CONVERSION TECHNOLOGY SUPPLIER INFORMATION

TABLE A-1
LIST OF CONVERSION TECHNOLOGY SUPPLIERS THAT RECEIVED THE QUESTIONNAIRE

TABLE A-1
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Gasification	Fixed bed	AmbientECO	Produces EnviroFuel, to gasification	MSW	ON, Canada	They license technology, but do not manufacture a gasifier. Patent submitted for WTE. Have used Simoneau Group close-coupled gasifier. Now talking with Emery. Syngas to boiler.	No operating plants	Small plant was at Caledon Landfill in Peel, Ontario, Canada. Can do testing.	Boiler
Gasification	Fixed Bed	Emery Energy Company	Emery Energy gasification process	Tires, RDF	Salt Lake City, UT	Pilot and demo units	1,200 TPY demo	Pilot and demo	Engines
Gasification	Fixed bed	Global Warming Prevention Technologies, Inc.	Natural State Reduction System (NSRS)	MSW, industrial, medical wastes	ON, Canada	Consortium of Thermogenics, Siemens Canada, Ltd., SENES Consulting, SK Precision Hydraulics, and Gardiner Roberts)	28 TPD	28 TPD demo plant in Anchorage, AK; 5 TPD demo plant in Kuala Lumpur. 64 ton batch process cells.	Boiler
Gasification	Fixed bed	Improved Converters, Inc.	Advanced Multi-Purpose Converter	MSW, RDF, tires, haz wastes	Sacramento, CA	Prototype to be tested within next 12 months		Commercial scale prototype, no throughput data	
Gasification	Fixed bed	Innovative Logistics Solutions, Inc.	Pyromex	MSW	Palm Desert, CA				

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Gasification	Fixed bed	Omnifuel Technologies, Inc.	RDF Gasification	Organic wastes, tires, sewage sludge, biomass	Folsom, CA	Omnifuel gasification	No plants	Plant in Ontario (1981) at 150 TPD on bark, sawmill residues, plywood trim. 25 TPD pilot plant ran 2,000 hours (including 24/7 for two 31-day runs) on RDF and other feedstocks in 1979.	CT
Gasification	Fixed Bed	Primenergy, LLC	PRM Energy gasification	Biomass, RDF, rice hulls, olive waste	Tulsa, Oklahoma	Main experience w/rice hulls and olive waste. Most have power generation.	200,000 TPY	18 gasifiers on biomass, up to 600 TPD	Boiler
Gasification	Fixed bed	Thermogenics, Inc.	Thermogenics Gasification System	Wood waste, MSW, lignin, tires	Albuquerque, NM	Pilot plant on tires		Plants planned for MSW in UAE, wood waste to ethanol in Mecca, CA, and lignin to syngas in Italy.	IC engines
Gasification	Fixed Bed	Whitten Group International	Entech Renewable Energy System	MSW, medical, animal food wastes, dried sewage, hazardous wastes	Longview, WA	Gasification at 1,040°F, close-coupled to combustion "thermal reactor"	30,000 TPY (Malaysia)	47 facilities in operation worldwide, 12 on MSW at 6-143 TPD. Taiwan facility at 30 TPD MSW (9,000 TPY)	Boiler
Gasification	Fluid bed	Ebara Corporation/ Environmental Plants Division	Ebara Twin Rec TIFG (Twin Internally Circulating Fluidized Bed Gasification) and Ash Melting	MSW, RDF, ASR, sewage sludge, plastics	Tokyo , Japan	Gasification at 1,100°F, w/close coupled combustion chamber at 2,500°F, w/ash melting	150,000 TPY	Plants in Japan, from 2,500-150,000 TPY. 461.5 TPD (150,000 TPYplant in Kawaguchi)	

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Gasification	Fluid bed	Energy Products of Idaho	Fluidized Bed Staged Gasification with Complete Combustion	MSW, RDF, biomass, wood chips, sawdust, paper mill sludge, industrial sludges, plastic, tires, coal	Coeur d'Alene, ID				Boiler
Gasification	Fluid bed	Enerkem Technologies, Inc. (part of KEMESTRIE Group, part of Univ. of Sherbrooke)	Biosyn Technology, Fluid bed w/alumina or silica	MSW, plastics, wood waste, RDF	Québec,Canada	PFBC at 1,832°F. Syngas produced at 1,472°F.	25,000 TPY		Engines
Gasification	Fluid Bed	Heuristic Engineering	EnvirOcycler	RDF, MSW, wood, biomass	Vancouver, Canada	Updraft gasifier with cyclonic combustion			
Gasification		United Recycling Technology, Inc.	Gasification	Medical, hazardous wastes	La Cresenta, CA				
Other Thermal	Microwave	Molecular Waste Technologies, Inc.			Marietta, GA				
Plasma Gasification		Geoplasma LLC (part of Jacoby Development, Inc.)	Plasma Direct Melting Reactor. Westinghouse Plasma torches.	MSW	Atlanta, GA	Works with Georgia Tech Research Institute	No plants.	No plants	NA
Plasma Gasification		Hitachi Metals, Inc.	Plasma Direct Melting Furnace (Westinghouse Plasma)	MSW	Tokyo, Japan				

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Plasma Gasification		Integrated Environmental Technologies, LLC	Plasma Enhanced Melter	MSW, hazardous, radioactive, medical, industrial, plastics	Richland, WA		3,650 TPY	1,460 TPY med waste facility in Hawaii; 3,650 TPY facility in construction at Fuji Kaihatsu's facility in Iizuka, Japan (near Fukuoka) to convert plastics and industrial waste into electricity.	
Plasma Gasification		MPM Technologies, Inc.	Skygas plasma gasification	MSW, industrial wastes, wood wastes	Parsippany, NJ			No plants	No plants
Plasma Gasification		Pearl Earth Sciences Corp.	Plasma Waste Converter		ON, Canada	Has agreement with Startech to supply plasma torches. Pearl acts as facility developer.	No plants.	Claims a 5 TPD plant, no location provided. Claims they are constructing 100 TPD tire gasification facility in Pickering, Durham Region, Ontario, Canada.	Boiler
Plasma Gasification		Phoenix Solutions Company		Ash vitrification, industrial, hazardous & medical wastes, PCBs, solvents	Crystal, MN			20 ash vitrification plants in Japan	
Plasma Gasification		Plasma Environmental Technologies,Inc.	Plasma Assisted Gasifier	MSW	Burlington, ON	Has 3 contracts in place to develop MSW gasification projects			

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Plasma Gasification		PyroGenesis, Inc.	Plasma Resource Recovery System (PRRS)	Hazardous wastes, incinerator ash	Montreal, Quebec, Canada	High temperature 2,732°F plasma gasification.	12 TPD	Two pilot systems at 11 TPD each in operation for 3 years. Scheduled to put on cruise ship in 2003 and U.S. Navy aircraft carrier in 2004/2005.	
Plasma Gasification		RCL Plasma, Inc. (formerly Resorption Canada Limited)	Phoenix Solutions or Europlasma	Biomedical and hazardous waste	ON, Canada	First commercial unit to be in Far East		Pilot plant near Ottawa for 15 years.	
Plasma Gasification		Recovered Energy, Inc.	Recovered Energy System	MSW	Pocatello, ID	Also uses "Nextpath Environmental"	No plants	No plants	
Plasma Gasification		Scientific Utilization, Inc.	Pyro-Electric Thermal Conversion (PETC)	Medical, hazardous wastes	Huntsville, AL	Molten slag at 2,900°F with induction heating (Allied Chemical ATGAS-PATGAS process). Syngas goes to AC Plasmatron.		Pilot plant under construction. Hazardous waste destruction plant in Taiwan at 15 TPD.	CT
Plasma Gasification		Solena Group	Plasma Gasification Vitrification	Industrial Waste/MSW	Washington, DC	Also partnered w/Europlasma	No plants	No plants	CT
Gasification	Fluid bed	Taylor Recycling Facility, LLC	FERCO SilvaGas	MSW, wood waste, agricultural waste and energy crops	Montgomery, New York,	Steam and hot sand at 1,800°F in gasifier. Close-coupled combustor.	3,650 TPY	10 TPD pilot at NcNeil Generating Plant in VT. Shut down. 300 TPD/23 MW plant in development using wood wates in Winkleigh, Devon, UK and 400 TPD wood waste/C&D debris in Forsyth County, Georgia.	Boiler

