

MSW - Fuels Feedstock in the Waste to Energy Mix

Jo-Walter Spear, Jr., S.C, P.E.
J Spear Associates
Jo@JSAcivil.com

Topics

- Why MSW?
- Characteristics
- Conventional Technology
- Products
- Current MSW-to-Ethanol Project

Attractive Fuel Feedstock Characteristics of Solid Waste

- Readily available in large quantities
- Negative cost
- High energy content
- Energy content accessible through conventional technology

Energy Content

- Approximately 4,600 BTU/lb. (about 5,500 BTU dry wgt)
- In terms of oil equivalence, the solid waste generated annually here in Wisconsin Dells is approximately equivalent to 7,000bbl of oil.

Madison ~ 390,000bbl

Milwaukee ~ 2.9×10^6 bbl

Energy Content Accessible through Conventional Technology

- All of the current conversion technology for converting waste to energy is conventional in nature and,
- all of the promising, emerging technologies for waste to energy conversions are conventional in nature.

Readily Available in Large Quantities

- We generate between 4.5 and 8.4 pounds per capita per day, of MSW depending upon the waste generation sectors that are included in the definition of Municipal Solid Waste used to develop the estimate.
- If we consider C&D wastes we add another 136 million + tons of material to the mix, Nationally.

• Negative Price

- Spot market prices for land disposal of MSW in the US range from \$22 per ton - \$190 per ton.
- Even if one is located in a \$22 per ton market but, must transfer any considerable distance, the cost could easily become around \$40 - \$45 per ton, at current fuel prices.

Conventional Technology

- Materials Recovery*
- LFG to Energy
- Gasification
- Plasma Arc
- Catalytic reformation
 - Bio-catalytic reformation
- Acid hydrolysis
- Fermentation
- Distillation

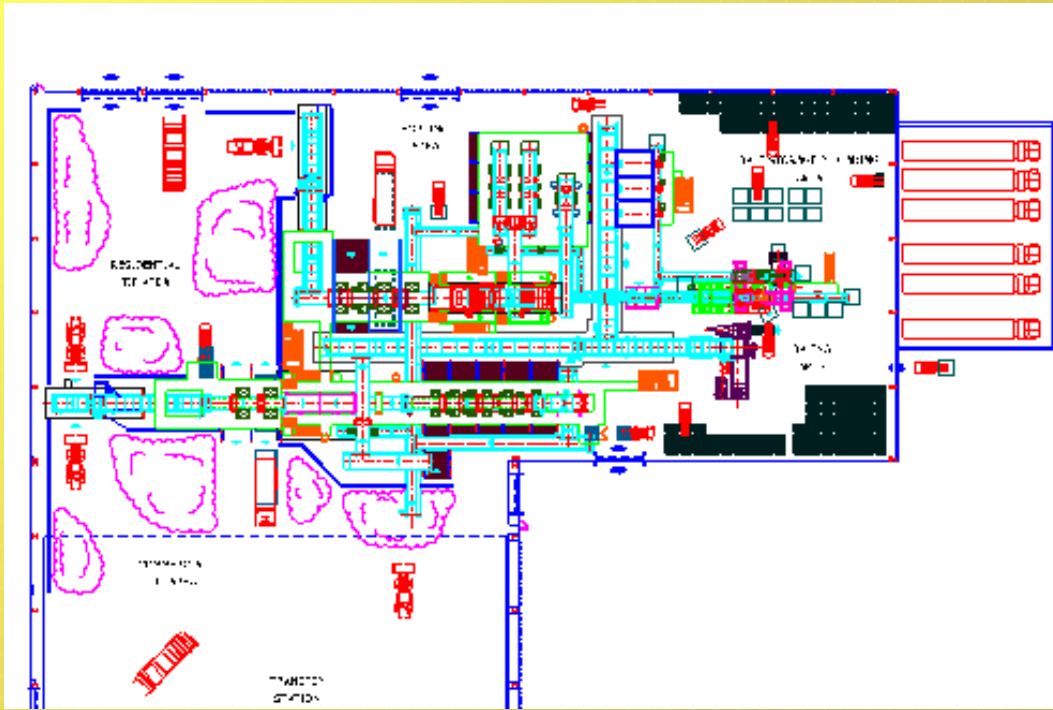
Conventional Technology Applied to Fuel Production

Primary

- Materials Recovery*
- LFG to Energy**
- Gasification*
- Plasma Arc

Secondary

- Catalytic reformation*
 - Fischer-Tropisch reformation
 - Bio-catalytic reformation
- Acid hydrolysis*
- Fermentation*
- Distillation*



