Zero Emissions

Ze LLC

Waste Disposal System

Los Angeles County Solid Waste Management Committee/
Integrated Waste Management Task Force
July 19, 2012

Ze LLC

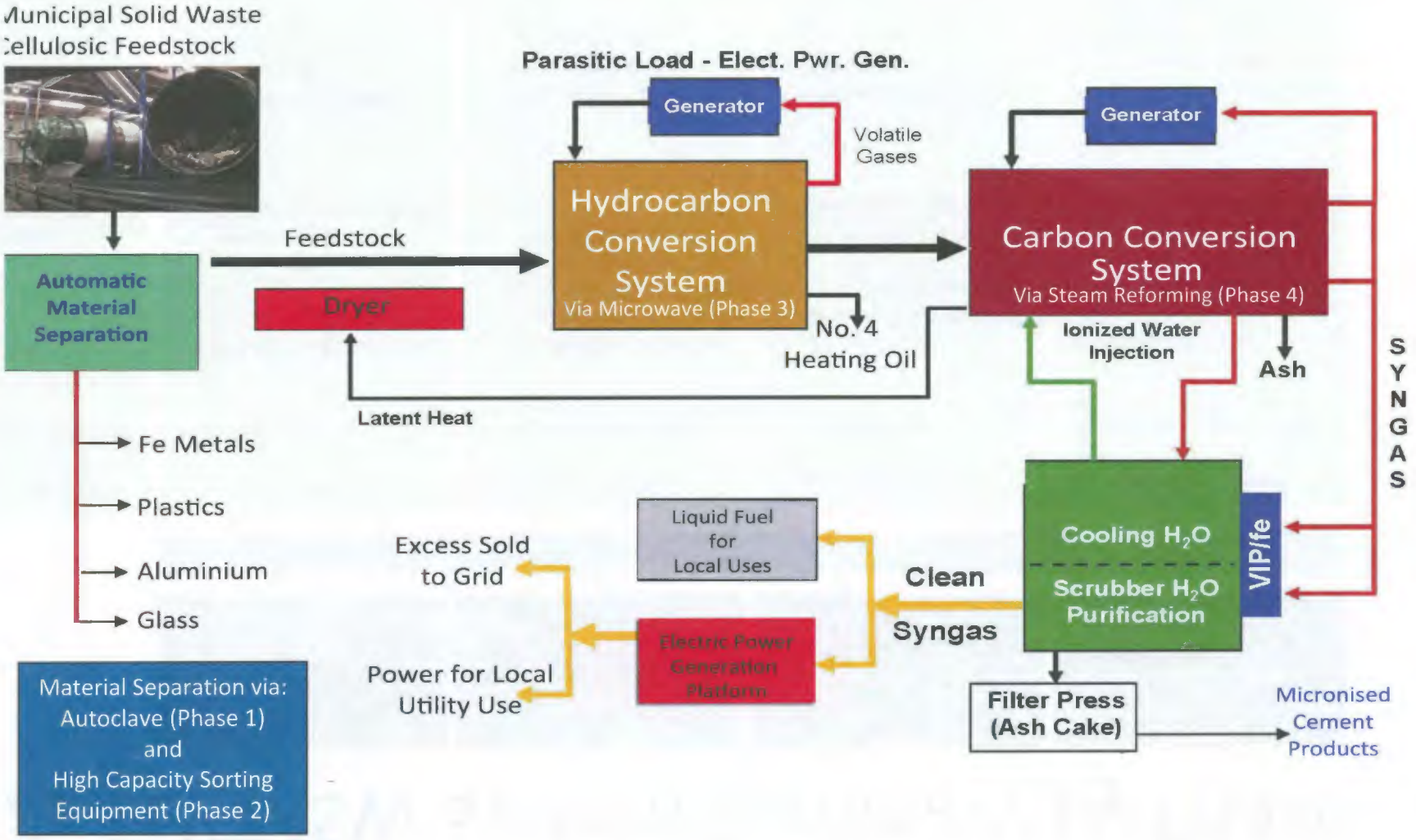
Ze LLC

- Owner, developer, representing investors
- Licensed by Applied Green Technologies (AGT) to develop the MSW system
- Will create joint venture with a qualified plant operator
- John F. Melvin, CEO
  - 30 years project finance with major investment banks
- Cathy Zambrano, VP Finance
  - 15 years in corporate / business development finance
- Paul McGuire, VP Technology
  - 40 years in project management / construction

Applied Green Technologies ("AGT")

- Inventor of the Ze LLC MSW system
- Paul McGuire, President
  - 40 years in energy businesses
  - Inventor of numerous patented technologies
  - B.S. in mechanical engineering
  - M.S. in nuclear engineering
- Will supervise construction of the MSW plant on behalf of Ze LLC

