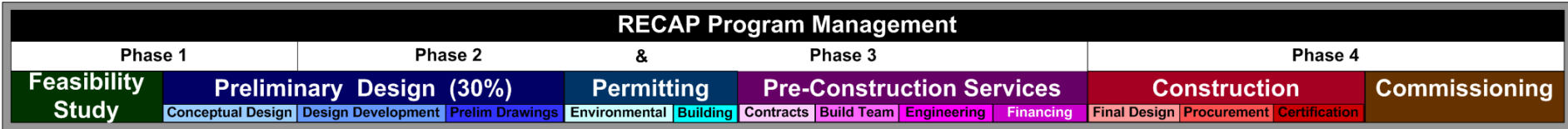
County	Tons	Recycle	Expire
Beltrami*	10,500	21.1%	2014
Cass	14,200	41.6%	2012
Hubbard	15,500	33.8%	2011
Itasca	22,816	28.8%	2013
Koochiching	7,662	26.6%	2011
Lake of the Woods	2,480	24.5%	2015
MSW Regional Totals	73,158		
RECAP Requirements 180T/day@320		57,600	









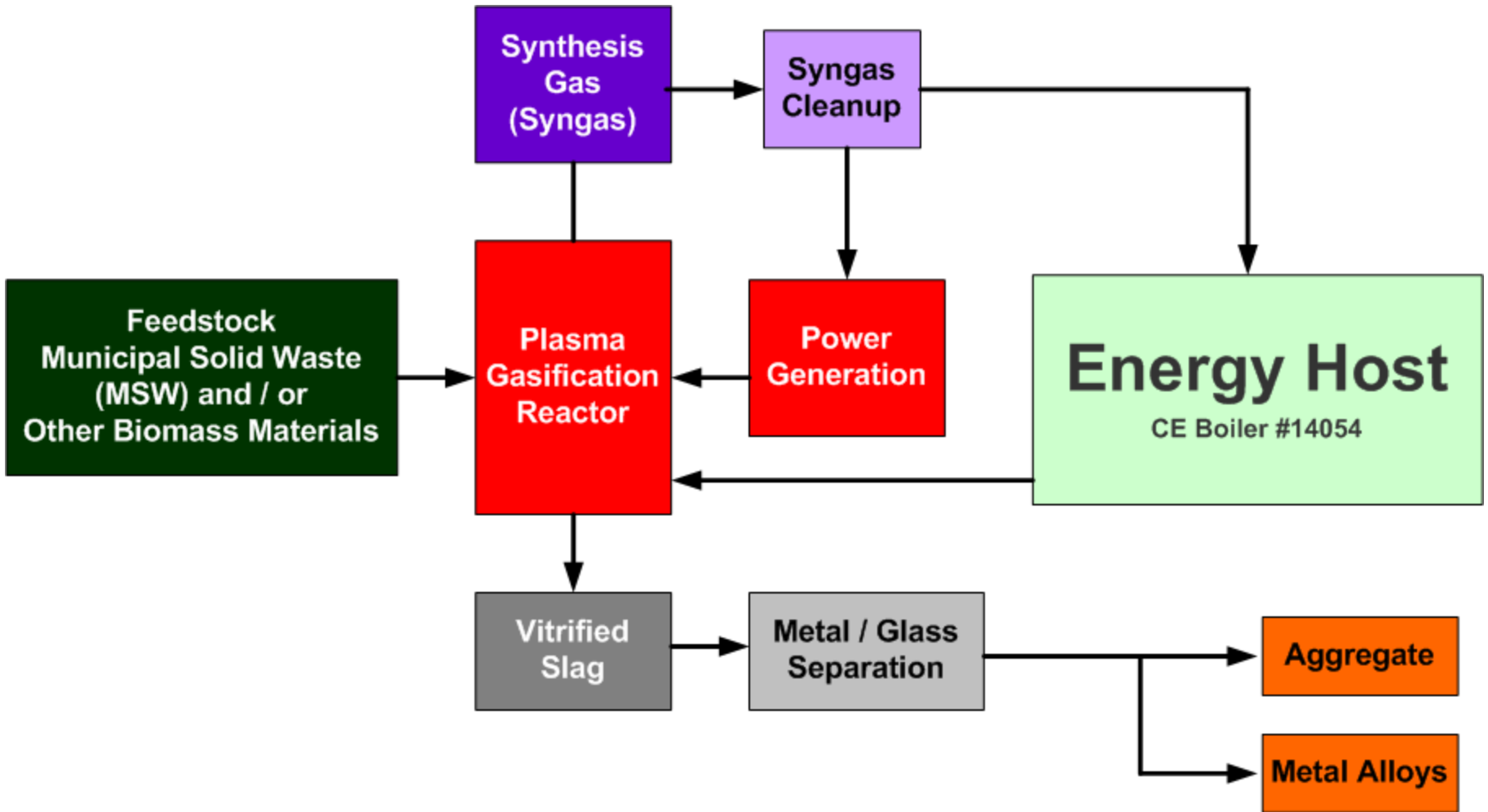




CORONAL



RECAP Block Schematic



Financial Pro forma



PROJECT: RECAP	NOI & Cash Flow	CORONAL
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Assumptions	PROJECT: RECAP	SynGas Revenue with Energy Output	CORONAL
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# of PGVRs		
Oxidant		
Max Capacity of PGVR (tons/d)	Max Capacity-tons	180
Run Capacity of PGVR (tons/d)	Days of Operation	320
Days of Operation Per Year	Efficiency of Plant	90%
	Avg Tipping Fee	\$5.00
	Sale Price MMBtu/hr	

PROJECT: RECAP	Tipping Fee Revenue	CORONAL
	Operation Tonnage per Day	180
	Operational Days per Year	320

	Waste Profile	Btu / lb
Cost of Coke	MSW	4,100
Cost of Flux	Tires	12,000
Cost of Electricity	Medical	3,000
Cost of Electrodes	Electrical	6,000
Cost of Water	Sludge	0
	ASR	8,400
	Mattress	6,000
	Railroad Ties/Utility Poles	6,000
	Other	8,000
	Coke	12,400
	Lime	0