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Pyrolysis		Conrad Industries	121 Melhart Road Chehalis, WA, 98532	Plastics	Chehalis, WA				
Pyrolysis		Graveson Energy Management	GEM High-Speed Conversion Technology	MSW	Summit, NJ				
Pyrolysis		North American Power Company	Thermal Recovery Unit	MSW, industrial, medical, plastic	Las Vegas, NV				Boiler
Pyrolysis		Pan American Resources, Inc.	Lantz Converter	MSW	Pleasanton, CA				
Pyrolysis		International Environmental Solution	Thermal Convertor	Mixed Waste	Romoland, CA	The pyrolysis gases go directly to a thermal oxidizer and the heat from the thermal oxidizer routed to a boiler to generate electricity	Demo 50 tpd	No plants	Boiler
Pyrolysis		WasteGen UK Ltd	Materials and Energy Recovery Plant (MERP)	MSW	Gloucester, U.K.		110,000 TPY	Burgau - 40,000 TPY; Hamm - 110,000 TPY	Boiler
Pyrolysis		Utility Savings & Refund LLC	Rapid Thermal Process Producing Bio Oil	Carbon Based Material	Newport Beach, CA	Developer of renewable energy projects from biomass, including gasification, pyrolysis, and anaerobic digestion	150 tpdbiomass	Canada and California	BioOil

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Pyrolysis/ Gasification	Fixed bed	Global Energy Solutions, Inc.	Thermal Converter	MSW	Sarasota, FL	Pyrolysis chamber at 2,200°F. Pyro-Thermic reaction in gasifier at 3,000-3,100°F. Molten slag.		Claims 23 plants in operation around the world, 4 on MSW	Boiler
Pyrolysis/ Gasification	Fixed bed	Interstate Waste Technologies	Thermoselect	MSW	Malvern, PA	Pyrolysis at 572°F, oxygen-blown gasification at 2,200°F	289,000 TPY	Italy - 100 TPD, Japan - 330 TPD, Germany - 792 TPD	Boiler or IC
Pyrolysis/ Gasification		Compact Power Holdings PLC/ Compact Power Ltd		MSW	Bristol U.K.	Pyrolysis, steam reforming, gasification	8,000 TPY	Avonmouth, UK	Boiler
Pyrolysis/ Steam Reforming		Brightstar Environmental	Solid Waste Energy Recovery Facility (SWERF)	MSW	Rouge, LA	Pyrolysis followed by steam reforming	60,000 TPY	Wollongong, Australia	Engines
Steam Reforming/ Catalysis		ThermoChem Recovery International, Inc.	Pulse Enhanced Steam Reformer	Black liquor, bark, wood waste and other organic waste products	Baltimore, MD	Steam reforming using superheated steam. Catalysts enhance water gas shift rection to get more syngas.		New Bern, NC (45 TPD); Big Island, VA (200 TPD); Trenton, Ontario, Canada (125 TPD)	
Thermal Depolymer-ization		Changing World Technologies	Heating under pressure, flash vaporization	Offall	Hempstead, NY				
Aerobic Composting		American Bio-Tech	Air Lance (in-vessel)		Irvine, CA				
Aerobic Composting		Hatch/Stinnes Enerco	System 25.1		Mississauga, Ontario				

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Aerobic Composting		Horstmann Recyclingtechnik GmbH	Various		Oeynhausen, Germany				
Aerobic Composting		HotRot Exports Ltd, or Outspoken Industries	HotRot		Christchurch, NZ				
Aerobic Composting		Wright Environmental Management Inc.	In-Vessel		Ontario, Canada				
Aerobic Digestion		International Bio Recovery Corporation (IBR)	IBR		Vancouver, B.C.				
Anaerobic Digestion		Arrow Ecology Ltd	ArrowBio		Haifa, Israel	ArroBio license holder, responsive			
Anaerobic Digestion		Arrow Ecology Ltd	ArrowBio	MSW	Wheeling, WV	ArrowBio licensee, responsive			
Anaerobic Digestion		Canada Composting Inc. (CCI)	BTA		Newmarket, Ontario				
Anaerobic Digestion		Citec	Waasa process		Vaasa, Finland				
Anaerobic Digestion		Global Renewables	UR-3R, ISKA	MSW	Perth WA Australia	ISKA licensee, responsive			
Anaerobic Digestion		ISKA GmbH	ISKA		Ettlingen, Germany				
Anaerobic Digestion		Kompogas	Kompogas		Glattbrugg				
Anaerobic Digestion		McElvaney Associates Corporation			Santa Barbara, CA				
Anaerobic Digestion		Onsite Power Systems, Inc.	APS		Camarillo, CA				
Anaerobic Digestion		Orbit Waste-to-Energy Systems	HSAD						

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Anaerobic Digestion		Organic Waste Systems nv	DRANCO		Gent - Belgium				
Anaerobic Digestion		Orgaworld NV	BioCel	SSO	UDEN, Netherlands				
Anaerobic Digestion		SEBAC	SEBAC		Gainesville FL				
Anaerobic Digestion		Valorga International S.A.S.	Valorga		Montpellier, France	Valorga license holder, not responsive			
Anaerobic Digestion		Waste Recovery Systems, Inc.	Valorga		Monarch Beach, CA	Valorga licensee, responsive			
Ethanol Fermentation		BC International		MSW	Dedham MA				
Ethanol Fermentation		Arkenol		Agricultural/ biomass	Irvine, CA				
Ethanol Fermentation		Masada Resource Group LLC		MSW	Birmingham, AL				
Ethanol Fermentation	Genahol Hydrolysis & WTE Pyrolysis	Waste To Energy	Genahol	MSW fractions	Paso Robles, CA.	Waste to Energy uses Genahol Process as well as an internally developed pyrolysis for the residuals of the Genahol process			
Ethanol Fermentation		Genencor International, Inc.		Biomass	Palo Alto, CA				
Ethanol Fermentation		GeneSyst International		MSW	Hudson OH				

TABLE A-1 (CONTINUED)
LIST OF CONVERSION TECHNOLOGY SUPPLIERS
LOS ANGELES COUNTY INTEGRATED WASTE MANAGEMENT TASK FORCE
ALTERNATIVE TECHNOLOGY SUBCOMMITTEE

Technology	Sub-Technology	Supplier Name	Process	Primary Feedstock Experience	Address	Comments	Largest Capacity	Plants	Syngas
Syngas-Ethanol		BRI Energy, Inc.	BRI		Studio City, CA				
Catalytic Cracking	Pyrolysis w/catalytic cracking	Plastic Energy LLC (SMUDA)	SMUDA	Plastics	Roseville, CA	Pyrolysis with Catalytic Cracking. The Company is planning to start construction of a facility to convert 26k to/year of non-recycled plastic to liquid fuel			
Plasma Gasification		Rigel Resource Recovery and Conversion Company			Baltimore, MD				

TABLE A-2
CONVERSION TECHNOLOGY SUPPLIERS QUESTIONNAIRE

TABLE A-3
AMENDMENTS TO
CONVERSION TECHNOLOGY SUPPLIERS QUESTIONNAIRE

CONVERSION TECHNOLOGY SUPPLIERS QUESTIONNAIRE

TABLE A-4
SUMMARY OF RESPONSES FROM THE THERMAL CONVERSION TECHNOLOGY SUPPLIERS

TABLE A-4
SUMMARY OF RESPONSES FROM THE THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Changing World Technologies, Inc. West Hempstead, NY	
Brief Description of the Technology	The Thermal Conversion Process consists of five main steps: 1) pulping and slurrying the organic feed with water; 2) heating the slurry under pressure to the desired temperature; 3) flashing the slurry to a lower pressure to release the biogas; 4) reheating the slurry (coking) to drive off water and light oils from the solids; and 5) separating the light oils from the water. The oil is further processed using distillation or solvent extraction. The biogas goes to electric and/or steam generation based upon the economics of on-site use.	
Project Partners	None	
Technical and Financial Resources (Credibility)	CWT has sufficient technical and financial resources, proven in its development of its pilot plant ($13 million) and the commercial plant at ConAgra Foods ($25 million project). CWT states that it has raised $94 million in capital contributions and commitments. It also has a joint venture, Renewable Environmental Solutions, with ConAgra Foods, Inc., that operates the commercial facility. EPA and DOE have supported the development of the commercial plant.	
For the Existing Facilities		
Facility Name	TCP Pilot Plant	Carthage Plant
Location	Philadelphia, PA	Carthage, MO
Owner	Changing World Technologies, Inc.	Renewable Environmental Solutions, LLC
Technology	Thermal Conversion Process	Thermal Conversion Process
Throughput, TPY	Pilot plant rated 7 TPD	82,500
Feedstock	Various	Turkey offal, mechanically de-boned material, feathers, grease
Start-up Date	1999	2004
Capital Cost	$13,000,000	$25,000,000
Annual O & M Cost	Not available	$4,000,000
Products	Oil, biogas, carbon, fertilizer	Oil, biogas, carbon, fertilizer
By-products	None	None
Residuals	None	None