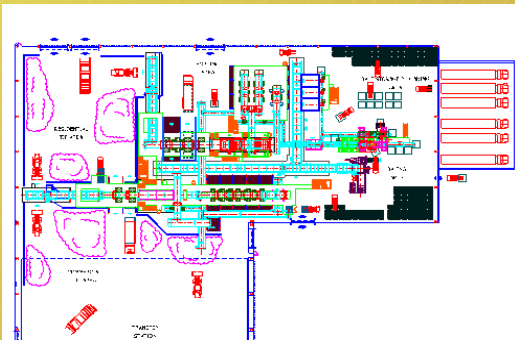
MRF



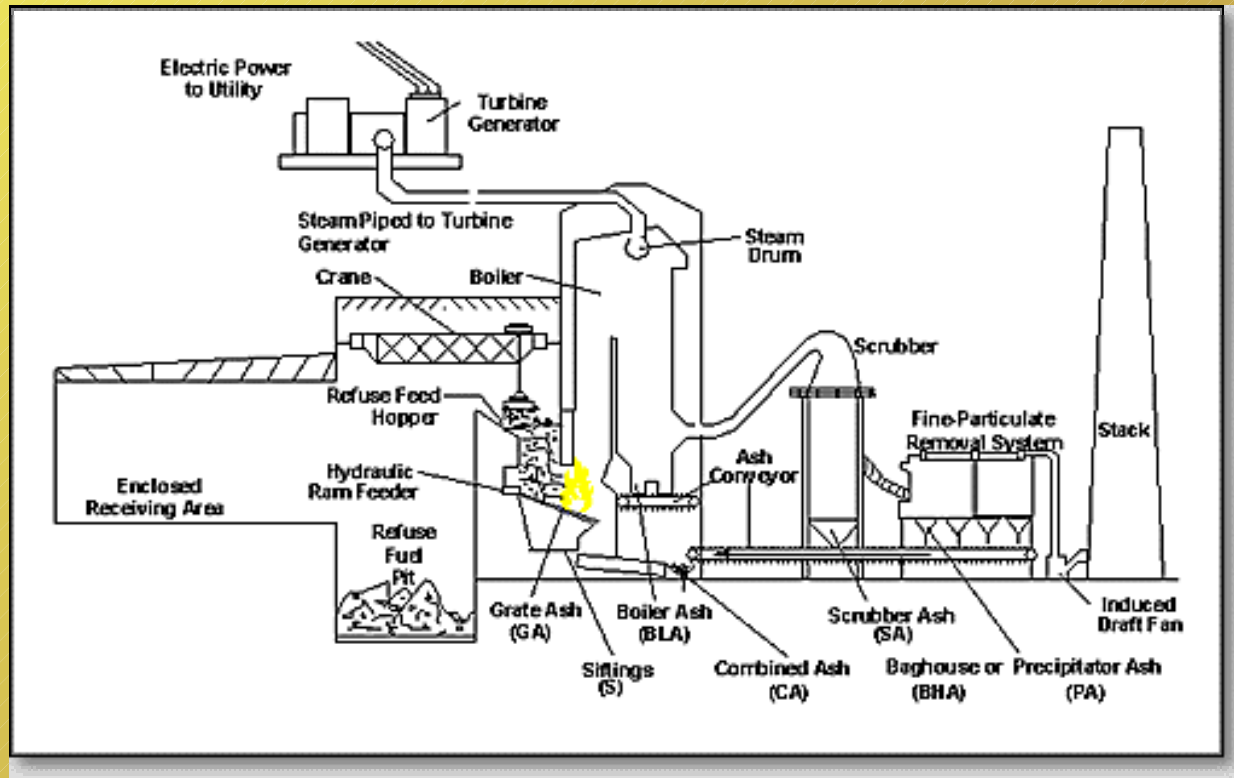
Materials Recovery



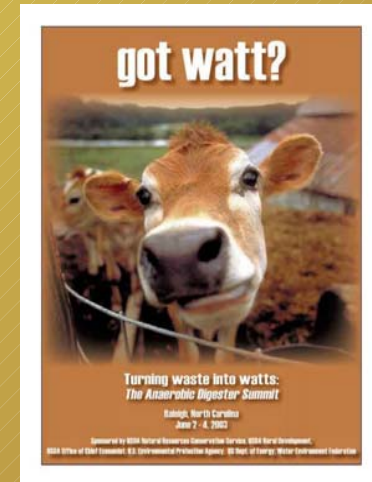
- The first process in all MSW to energy, except LFG to energy and mass burn.
- In the arena of fuels, pharmaceuticals and fertilizers materials recovery is a step to prevent contamination or poisoning of down stream processes.
- This drives high recovery rates of MSW recyclables.