Waste Profile	Tipping Fee / Ton	Percentage of Waste	Oper Tonnage Per Day	Annual Tonnage Needed	Tipping Fee Revenue
MSW	\$50	66%	118.8	38,016	\$1,900,800
Tires	\$100	14%	25.2	8,064	\$806,400
Medical	\$200	5%	9.0	2,880	\$576,000
Electrical	\$100	2%	3.2	1,037	\$103,680
Sludge	\$250	0%	0.5	173	\$43,200
ASR	\$20	0%	0.0	0	\$0
Mattress	\$20	1%	1.8	576	\$11,520
Railroad Ties/Utility Poles	\$5	0%	0.0	0	\$0
Other	\$180	5%	9.0	2,880	\$518,400
Coke	(\$300)	4%	7.2	2,304	(\$691,200)
Lime	(\$14)	3%	5.2	1,670	(\$23,386)
Avg Tipping Fee	\$56.34	100%	180.0	57,600	\$3,245,414

REVENUES		
Tipping Fees		
Energy Sales		
Road Aggregate		
Other Income- Recyclables		
TOTAL REVENUES		
OPERATING EXPENSE		
Coke (4% by weight)		
Flux (2.9% by weight)		
Power Systems (750 Kwh)		
Power Torches (710 Kwh)		
Electrodes (10)		
Water (20,000gal/yr)		
Total Variable Costs		
Labor		
Benefits (30%)		
Taxes & Insurance		
Administrative		
Maintenance		
Contract Services		
Total Fixed Costs		
TOTAL OPERATING EXPENSE		
NOI		
Operating Exp		
Debt		

MSW Before Recycling		Recycling Center - MSW
54,309	tons per year	25
30%	recyclables in MSW	8
300	days of tipping floor operation	250
181	tons per tipping floor day	50,000
15	tons per truck	2
12.1	# trucks per day	70
		8,750
8,064	annual tonnage	17,500
806,400	# of passenger tires	35,000