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	32,850 (100 TPD at 90%)
Description of Preprocessing System	CWT assumes that the MRF would provide the appropriate feedstock containing paper, plastics, organics, fats, oils, and greases. If any additional removal of glass or metals is required, CWT would include that equipment as needed. Costs are included in Attachment 2.
Description of Conversion Unit	The Thermal Conversion Process would be sized to treat 100 TPD of specific feedstock from the MRF residuals. The 5 main steps of the facility are as described above. Temperatures and pressures are proprietary to CWT. The general schematic block diagram provides an overall view of the subsystems in the conversion unit, including odor control, pulping and storage, reactors, gas treating, electric generation, water treatment, calciners, oil storage, and the thermal oxidizer feed.
Description of Energy Production Systems	CWT proposes to use a boiler which would combust the biogas produced from the system. All of the steam produced would be utilized within the CWT system.
Description of By-Products Processing & Handling Systems	There are no actual by-products, as the process creates only the primary products.
Feedstock Requirements	Composition: Paper, plastics, organics, fats, oils, and greases
	Size: No size specification
	Moisture Content: Moisture content is not an issue, since water is added for pulping.
Diversion Rate, %	Essentially 100% of processed MRF residuals.
Environmental Issues	Air: The closed, pressurized system has minimal requirements for environmental controls. Odors are piped to a thermal oxidizer for destruction. Commercial plant in Carthage qualified as *de minimis* emission source and did not require an individual air permit. Combustion of the biogas for steam production would result in air emissions; commercially available clean-up equipment would be utilized to meet applicable air emission standards. Produced oil could be combusted for power generation; this would be evaluated later.
	Water: Most process water is recycled. Vacuum/recompression system to be utilized to minimize wastewater discharge.
	Solid Residue: None identified.
	Odor: Any tanks or vessels that have a potential to generate or omit odors are piped to a thermal oxidizer. Tipping hall would likely utilize odor control system.
	Noise: Trucks
	Other: Planned installations in Colorado and Pennsylvania required Environmental Assessments; result in Finding of No Significant Impact is very positive.
Description of Products and By-Products	Products: Oil, biogas, carbon and fertilizers
	By-Products: None

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Products and By-Products, TPY	Products: Biodiesel: 9,113 Mineral Fertilizer: 2,488 Liquid Fertilizer: 8,240 Activated Carbon: 3,947 Metals: 242 Biogas: 4,568
	By-Products: None
Area Requirement, acres	3-5
Utility Requirements	Natural Gas: 14 MMBtu/hr
	Fuel Oil: None
	Water: Not specified
	Sewer: Domestic use
	Electricity: 1 MW from an external source, or about 7,884 MWh/year.
Composition of Residuals Generated by the Facility	Hazardous: N/A
	Non-Hazardous: N/A
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 32,850 (100 TPD at 90% availability)
	Material Recycled: Metals: 242
	Material Disposed: None identified
	Products Generated: 23,788 (does not include biogas, which is combusted for making steam for internal process use). Balance is water.
	By-Products Generated: None
Costs & Revenues	Capital: $15,000,000
	Annual O&M: $4,523,040
	Annual Capital Recovery: $750,000
	Annual Revenue Generated: $5,136,848
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $136,192
	Net cost/ton MSW delivered: $4/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Conrad Industries Chehalis, WA	
Brief Description of the Technology	KleenAir Products Co. Advanced Recycling Technology (pyrolysis) Pre-processing: none described Conversion Unit: Feed enters the pyrolysis unit, which includes the retort, process auger, outlet end bell and furnace chamber. The retort is a horizontal cylindrical vessel and serves as a combined reactor, heat exchanger and mixing device. The retort extends into the furnace. The auger mixes the feedstock and moves it through the reaction vessel. Surrounding the retort is the furnace chamber. Four propane burners provide pre-heat needed for start-up, then syngas is utilized. Hot pyrolyzed vapors which exit the retort are first condensed in the high temperature condensing unit. Pyrolysis occurs at ~1,400 °F. Energy generation: not described.	
Project Partners	Pyrolysis equipment provided by KleenAir Products Co., but information brochure provided about KleenAir does not include any mention of pyrolysis equipment manufacture.	
Technical and Financial Resources (Credibility)	No technical or financial resources described. Supplier's prior experience is primarily with plastics and tires. Some testing on MSW shown in DVD provided. Supplier's submittal questions the need to provide financial guarantees and security arrangements.	
For the Existing Facilities		
Facility Name	Conrad Industries test facility	
Location	Chehalis, WA	
Owner	Conrad Industries, Inc.	
Technology	KleenAir Products Co. Advanced Recycling Technology of Pyrolysis	
Throughput, TPY	Demonstration Unit (KleenAir Products Model # 2977): 930	Commercial Unit: 7,440
Feedstock	Used for treating plastics and tires to produce petrochemical feedstocks which are sold.	
Start-up Date	1993	
Capital Cost	$6,500,000	
Annual O & M Cost	Not provided	
Products	Not described	
By-Products	Not described	
Residuals	Not described	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	30,000
Description of Preprocessing System	Recovery of glass, metals, other (C&D, white goods) fraction. Shredding, pelletizing or cubing for moisture reduction and sizing. No details provided.
Description of Conversion Unit	No details provided. See description above (note: proposed system may be different than existing commercial and demo units, since feedstocks are very different, i.e., MSW vs. plastics and tires). Conversion unit is designed as a 72 TPD module.
Description of Energy Production Systems	No energy production subsystem described. No prior experience with power generation is noted. Submittal notes that the proposed facility would be used to convert MSW to char, oil, and vapor gas (syngas). No use of syngas is noted.
Description of By-Products Processing & Handling Systems	Not provided.
Feedstock Requirements	Composition: Not provided.
	Size: Not provided (may be shredded, cubed or pelletized for sizing and moisture reduction)
	Moisture Content: 15% maximum
Diversion Rate, %	94
Environmental Issues	Air: Requires process stack exhaust, waste gas flare, carbon char silo baghouse. No details on power generation subsystem, so it is not known if syngas or flue gas cleanup will be utilized.
	Water: None determined
	Solid Residue: Disposal of carbon char/ash
	Odor: Likely to incorporate negative pressure maintained in tipping hall to reduce odors, with air routed to power generation subsystem for combustion and destruction of odor-causing compounds.
	Noise: Trucks
	Other: None determined.
Description of Products and By-Products	Products: Electricity, pyrolysis oil (similar to diesel or marine fuel)
	By-Products: Char/ash
Quantity of Products and By-Products, TPY	Products: Electricity: No information on generation provided
	By-Products: Pyrolysis oil: 8,400 (2.1 million gallons)
Area Requirement, acres	Not provided.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: No information
	Fuel Oil: No information
	Water: No information
	Sewer: No information
	Electricity: No information
Composition of Residuals Generated by the Facility	Hazardous: None
	Non-Hazardous: Char/ash
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: Char/ash: 1,680
Mass Balance, TPY	Material Delivered: 30,000
	Material Recycled: Glass and metals: 6,000
	Material Disposed: Char/ash: 1,680
	Products Generated: Electricity
	By-Products Generated: Oil: 8,400
Costs & Revenues	Capital: No information provided
	Annual O&M: No information provided
	Annual Capital Recovery: No information provided
	Annual Revenue Generated: No information provided
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : No information provided
	Net cost/ton MSW delivered: No information provided