Mass Burn (deux)



Anaerobic Digestion (LFG)



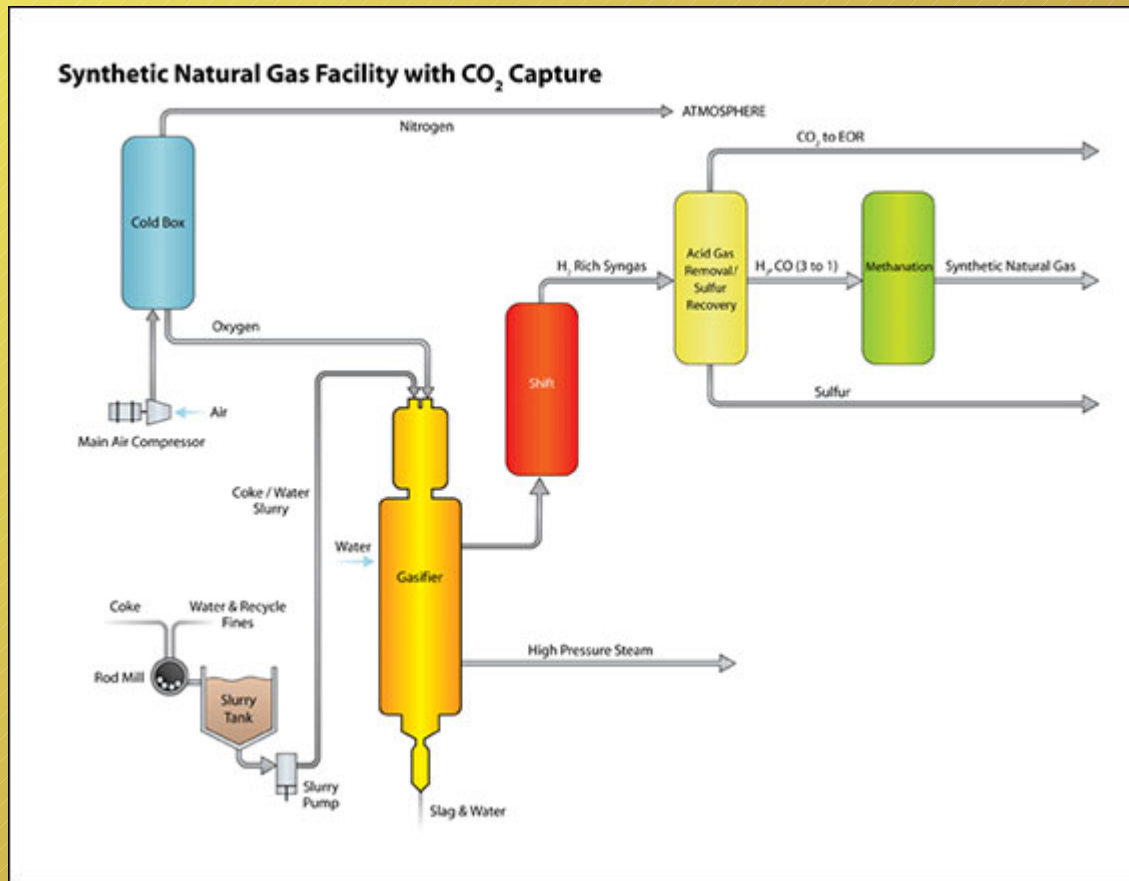
Primary Products:

Heat
Methane
Methanol

Secondary Products:

Electrical Power
Petrochemicals

Gasification Technology



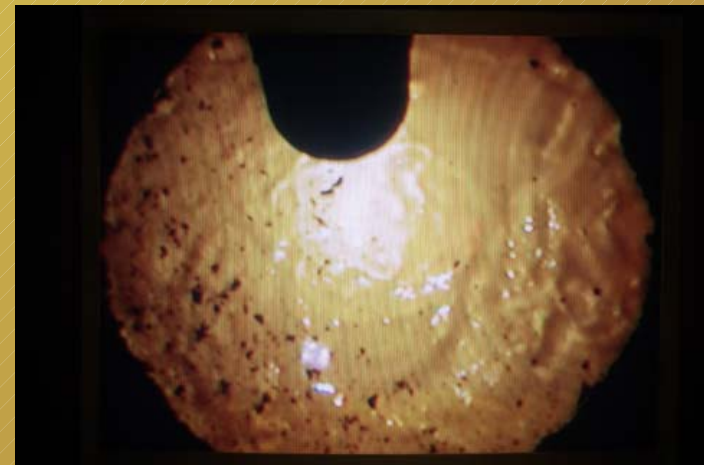
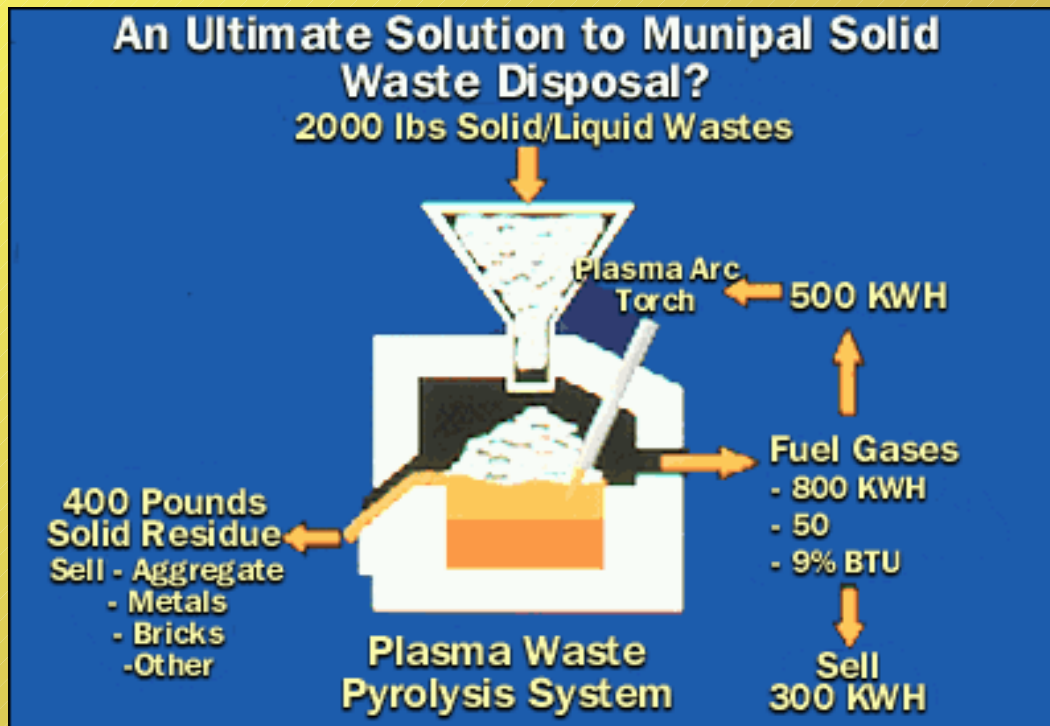
Gasification In North America

- Syngas fuels 17% of the total electrical power generation.
- Syngas is the feedstock for catalytic reformation of fertilizers, alcohols and some heavier petroleum compounds such as a synthetic diesel.

Plasma

- The fourth naturally occurring state of matter.
 - Electro-magnetic state of matter
 - Most common state of matter
 - 99% of the visible Universe

Plasma Arc



Plasma

- Is being tried as the gasification process to feed FT reformers to form ethanol and/or methanol in three projects in North America.
- Perhaps a more economical fuel would be the generation of Hydrogen for the steel, aerospace, or other high Hydrogen utilizing industry. There are several such projects proposed in the US with two about to undergo construction. One advantage of Plasma as a source of Hydrogen is the ability to select waste types that optimize hydrogen production.

Catalytic Reformation

- Chemical reformation
 - Fischer-Tropisch
 - Passes gas over a metallic catalyst to reform larger carbon chain compounds from the CH_4 , CO_2 , H_2 , NO_x , and sulfur compounds in the 'syngas'. Specific Products are favored by adjusting the mix of gases, managing temperature and pressure and selecting metals to act as catalyst. For example, a copper based FT catalyst favors ethanol.

Biological Reformation

- Genetically engineered microorganisms, principally bacteria, in aqueous solution, are fed syngas. Their genetics favor individual compounds or groups of compounds as predominate waste products.

MSW To Ethanol Project

- Lake County Solid Waste District Disposal Capacity Procurement, Merrillville, IN
 - Disposal Capacity for 2000 – 4000 TPD of MSW
 - Three Bidders
 - Transfer to landfill
 - GPV conversion to ethanol (ETOH-1)
 - Gasification conversion to ethanol (ETOH-2)

Proposer	Technology	Price per Ton
1	Transfer to landfil	\$41.50
2	Gasification Biocatalytic converson to ethanol Distillation	\$17.50
3	GVP acid hydrolysis Fermentation Distillation	\$20.00

Current Status

- ETOH-1 Powers Energy of America plants 1 and 2 are being sited in Lake County, Indiana with construction scheduled to begin mid or end of the second quarter of 2009.

THANK YOU

jw@JSAcivil.com