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Cash Flow	\$764,728	\$677,479	\$588,486	\$497,712	\$405,123	\$310,682
Cash-On-Cash	3.03%	2.69%	2.34%	1.98%	1.61%	1.23%
Debt Coverage	1.70	1.62	1.54	1.46	1.37	1.28

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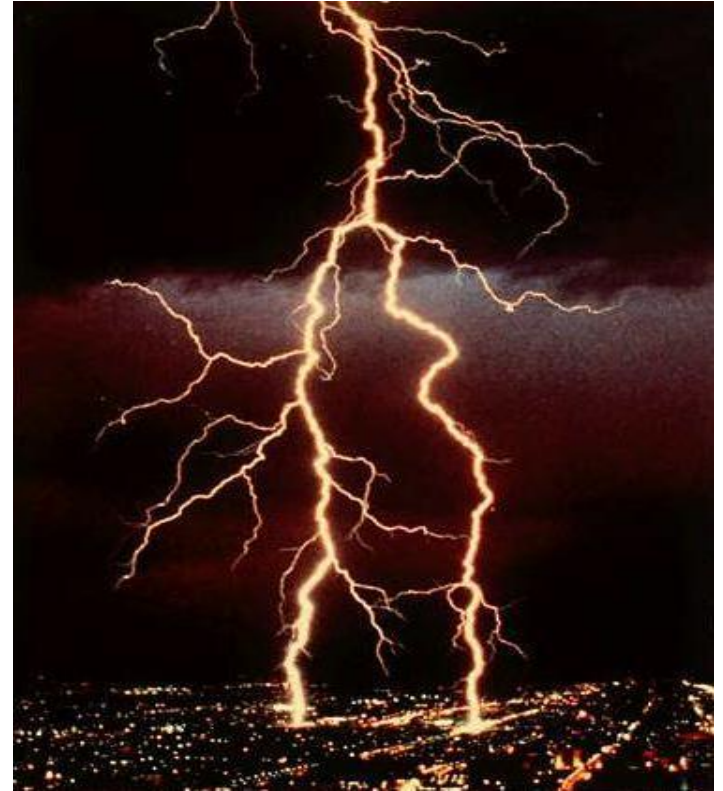