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Ebara Corporation Tokyo, Japan	
Brief Description of the Technology	Internally Circulating Fluidized-bed Gasifier (ICFG), using pyrolysis coupled with char combustion. Pre-processing: None required, other than removal of large items. Conversion unit: Combines pyrolysis reactor and char oxidation chambers. Fluidizing sand provides heat source, with steam addition for fluidization and production of syngas at 1,560 °F. Sand moves to char oxidation chamber, where air is added and combustion occurs. Energy production: syngas cleaned and combusted in reciprocating engines.	
Project Partners	No others.	
Technical and Financial Resources (Credibility)	Ebara is a global engineering, environmental, construction, and operations company. Ebara's Environmental Engineering Group alone does $1.8 billion per year in business. They have extensive environmental and engineering capabilities, and have experience in providing guarantees and letters of credit.	
For the Existing Facilities		
Facility Name	Sodegaura ICFG Pilot Plant #1 (now shut down)	Sodegaura ICFG Pilot Plant #2 (in operation)
Location	Nakasode 3-1, Sodegaura City, Chiba Prefecture	Nakasode 3-1, Sodegaura City, Chiba Prefecture
Owner	Ebara	Ebara
Technology	ICFG	ICFG
Throughput, TPY	6,600	4,950
Feedstock	Wood chips, plastic, RDF, Sewage sludge	MSW
Start-up Date	Jan. 2003	May 2004
Capital Cost	No data	No data
Annual O & M Cost	No data	No data
Products	No data	No data
By-products	No data	No data
Residuals	Bottom ash	Bottom ash

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	21,160 (70.5 TPD @ 300 days)
Description of Preprocessing System	None required. Manual picking of items > 12 inches.
Description of Conversion Unit	Reactor integrates a pyrolysis section and char oxidation section, using fluidizing sand that is moved between the two sections. In the pyrolysis section, steam is injected for fluidizing (fluidizing air cannot be used since the process is pyrolysis). The hot sand transfers heat to the MSW feedstock, resulting in thermal decomposition of the organic constituents. Unreacted carbon char and ash materials fall into the sand bed, and are transferred into the oxidation chamber for combustion. The combustion heats the sand, which is then moved to the pyrolysis section for providing heat. The syngas is cleaned in a water scrubber, and the cool, clean syngas is combusted in a reciprocating engine for power production. The hot exhaust gas goes through a heat recovery system, which heats up the air used in the oxidation/combustion chamber. The hot flue gas from the char combustion section flows through a heat recovery boiler, where steam is produced for the fluidizing process in the pyrolysis chamber. The cooled flue gas leaving the boiler enters a fabric filter, then a selective catalytic reduction (SCR) system, then to a stack.
Description of Energy Production Systems	The syngas is combusted in a reciprocating engine, producing 1.57 MW gross/992 kW net. The hot exhaust gas flows through a heat recovery system (no data on what it's used for), then through an SCR system, then to a stack.
Description of By-Products Processing & Handling Systems	Recovery of bottom ash and metals that are >1/8 inch. Metals removed from fluidizing sand. Fly ash and fabric filer ash are disposed of in landfill.
Feedstock Requirements	Composition: MSW
	Size: 12 inches
	Moisture Content: 43% per submittal.
Diversion Rate, %	95
Environmental Issues	Air: Flue gas from reciprocating engines is cooled and sent to SCR system for NO_x reduction. Hot flue gases from char oxidation are cooled; lime addition for removal of acid gases, then fly ash and reaction products removed in fabric filer, followed by SCR for NO_x reduction.
	Water: Blowdown from water treatment system to sewer.
	Solid Residue: Fly ash and reaction products to landfill.
	Odor: Trucks
	Noise: Tipping hall would likely be maintained under negative pressure, with air going to engines and char oxidation for combustion, destroying odor-causing compounds.
	Other: None identified

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Description of Products and By-Products	Products: Electricity
	By-Products: Bottom ash and metals
Quantity of Products and By-Products, TPY	Products: Electricity: 7,149 MWh/year
	By-Products: Metals/bottom ash: 288
Area Requirement, acres	2.5
Utility Requirements	Natural Gas: 135 TPY
	Fuel Oil: 450,000 gallons/year
	Water: 5,310,000 gallons/year
	Sewer: 4,854,000 gallons/year
	Electricity: Internal requirement of 575 kW = 4,140 MWh/year
Composition of Residuals Generated by the Facility	Hazardous: Fly ash and fabric filter reaction products
	Non-Hazardous: Bottom ash and metals
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 864 (fly ash to landfill)
	Non-Hazardous: 288 (bottom ash to landfill as daily cover)
Mass Balance, TPY	Material Delivered: 21,160
	Material Recycled: none
	Material Disposed: 1,152
	Products Generated: Electricity: 7,149 MWh/year
	By-Products Generated: Metals: 94
Costs & Revenues	Capital: $47,490,000 ($2,244/TPY)
	Annual O&M: $3,590,000
	Annual Capital Recovery: $2,850,000
	Annual Revenue Generated: $327,865
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $6,112,135
	Net cost/ton MSW delivered: $289/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	GEM America, Inc. Summit, NJ
Brief Description of the Technology	Flash Pyrolysis Pre-processing: to remove inerts such as glass and metals. Shredding, granulating, and drying to produce feedstock at 8% moisture and 1/16th inch size. Conversion unit: flash pyrolysis at 1,500 °F. Produces syngas and char/ash mixture. Syngas is quenched in ½ second to 75 °F. Chlorine compounds removed. Sulfur compounds removed in wet scrubber. Syngas to power generation. Power generation: reciprocating engines.
Project Partners	ICC, Inc. (engineering firm)
Technical and Financial Resources (Credibility)	Sufficient technical resources. ICC, Inc. to provide complete EPC services and project insurance. GEM has already developed a pilot (1/3 scale) and commercial facility. GEM would guarantee facility at 75% of rate capacity, with sufficient funds in an escrow account to ensure performance
For the Existing Facilities	
Facility Name	Davies Brothers Waste (presently inactive, awaiting long-term MSW contract)
Location	Bridgend, South Wales, UK
Owner	Davies Brothers Waste
Technology	Graveson Energy Management Thermal Cracking Technology
Throughput	14,000 TPY (dried)
Feedstock	MSW
Start-up Date	April 2000
Capital Cost	No data
Operating Cost	No data
Products	Syngas for power generation in GE Jenbacher engine
By-products	None noted.
Residuals	30% char/70% ash mixture to landfill (10% of inlet feedstock)

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	30,000 TPY
Description of Preprocessing Systems	Removal of all glass and metals. Shred Tech primary and secondary shredders; Scott Rotary dryer with Thermal Oxidizer, and Rapid Granulators – to achieve 8% moisture and 1/16th inch size.
Description of Conversion Unit	Two 50 TPD capacity thermal cracking reactors. Reactor is 20' high by 17' diameter, constructed of stainless steel, with a mechanical stirrer. Feedstock fed in and contacts hot stainless steel walls at 1,500 °F. Decomposition to syngas in < 1 second. 90% of carbon is converted. Ash and unconverted carbon char are removed at bottom of reactor.
Description of Energy Production Systems	A GE Jenbacher reciprocating engine will be used to generate 3 net MW, for a conversion of 1,060 net kWh/ton feedstock.
Description of By-products Processing & Handling Systems	No by-products noted, only residuals.
Feedstock Requirements	Composition: MSW
	Size: 1/16th inch
	Moisture Content: 8%
Diversion Rate	100% if char/ash found to be non-hazardous. 83% if it is hazardous.
Environmental Issues	Air: Syngas cleaning provides extensive cooling and cleaning prior to combustion in engine.
	Water: No wastewater identified.
	Solid Residue: Char/ash likely to be non-hazardous, but will need to be tested for assurance.
	Odor: Tipping hall would likely be maintained under negative pressure, with air going to engines for combustion, destroying odor-causing compounds.
	Noise: Trucks, engines.
	Other: None
Description of Products and By-Products	Products: Electricity
	By-Products: Char/ash may be recyclable.
Quantity of Products and By-Products	Products: Electricity: 23,652 MWh
	By-Products: Char/ash: 5,045 (if not shown to be hazardous)
Area Requirement	½ acre