The Ze LLC MSW System



Ze LLC MSW System Summary by Phase

	Phase 1 Material Separation via Autoclave	Phase 2 Material Separation via High Capacity Sorting Equipment	Phase 3 Hydrocarbon Conversion via Microwave Technology	Phase 4 Carbon Conversion via Steam Reforming
	Assumes 1 autoclave processing 320 tons of MSW per day			
Weight In/Out	• 20 tons / 20 tons	• 20 tons / 10 tons	• 10 tons / 3.5 tons	• 3.5 tons / 0.58 tons
Volume % Chg	• 85% decrease	• 42.5% decrease after separation	• 9% decrease	• 98% decrease in total
Output Content	• 50% sorted recyclables and 50% cellulosic biomass	• Recyclables sorted by type and celluistic fiber	• #4 heating oil, noncondensable gases, Char (Carbon and Ash)	• CO and H2, ash
Process Duration	• 90 minutes (includes 30 min. to load/unload)	• 20 minutes processing time	• 15 minutes processing time (4 tons per hour)	• 15 minutes processing time (25–500 tons/day)
Emissions	• Zero	• Zero	• Zero	• Zero
Next Steps	• Separated cellulosic biomass and recyclables go to Phase 2	• Recyclables sold by type, cellulosic fiber sent to Phase 3 (10 tons)	• Char goes to Phase 4, Oil is sold	• Ash is mixed with C&D to make cement products. CO and H2 used to run a fuel cell or converted to liquid fuel.

The Ze LLC MSW System – Phase 1

Separation via Autoclave

- Unsorted MSW enters the autoclave
  - 20 ton canister is injected with steam
  - 60 minutes at 325 degrees
  - 90 minute cycle
  - Energy from steam comes from syn-gas and heat recovery
  - One autoclave processes 320 tons per day
  - Reduces volume by 85% with no change in weight

The Ze LLC MSW System – Phase 1 (cont.)

Separation via Autoclave (cont.)

- Toxins and pollutants extracted from condensate through filtration, clarification, and reverse osmosis
  - Condensates injected with ionized air
    - Hydrogen peroxide is produced in the water by reactive oxygen
    - Hydroxide disinfecting, oxidizing, and coagulating
    - Heavy metals are removed by electro-filters
    - Remaining water is reused to make steam
    - Exhaust gas – carbon conversion system
    - Rotary trummel sorts into species, color and type
- Phase 1 reduced 20 tons to 20 tons, a reduction in volume of 85% with no change in weight

The Ze LLC MSW System – Phase 2

Material Separation via High Capacity Sorting Equipment

- Sophisticated automatic sorting equipment
  - Overhead magnets for ferrous metals
  - Eddy current separators for non-metallic metals
  - Auto-sort plastic (densitometer)
  - Clarifier for separating glass

The Ze LLC MSW System – Phase 2 (cont.)

Material Separation via High Capacity Sorting Equipment

- Recyclables are processed by type
  - Metals shredded
  - Plastics sorted and non-recyclables plastics are mixed with cellulosic fiber
  - Glass is ground for high quality cement products
  - Conversion process to USDA approved materials
- Phase 2 reduced 20 tons to 10 tons

The Ze LLC MSW System – Phase 3

Hydrocarbon Conversion through Microwave Technology

- Remaining waste - clean cellulosic bio mass - is sent to microwave and heated to 680 degrees
- Nitrogen blanket in microwave prevents combustion
- Hydrocarbon chain "cracked" and converted to syn-gas
- Gas filtered, scrubbed, collected and condensed into #4 heating oil and converted into non-condensable gases

The Ze LLC MSW System – Phase 3 (cont.)

Hydrocarbon Conversion with Microwave Technology

- "Cracking" done by absorption rate frequencies – not heat
- Done without water and oxygen
- No CO_2 or CO produced
- Non-condensable gases go to a gas turbine or engine depending on size
  - Phase 3 reduced 10 tons to 3.5 tons, a reduction in weight of 65% in this phase, or 94% in volume phase 1-3
  - No furans and phenols produced

The Ze LLC MSW System – Phase 4

Carbon Conversion via Steam Reforming

- Remaining char from Phase 3 enters the Carbon Conversion System
  - Of the 6%, 1% is ash, 5% is carbon
- Carbon heated to 1600°F
  - Water is injected into the carbon stream
  - Creates syngas of hydrogen and carbon monoxide which can be used for a fuel cell or liquid fuels
  - Phase 4 reduced 3.5 tons to 0.58 tons, a reduction of 94% in volume in this phase, or 98% in volume phase 1-4, with a weight reduction of 97%
  - Remaining ash is sent to be mixed with construction and demolition materials (C&D) and made into cement products

Summary of Weight Reduction

Phase	Tons
•Phase 1 – Separation by Autoclave	20.00
•Phase 2 – Separation by Sorting Equipment	10.00
•Phase 3 – Hydrocarbon Conversion via Microwave	3.50
•Phase 4 – Carbon Conversion via Steam Reforming	0.58

Result

- Remaining 0.58 tons is ash cake
- Ash cakes will be combined with pulverized C&D materials to create over 50 cement products
- All materials turned into by-products
- No residual materials sent to landfill

Advantages of the Ze LLC MSW System

- Lower tipping fees
- Zero emissions
- Generates parasitic power for system plant needs
- All by-products contribute to economic feasibility
- No household sorting required, fewer trucks and employees required
- Could lead to lower household charges or favorable budgetary impact
- No residual waste dumped in landfill