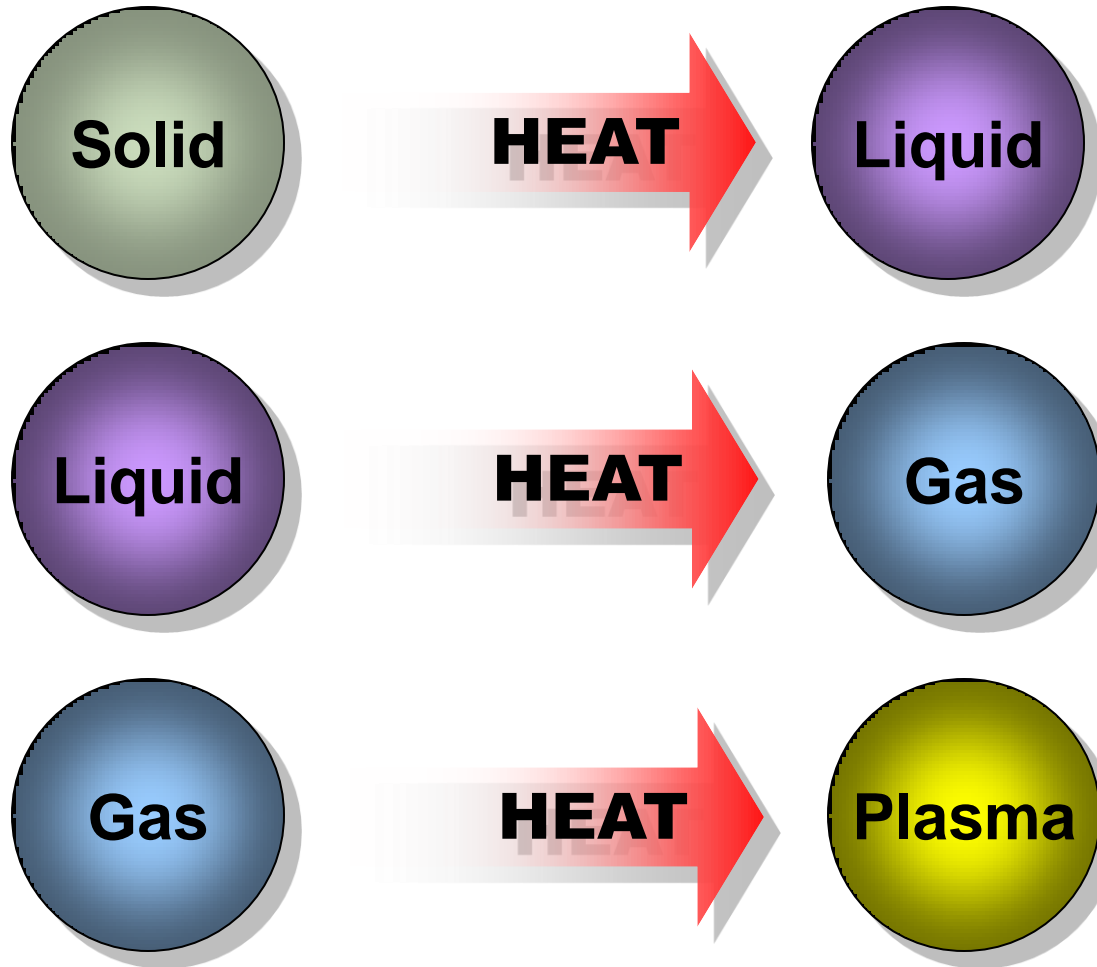


- ❑ Waste Transfer Function
- ❑ Recycling & Sorting
- ❑ Continuous Feed

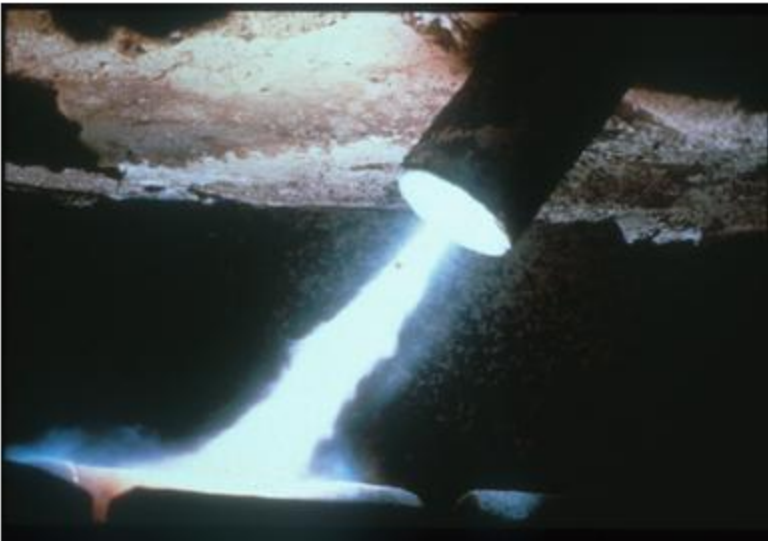


- ✦ The fourth state of matter.
- ✦ Ionized gas at high temperature capable of conducting an electrical current.
- ✦ Lightning is an example from nature.