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: Only on start-up for heating; no quantity specified.
	Fuel Oil: None
	Water: Not specified
	Sewer: Not specified
	Electricity: Uses 0.3 MW internal load.
Composition of Waste Generated by the Facility	Hazardous: None
	Non-Hazardous: Char/ash mixture (testing needed to confirm)
Quantity of Waste Generated by the Facility	Hazardous: 0
	Non-Hazardous: 5,054 TPY char/ash mixture (testing needed to confirm)
Mass Balance	Material Delivered: 30,000 TPY
	Material Recycled: 1,800 TPY
	Material Disposed: 0 (unless char/ash is found to be hazardous; 5,054 if hazardous)
	Product Generated: Syngas
Cost	Capital: $13,215,317 ($440/TPY)
	Annual O &M: $2,071,450
	Annual Capital Recovery: $2,316,680
	Annual Revenue Generated: $1,244,340
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $3,143,790
	Net cost/ton MSW delivered: $105/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Geoplasma, LLC Atlanta, GA	
Brief Description of the Technology	Pre-processing: Shredding to 6 inch size may be required. Conversion unit: uses Hitachi Metals' Plasma Direct Melting Reactor using Westinghouse plasma torches. MSW fed with coke at a rate of 7% of MSW feed (provides for a porous bed at the bottom of the reactor that acts as a heat reservoir and assures even distribution of the plasma gases and free flow of the vitrified residue) and limestone (for lowering fusion temperature of melt to keep it in molten form). Plasma torches (consuming about 20 kWh/ton MSW) heat air to 4,500 °F. This gasifies organic portion of MSW and melts inorganics to form slag layer above molten metal layer. Use of coke contributes to about 13% of the syngas produced. Slag and metals removed in molten form and cooled. Forms glassy aggregate and metal nodules. Syngas combusted in adjacent combustor. Hot flue gas flows through boiler to make steam; steam flows to steam turbine generator. Flue gases go through emission control system with caustic scrubber to remove acid gases, and activated carbon injection, then to stack.	
Project Partners	Geoplasma is subsidiary of JDI, Inc., which re-develops environmentally sensitive or impaired sites into industrial parks and malls. Hitachi Metals Corp. (process design, process equipment design and supply, facility design and construction oversight), Westinghouse Plasma Corp. (plasma torches), Energy Systems Group LLC (subsidiary of Vectren, to operate facility and provide guarantees), SPF Group and UBS (financial), MACTEC (engineering, siting, and permitting) and Georgia Institute of Technology (technological oversight and permitting assistance).	
Technical and Financial Resources (Credibility)	Sufficient to implement project. See partner descriptions above.	
For the Existing Facilities		
Facility Name	Mihama-Mikata	Utashinai
Location	Mihama-Mikata, Japan	Utashinai, Japan (near Hokkaido)
Owner	Cities of Mihama and Mikata	City of Utashinai
Technology	Hitachi Metals Plasma Direct Melting Furnace	Hitachi Metals Plasma Direct Melting Furnace
Throughput, TPY	8,000	65,700
Feedstock	MSW and sewage sludge	2/3 MSW and 1/3 Auto Shredder Residue
Start-up Date	December 2002	July 2002
Capital Cost	$18,000,000 ($2,250/TPY)	$65,000,000 ($989/TPY)
Annual O & M Cost	$700,000 ($84/ton)	$5,500,000 ($84/ton)
Products	Hot water for district heating	Electricity (7.9 MW steam turbine generator)
By-products	Slag aggregate, metals	Slag aggregate, metals

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Residuals	None	None
For the Proposed Facility		
Throughput, TPY	29,200	
Description of Preprocessing System	Shredding to 6 inch size.	
Description of Conversion Unit	Uses a single Hitachi Metals' Plasma Direct Melting Reactor using Westinghouse plasma torches. MSW fed with coke and limestone. Plasma torches heat air to 4,500 °F. This gasifies organic portion of MSW and melts inorganics to form slag layer above molten metal layer. Slag and metals removed in molten form and cooled. Forms glassy aggregate and metal nodules. Syngas combusted in adjacent combustor. Hot flue gas flows through boiler to make steam; steam to steam turbine generator. Flue gases go through emission control system (caustic scrubber to remove acid gases, then activated carbon injection and baghouse) to stack.	
Description of Energy Production Systems	Syngas burned in combustor to produce hot flue gas; hot flue gas flows through boiler to produce steam; steam to steam turbine generator to generate 2.8 MW gross/1.375 MW net.	
Description of By-Products Processing & Handling Systems	Conveyor to remove slag aggregate and metal nodules and send to pit for transfer to trucks for removal to sale.	
Feedstock Requirements	Composition: Unsorted MSW, with some shredding	
	Size: Not stated	
	Moisture Content: 30% desirable - water turns to steam, which promotes steam reforming of carbon to syngas)	
Diversion Rate, %	~100%	
Environmental Issues	Air: emission control system, using caustic scrubber for removing acid gases, followed by activated carbon injection and baghouse, removes pollutants. Fly ash and other compounds from the emission control system are re-injected into the reactor and become part of the vitreous slag when it solidifies.	
	Water: Water and wastewater streams are injected into reactor, where contaminants become mixed into molten slag layer and are captured into the vitreous granulate when it solidifies.	
	Solid Residue: No residuals	
	Odor: Negative pressure maintained in tipping hall to reduce odors – air is routed to reactor and combustor, destroying odor-causing compounds.	
	Noise: Trucks	
	Other: Not determined	
Description of Products and By-Products	Products: Electricity sold on grid.	
	By-Products: Slag aggregate sold for cement-making; metals have existing market.	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Products and By-Products, TPY	Products: Electricity: 9,900 MWh
	By-Products: Metals: 1,168 TPY Slag: 3,504 TPY
Area Requirement, acres	3-4
Utility Requirements	Natural Gas: only on start-up for heating
	Fuel Oil: None
	Water: 91,600,000 for cooling tower; 290,000 for sanitary
	Sewer: Sanitary use.
	Electricity: Internally generated
Composition of Residuals Generated by the Facility	Hazardous: None
	Non-Hazardous: None
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 29,200 MSW/2,000 coke/200 limestone
	Material Recycled: 0
	Material Disposed: 0
	Product Generated: 0
	By-products Generated (metals and slag aggregate): 4,678
Costs & Revenues	Capital: $45,190,000 ($1,548/TPY)
	Annual O&M: $2,668,000
	Annual Capital Recovery: $2,380,000
	Annual Revenue Generated: $540,500
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $4,507,500
	Net cost/ton MSW delivered: $172/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Global Energy Solutions, LC Sarasota, FL
Brief Description of the Technology	Pre-processing: shredding to 3 inch size. Conversion unit: Pyrothermic Thermal Converter incorporates pyrolysis, along with medium and high-temperature gasification to convert MSW to syngas. The converter includes a pre-heat zone, degasification zone, pyro-thermic zone, pre-molten zone, and molten layer. MSW enters through airtight, interlocked doors mounted above the upper chamber. A portion of the converter is internally rotated for mixing purposes. MSW comes into direct contact with preheated air at 660-840 °F, and falls into primary conversion chamber. There, water is evaporated, and some of the gases are liberated. It is subjected to indirect heat from gases at 2,192-2,460 °F, and the MSW is converted to syngas. Material falling into secondary conversion chamber subjected to temperatures of 3,000-3,300 °F. At the center of this chamber is a 6" thick bed of molten slag. Combustion of fuel oil or natural gas is used to maintain the slag in molten form. All produced gases must first pass through the molten bed before exiting through the bottom of the converter. Apparently, GES expects that contaminants are in some way filtered by the molten layer. The syngas is then mixed with air and combusted within the bottom chamber. The molten slag enters a heat recovery chamber, then falls into the quench tank where the temperature is reduced to 122-140 °F. The slag droplets solidify into a granulate form, and are removed by a conveyor. GES claims that the granulate residue is sterile and inert, and can be used as fill for road construction and/or lightweight building blocks.
Project Partners	GES has listed a team of attorneys, environmental consultants, architects, and technology solutions companies.
Technical and Financial Resources (Credibility)	GES has developed 20 other facilities worldwide, and with their team partners, is likely to be able to develop a facility for the County. GES proposes to develop the facility at no capital cost to the County, and O&M, capital recovery and profit would be funded by tipping fees (level not stated).