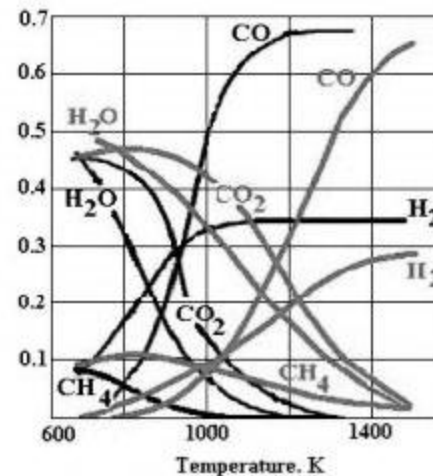
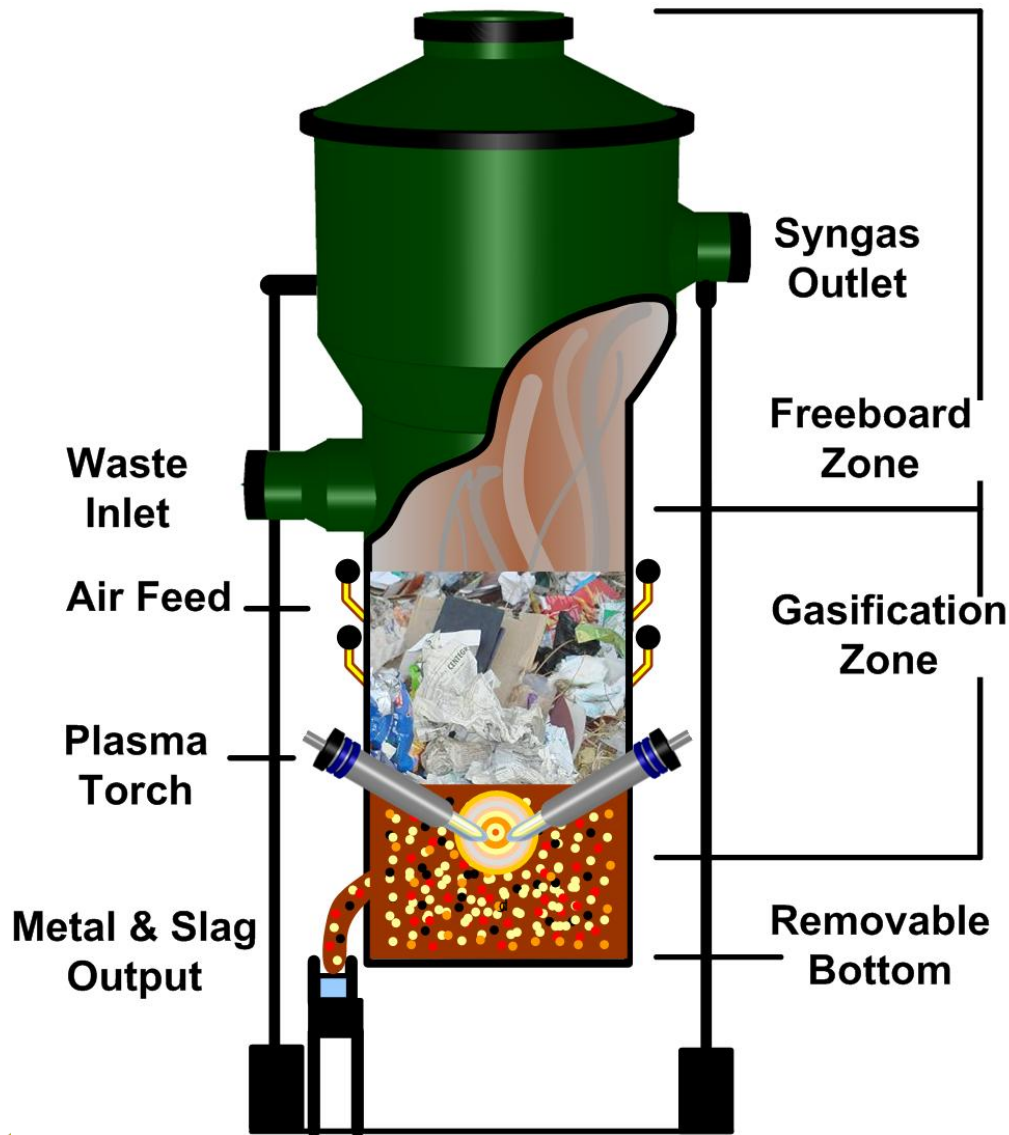




Plasma Torch



Plasma Gasification Reactor

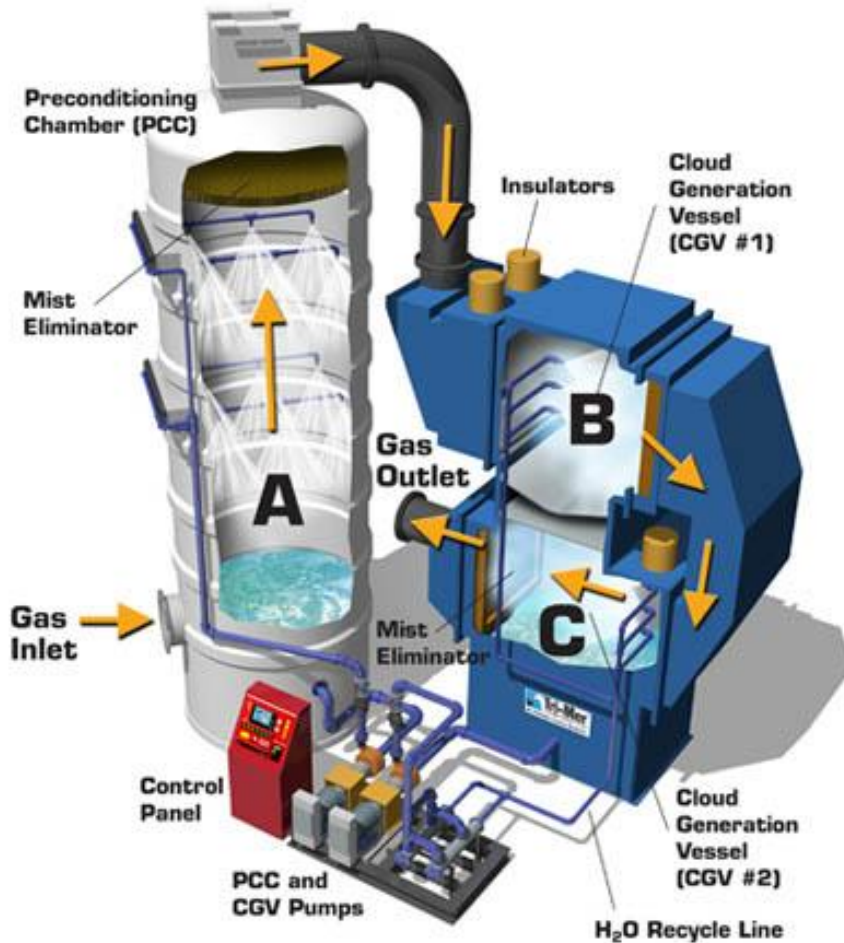


Equilibrium Characteristics For C-H-O System (hydrogen : oxygen 1g-atm / g-atm)

Legend:
 — 1 atm
 — 100 atm

Syngas output is rich in hydrogen and carbon





Syngas Filtration

- A** Kiln Applications
- A-B** Steam Generation
- A-B-C** Electricity Generation
- A-B-C-D** Bio-Fuels



Energy Synthesis / Facility Mission

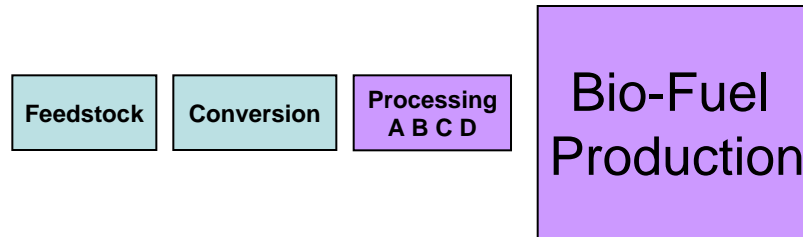
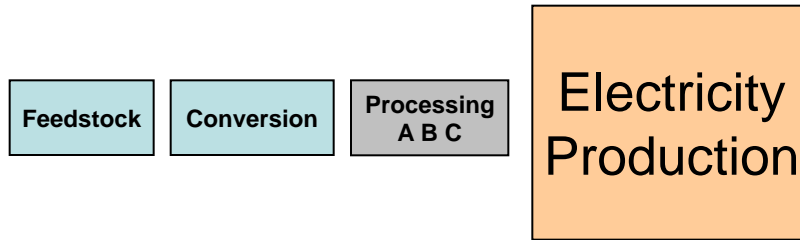
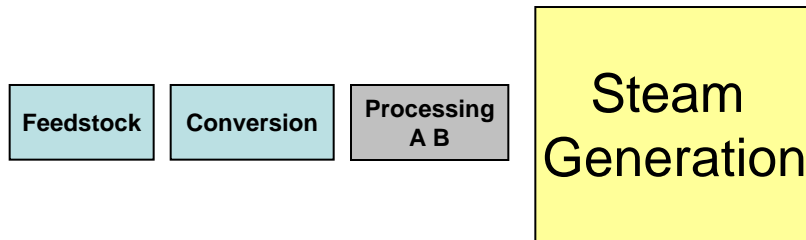
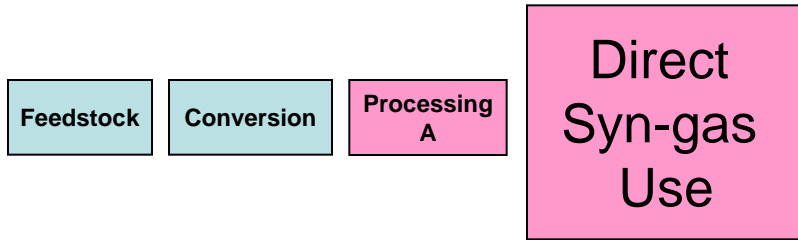