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Existing Facilities	
Facility Name	GES provided a list of 20 existing facilities worldwide that utilize the Thermal Converter, treating MSW, industrial wastes, and auto wastes at throughputs of 72-420 TPD. They list a 180 TPD unit in Tokyo treating MSW, and one at Japan Gas Co. with 8 converters that treats MSW. One system in Germany uses the heat from the process to produce steam, which is piped to a steam turbine for generation of electricity.
Location	Most of the units are in Japan, Germany, Belgium, and the UK.
Owner	Various cities and industrial companies.
Technology	Pyrothermic Thermal Converter.
Throughput, TPY	23,000-125,000
Feedstock	MSW, industrial wastes, auto wastes
Start-up Date	Not provided
Capital Cost	Not provided
Annual O & M Cost	Not provided
Products	Not provided
By-products	Slag at approximately 3% of inlet waste
Residuals	Not provided
For the Proposed Facility	
Throughput, TPY	33,000
Description of Preprocessing System	MSW is run though a shredder to reduce size to 3 inches. No removal/recovery of recyclables is noted.
Description of Conversion Unit	See discussion above. GES proposes to use two model 150S Pyrothermic Thermal Converters, each rated at 72 TPD, for a total capacity of 144 TPD, to handle the 100 TPD. They state that the excess capacity allows for maintenance and assures that the entire system will never be completely shut down. The Pyrothermic Thermal Converter uses a multi-zone pyrolysis and gasification system to convert MSW to syngas. The syngas is combusted in an integrated chamber within the converter, and the hot flue gases and hot air are internally recirculated, subjecting the inlet MSW to temperatures up to 3,100 °F. Some of the heat is applied indirectly (for pyrolysis to occur) and some is direct heat exchange with the MSW and converted gases. No emission control system is noted. (see discussion below)
Description of Energy Production Systems	Each converter will have a waste heat boiler and a steam turbine rated at 3 MW. Total output will be 5.45 MW. Internal load is 0.25 MW, for a net output of 5.2 MW.
Description of By-Products Processing & Handling Systems	No description provided.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Feedstock Requirements	Composition: MSW
	Size: No data provided
	Moisture Content: No data provided
Diversion Rate, %	No information provided. Submittal states that a slag granulate is produced at approximately 3% of inlet MSW; diversion could therefore be 97%.
Environmental Issues	Air: No information on emission controls is provided. Apparently, GES expects that all contaminants in the syngas are removed as the syngas passes through the molten slag bed. GES states that "there is no smoke emitted into the air and the clean exhaust gasses that are allowed to leave the unit are constantly monitored so that they will not release any toxic or harmful gasses into the atmosphere." GES provided some monitoring results, which show cases where emissions are above applicable standards, and notes "while the units are developing heir operating temperatures (at start-up and after shutdown) some of the emission results may be above standard until the units reach optimum operating temperatures." This would not be acceptable in the LA area.
	Water: No information on water or wastewater treatment is provided.
	Solid Residue: No information on solid residues is provided; slag granulate may be marketable, so that there are no residues.
	Odor: Tipping hall would likely be maintained under negative pressure, with air going to engines and char oxidation for combustion, destroying odor-causing compounds.
	Noise: Trucks
	Other: Insufficient information in submittal to determine.
Description of Products and By-Products	Products: Not specified.
	By-Products: Slag granulate
Quantity of Products and By-Products, TPY	Products: No information provided
	By-Products: Slag granulate may be produced at 3% of inlet MSW, but no inlet MSW feed was proposed. System may also produce steam and/or desalinate water, but actual by-products were not described.
Area Requirement, acres	No information provided
Utility Requirements	Natural Gas: No information provided
	Fuel Oil: No information provided
	Water: No information provided
	Sewer: No information provided
	Electricity: No information provided
Composition of Residuals Generated by the Facility	Hazardous: No information provided
	Non-Hazardous: No information provided

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Residuals Generated by the Facility, TPY	Hazardous: No information provided
	Non-Hazardous: Slag granulate produced at approximately 3% of inlet MSW feed, but no inlet MSW feed was proposed.
Mass Balance, TPY	Material Delivered: No information provided
	Material Recycled: No pre-sorting required
	Material Disposed: No information provided
	Products Generated: No information provided
	By-Products Generated: Slag granulate produced at approximately 3% of inlet MSW feed, but no inlet MSW feed was proposed. Steam and/or desalinated water might also be produced, but GES did not propose anything specific for the County.
Costs & Revenues	Capital: No information provided. GES proposes to develop a facility at no capital cost to the County.
	Annual O&M: No information provided
	Annual Capital Recovery: No information provided
	Annual Revenue Generated: No information provided
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : No information provided
	Net cost/ton MSW delivered: No information provided. GES proposes that the facility (no throughput specified) would be built and operated at no cost to the County other than a tipping fee to be negotiated between GES and the County. However, since GES provided no financial information, it is impossible to evaluate the economic implications of a GES facility. No tipping fee (or range of tipping fees) can be determined for comparison with existing landfill disposal costs or for comparison with other technology submittals. The fact that GES's submittal states that "At this time, there is not enough data to determine exact capital cost requirements" is a concern. Given that GES has apparently provided over 20 other Thermal Converter facilities, it is surprising that they are not able to prepare even a conceptual cost estimate for the facility for the county.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	International Environmental Solutions Corporation Romoland, CA
Brief Description of the Technology	Advanced Pyrolytic Technology, utilizing pyrolysis.
Project Partners	H. West Equipment (design of conveyors and MRFs), Northern Power Systems (provided feasibility study and designs power plants), DeVere Construction Company (develops and engineers power plant designs), Advanced Energy Strategies (energy project development and regulatory issues), Manit Systems (automated controls)
Technical and Financial Resources (Credibility)	The overall team that IES has proposed has significant technical capabilities and experience in MSW management, MRF and power plants design, and energy sales; together, they provide financial strength and ability to develop and guarantee the project. DeVere has the capability to bond projects up to $100 million.
For the Existing Facilities	
Facility Name	International Environmental Solutions test facility
Location	Romoland, CA
Owner	International Environmental Solutions
Technology	Advanced Pyrolytic Technology (pyrolysis)
Throughput, TPY	Rated at 50 TPD. TPY not appropriate for a test facility. (A 147 TPD system has been designed and will be constructed)
Feedstock	Various feedstocks for tests, including post-MRF residuals, infested wood bark, industrial waste, industrial sludge, pharmaceuticals, auto shredder residue.
Start-up Date	Not provided
Capital Cost	$8,000,000 for test facility
Annual O & M Cost	Not provided – test facility
Products	Test facility
By-products	Carbon char, glass and metals (ferrous and non-ferrous)
Residuals	None