Table 2 displays the comparison of Mihama-Mikata’s slag leachate constituent levels to the Drinking Water Quality Standards of Canada, the United States, the European Commission and the United Kingdom.

Table 2

MIHAMA-MIKATA SLAG NEN-7341 LEACHATE TEST RESULTS VS DRINKING WATER STANDARDS

Compound	Mihama-Mikata Slag Leachate	Canadian DWQS	United States DWQS	European Commission DWQS	United Kingdom DWQS
Antimony	< 0.001	0.006	0.006	0.005	0.005
Arsenic	< 0.001	0.01	0.01	0.01	0.01
Barium	< 0.05	1	2		
Beryllium	<0.005		0.004		
Boron	<0.1	5		1	1
Cadmium	< 0.001	0.005	0.005	0.005	0.005
Chromium	0.01	0.05	0.1	0.05	0.05
Copper	< 0.01		1.3	2	2
Lead	< 0.001	0.01	0.015	0.01	0.025
Mercury	< 0.0001	0.001	0.002	0.001	0.001
Nickel	< 0.05			0.02	0.02
Selenium	< 0.001	0.01	0.05	0.01	0.01
Thallium	<0.001		0.002		
Uranium	<0.001	0.02	0.03		

Notes:

All Data is mg/L = parts per million (ppm)
DWQS = Drinking Water Quality Standard
NA = Level was not listed



Air Emissions

Emission Element	Gasification	Incineration
Metals		
Antimony (mg/dscm)	0.02 - 0.05	0.5 - 2.6
Cadmium (mg/dscm)	0.004 - 0.03	0.06 - 0.9
Chromium (mg/dscm)	0.02 - 0.08	0.03 - 0.1
Lead (mg/dscm)	0.2 - 0.6	8.4 - 15
Mercury (mg/dscm)	ND* - 0.02	0.5 - 0.9
Nickel (mg/dscm)	0.02 - 0.08	0.2 - 0.5
ACID GASES		
NO _x (ppm)	30 - 50	169 - 246
SO ₂ (ppm)	10 - 20	128 - 225
PARTICULATES		
mg/dscm	2.4 - 9.9	167 - 247

Solids By-products

Leachate Element	Gasification	Incineration
Metals		
Antimony (mg/l)	0.02 - 0.05	0.5 - 2.6
Arsenic	ND* - 0.1	5.0
Barium (mg/l)	0.03 - 0.1	55.0 - 100.0
Cadmium (mg/l)	0.004 - 0.02	0.2 - 0.5
Chromium (mg/l)	0.05 - 0.2	3.3 - 5.0
Copper (mg/l)	0.02 - 0.08	0.03 - 0.1
Lead (mg/l)	0.01 - 0.02	2.5 - 5.0
Mercury (mg/l)	ND*	0.05 - 0.1

ND*- Not Detectable

Data Source: Plasma Gasification of MSW, Carter Report