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	53,655
Description of Preprocessing System	MRF residuals at inlet conveyor to dryer are sized at ≤ 2 inches (if MRF residuals do not meet this size, an additional stage will be required). Feed enters dryer where moisture is reduced from 25% to 10%. Feed system uses patented valve that seals out air (since pyrolysis is used).
Description of Conversion Unit	The process utilizes a horizontal retort, with a proprietary rotating auger to move the feed through the system. The chamber is a three-arch, triangular design, using the upper portion to transport the syngas to the thermal oxidizer, with the two bottom arches conveying the MSW through the retort for pyrolysis. Hot gases from combustion of natural gas provide the indirect heat needed for pyrolysis. The MSW is heated to 1,200-1,800 °F, where thermal degradation of the organic portion of the MSW occurs. Syngas is produced, and a carbon char mixed with metals and glass is discharged by gravity onto a conveyor. The syngas is immediately combusted in a thermal oxidizer, creating flue gas at 2,250 °F. The flue gases are routed through a heat recovery steam generator to produce steam, then through a fabric filter, wet scrubber, and activated carbon filter, and are then exhausted through a stack. The steam is piped to a steam turbine generator.
Description of Energy Production Systems	The steam from the boiler is piped to a steam turbine generator, producing electricity at 8 MW gross/7.6 MW net.
Description of By-Products Processing & Handling Systems	No description, but video showed magnetic separator and eddy-current separator for metals. Glass will also be recovered.
Feedstock Requirements	Composition: MSW from MRF
	Size: ≤ 2 inches
	Moisture Content: 25% (will dry to 10% moisture)
Diversion Rate, %	99
Environmental Issues	Air: Flue gases from combustion chamber will be treated by fabric filter, wet scrubber, and activated carbon filter, and are then exhausted through a stack.
	Water: No discharge noted. Water is recovered from the system for re-use.
	Solid Residue: Wet scrubber produces small amount of by-product, but no quantities are noted. This may or may not be commercially usable.
	Odor: Tipping hall would likely be maintained under negative pressure, with air going to engines and char oxidation for combustion, destroying odor-causing compounds.
	Noise: Trucks
	Other: None determined.
Description of Products and By-Products	Products: Electricity:
	By-Products: Carbon char, metals and glass.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Products and By-Products, TPY	Products: Electricity: 60,793 MWh
	By-Products: Char: 1,073 Metals: 805 Glass: 5,365
Area Requirement, acres	0.2 acre (no area for MSW delivery and storage)
Utility Requirements	Natural Gas: Used for providing indirect heat for pyrolysis
	Fuel Oil: None used
	Water: Used in the process for steam generation; reclaimed from water recovered within the process.
	Sewer: For employee use only
	Electricity: Internal load of 3,504 MWh
Composition of Residuals Generated by the Facility	Hazardous: None
	Non-Hazardous: Wet scrubber by-product and fabric filter ash
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: 91
Mass Balance, TPY	Material Delivered: 53,655
	Material Recycled: 805
	Material Disposed: 91
	Products Generated: Electricity: 60,793 MWh
	By-Products Generated: Char: 1,073 Metals: 805 Glass: 5,365
Costs & Revenues	Capital: $23,225,500 ($433/TPY)
	Annual O&M: $2,328,650
	Annual Capital Recovery: $3,973,226
	Annual Revenue Generated: $3,004,282
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $3,297,594
	Net cost/ton MSW delivered: $61/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Interstate Waste Technologies, Inc. Malvern, PA		
Brief Description of the Technology	Thermoselect high temperature gasification. This technology incorporates an initial degassing (pyrolysis) chamber, decomposing the MSW into volatile syngas and a carbon char mixed with inorganic components of the MSW. The carbon char enters the gasification chamber, where oxygen is added to complete the gasification of the carbon into more syngas. The syngas is then quench-cooled and cleaned; it can then be combusted in a boiler, reciprocating engine, or gas turbine for power generation. The inorganic components are heated in the bottom of the reactor, where oxygen is added, to >3,000 °F, where they are converted to molten form. They flow into a water bath and are recovered as a metal shot and a slag aggregate, both of which are saleable. Some of the syngas cleaning system byproducts are marketable.		
Project Partners	Thermoselect S.A. (gasification technology), HDR Engineering, Inc. (engineering), H.B. Zachry (construction), Montenay Power Corporation (facility O&M)		
Technical and Financial Resources (Credibility)	IWT has developed the Interstate Waste Management Alliance, composed of IWT and its partners listed above. These are large, financially sound companies which have implemented large projects worldwide. HDR/Zachry have prior experience in providing financial guarantees, letters of credit and performance bonds in their work. They would provide a 100% payment and performance bond for the design and construction of the facility. Montenay Power would provide appropriate guarantees for the O&M of the facility.		
For the Existing Facilities			
Facility Name	Thermoselect Sudwest	Chiba Facility	Mutsu Facility
Location	Karlsruhe, Germany	Chiba, Japan	Shimokita, Japan
Owner	EnBW (electric utility)	JFE (formerly Kawasaki Steel)	Mitsubishi Materials Corp.
Technology	Thermoselect	Thermoselect	Thermoselect
Throughput, TPY	246,500	103,500	47,850
Feedstock	MSW	MSW	MSW
Start-up Date	1999	1999	2003
Capital Cost	$120,000,000	$80,000,000	Not available
Annual O & M Cost	$19,500,000	$13,000,000	Not available
Products	Electricity, steam	Electricity	Electricity
By-products	Slag aggregate, metal shot, sulfur, mineral salts, zinc concentrate (hydroxide)	Slag aggregate, metal shot, sulfur, mineral salts, zinc concentrate (hydroxide)	Slag aggregate, metal shot, sulfur, mineral salts, zinc concentrate (hydroxide)
Residuals	Mineral salts may or may not be saleable		

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	100,000
Description of Preprocessing System	No preprocessing is required with the Thermoselect technology, other than removal of large objects.
Description of Conversion Unit	The proposed facility would use one Thermoselect module rated at 13.3 tons/hour, or 319 tons/day. The system layout is as described above.
Description of Energy Production Systems	The syngas would be combusted in two B&V Pielstick reciprocating engines, each rated at about 8 MW, for a total of 16.125 MW gross/11.142 MW net.
Description of By-Products Processing & Handling Systems	The slag and metal exit the bottom of the gasifier reactor in molten form, and fall into a water batch. The metals cool, forming small metal nodules. The molten slag cools, forming a glassy, non-hazardous slag, which is crushed into a fine aggregate. Both are conveyed to outdoor pits for temporary storage prior to being loaded into trucks for sale. The water treatment system removes other metals in the process in a concentrated hydroxide form. These may be marketable. Sulfur in the MSW is eventually removed as a pure sulfur product, which is salable.
Feedstock Requirements	Composition: MSW
	Size: Very large white goods, engines, etc. are removed manually
	Moisture Content: No requirement
Diversion Rate, %	>99%. If mineral salts can be sold, diversion is essentially 100%.
Environmental Issues	Air: Extensive cleaning system removes solid and gaseous contaminants from syngas prior to combustion. Low-NO_x burners in reciprocating engines, followed by SCR, further reduce NO_x emissions.
	Water: No discharges.
	Solid Residue: Mineral salts may or may not be saleable.
	Odor: Tipping hall would likely be maintained under negative pressure, with air going to engines for combustion, destroying odor-causing compounds.
	Noise: Trucks
	Other: None determined
Description of Products and By-Products	Products: Electricity
	By-Products: Slag aggregate, sulfur, metal shot, mineral salts, zinc concentrate
Quantity of Products and By-Products, TPY	Products: Electricity: 83,700 MWh
	By-Products: Slag: 15,024 Metal shot: 2,567 Mineral salts: 2,723 Sulfur: 125 Zinc concentrate: 845
Area Requirement, acres	3.4

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: 110 million scf/year
	Fuel Oil: 187,800 gallons/year
	Water: 75 million gallons/year
	Sewer: 829,450 gallons/year
	Electricity: Internal load of 5 MW, or 37 million kWh/year
Composition of Residuals Generated by the Facility	Hazardous: Mineral salts, if not saleable, will require appropriate disposal in hazardous landfill
	Non-Hazardous: None
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 3,175 of mineral salts, if not saleable
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 100,000
	Material Recycled: None in preprocessing
	Material Disposed: possible 3,175 of mineral salts, if not saleable
	Products Generated: Electricity: 83,700 MWh
	By-Products: Slag: 15,024 Metal shot: 2,567 Mineral salts: 2,723 Sulfur: 125 Zinc concentrate: 845
Costs & Revenues	Capital: $75,511,000 ($755/TPY)
	Annual O&M: $10,787,432
	Annual Capital Recovery: $12,258,573
	Annual Revenue Generated: $4,430,873
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $18,615,132
	Net cost/ton MSW delivered: $186/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Molecular Waste Technologies, Inc. Marietta, GA
Brief Description of the Technology	Uses magnetrons to induce microwaves into the feedstock, resulting in "molecular reduction of organics", breaking it down into oil and carbon char.
Project Partners	Lockwood Greene would design and construct the facility.
Technical and Financial Resources (Credibility)	MWT's business plan is to design, research and license the technology. MWT may have sufficient technical resources with Lockwood Greene on the project. They have questionable financial resources to implement the project. MWT states that they have "no appreciable assets except equipment". The submittal states that Lockwood Greene would provide performance bonds.
For the Existing Facilities	
Facility Name	None in operation. Had pilot plant at Georgia Tech.
Location	Georgia Tech, Atlanta, GA
Owner	MWT
Technology	Microwave-induced breakdown of organic compounds
Throughput, TPY	No data
Feedstock	No data
Start-up Date	No data
Capital Cost	No data
Annual O & M Cost	No data
Products	Oil and carbon char
By-products	None
Residuals	No data

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	
Description of Preprocessing System	Removal of glass and metals is required, but no description provided. MWT presented no information on prior experience in pre-processing of MSW.
Description of Conversion Unit	No information provided. Chart shows that for every ton of MSW, the system would produce 922 lbs carbon, 370 lbs oil, 50 pounds off-gases, 70 lbs metals, 46 lbs glass, and 42 lbs other materials (total =1,500 lbs, with balance being water). No information on off-gases is provided, i.e., whether or not they are combustible. Brochure states that 1 ton of MSW produces 1.1 barrels of oil and 882 lbs of carbon (slightly different values).
Description of Energy Production Systems	None.
Description of By-Products Processing & Handling Systems	No information provided.
Feedstock Requirements	Composition: MSW from MRF
	Size: No information provided
	Moisture Content: 25%
Diversion Rate, %	Insufficient data to calculate
Environmental Issues	Air: MWT states that it would include a fabric filter and scrubber.
	Water: Produces water; no discharge
	Solid Residue: Insufficient information
	Odor: Tipping hall would likely be maintained under negative pressure, with air going to engines and char oxidation for combustion, destroying odor-causing compounds.
	Noise: Trucks
	Other: None determined
Description of Products and By-Products	Products: Oil and carbon black
	By-Products: No information
Quantity of Products and By-Products, TPY	Products: Oil: 1,009,008 gallons/year Char: 10,833 TPY
	By-Products: No information
Area Requirement, acres	4-5
Utility Requirements	Natural Gas: None
	Fuel Oil: None
	Water: None (produces water from moisture in MSW)
	Sewer: Domestic use only
	Electricity: 1 MW at rate of 85 TPD/26,208 TPY

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Composition of Residuals Generated by the Facility	Hazardous: None identified
	Non-Hazardous: None identified
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None identified
	Non-Hazardous: None identified
Mass Balance, TPY	Material Delivered: 26,208
	Material Recycled: 1,267
	Material Disposed: 0
	Products Generated: Oil: 1,009,008 gallons/year Carbon char: 10,833
	By-Products Generated: None identified
Costs & Revenues	Capital: $2,008,500 ($101/TPY)
	Annual O&M: $1,222,950
	Annual Capital Recovery: $448,140
	Annual Revenue Generated: $2,042,287
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : -$371,197
	Net cost/ton MSW delivered:$0/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Ntech Environmental Longview, WA		
Brief Description of the Technology	Ntech uses the ENTECH Renewable Energy System. The process utilizes low temperature, fixed-bed gasification with very low amounts of air, nearing pyrolysis, to convert MSW to syngas. Since MRF residuals are the feedstock, no pre-processing is required. The technology includes: 1) a stepped-hearth designed pyrolytic gasification stage for conversion of MSW to syngas at 1,100 °F, 2) a thermal reactor stage for immediate combustion of syngas at 2,200 °F, 3) an energy utilization stage, including a heat recovery boiler for steam production and power generation, 4) an air quality control stage with emission controls, and 5) a flow control stage with blowers to exhaust the flue gases to stack.		
Project Partners	Whitten Group International, located in the U.S., would provide the project development and management services, while NTech Environmental, which licenses the ENTECH technology, will provide the engineering services for the ENTECH technology. The gasification technology itself is provided by ENTECH.		
Technical and Financial Resources (Credibility)	Whitten Group International (Whitten) is a project management and development company founded in 1984 to provide construction services to project developers world wide. Whitten holds proprietary intellectual properties and equipment patents. Its clients and partners are international construction developers, gas & oil companies, and local and federal governments. ENTECH as the technology provider would make available a number of bonds and guarantees. Whitten, as the project developer, would incorporate these bonds in the facility construction, through Allianz, its financial partner. Allianz underwrites projects up to $100 million.		
For the Existing Facilities			
Facility Name	Genting	Chung Gung	Hong Kong
Location	Sri Layang, Malaysia	Chung Gung, Taiwan	Lantau Island, Hong Kong
Owner	Genting Corporation	City of Chung Gung	Government of Hong Kong
Technology	ENTECH	ENTECH	ENTECH
Throughput, TPY	22,000	11,000	22,000
Feedstock	MSW	Wet MSW	Industrial wastes
Start-up Date	1998	1991	1988
Capital Cost	Not available	Not available	Not available
Annual O & M Cost	Not available	Not available	Not available
Products	Steam	Steam	Steam
By-products	Bottom ash	Bottom ash	Bottom ash
Residuals	Fly ash, emission control system reaction products	Fly ash, emission control system reaction products	Fly ash, emission control system reaction products

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	33,000
Description of Preprocessing System	No pre-processing would be required for this application.
Description of Conversion Unit	Ntech/Whitten propose two operating Pyrolytic Gasification Chambers (PGCs), plus one spare, each rated at 50 TPD. The MSW is fed into the refractory-lined PGC, which operates with little air to initiate pyrolysis and then gasification reactions. The PGC uses a stepped hearth design, where the feedstock is moved by ram feeders or gravity fed down a series of steps in the PGC, providing mixing of the feedstock to ensure that all of it is subjected to sufficient thermal decomposition and gasification. The inorganic components of the feedstockare converted to ash and move to the end of the PGC for collection. Metals and glass are recovered later from the ash. The syngas from both operating PGCs is then combusted immediately in one Thermal Reactor (a combustion chamber) at 2,200 °F, and the hot flue gases flow to the single heat recovery boiler for generation of steam. Flue gases exit the boiler and enter the air quality control system, which includes lime injection to a spray dryer absorber, for removal of acid gases. Following the spray dryer absorber, activated carbon is injected to mix with the flue gas for the removal of heavy metals, such as mercury. The byproducts of the emission controls are captured in a fabric filter.
Description of Energy Production Systems	Heat recovery boiler produces steam. Steam flows to steam turbine generator, producing 2.56 MW gross/2.44 MW net.
Description of By-Products Processing & Handling Systems	Magnetic separator and eddy-current separator for removal of ferrous and non-ferrous metals from bottom ash.
Feedstock Requirements	Composition: MSW
	Size: 80 inch max, i.e., furniture, carpets, but not a solid block.
	Moisture Content: variable
Diversion Rate, %	99
Environmental Issues	Air: Emission controls for acid gases include lime spray dryer followed by pulverized activated carbon injection. Fly ash, reaction products and spent carbon are captured in a fabric filter.
	Water: No discharges noted.
	Solid Residue: Fly ash and spent reactants are disposed of in a landfill.
	Odor: The MSW storage building will be maintained under negative pressure and this air used for combustion. Odor-causing compounds will be destroyed.
	Noise: Trucks
	Other: None identified.
Description of Products and By-Products	Products: Electricity
	By-Products: Glass and bottom ash

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Products and By-Products, TPY	Products: Electricity: 19,320 MWh
	By-Products: Glass: 990 Bottom ash: 4,479
Area Requirement, acres	<1 acre
Utility Requirements	Natural Gas: None
	Fuel Oil: 145,371 gallons/year
	Water: 7,166,833 gallons/year
	Sewer: Employee use only
	Electricity: 992 MWh/year
Composition of Residuals Generated by the Facility	Hazardous: Fly ash and spent reaction products
	Non-Hazardous: None
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 358
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 33,000
	Material Recycled: 990
	Material Disposed: 358 (spent lime and activated carbon)
	Products Generated: electricity: 19,320 MWh
	By-Products Generated: Glass: 990 Bottom ash: 4,479
Costs & Revenues	Capital: $19,356,500 ($587/TPY)
	Annual O&M: $1,783,960
	Annual Capital Recovery: $3,356,480
	Annual Revenue Generated: $869,400
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $4,271,040
	Net cost/ton MSW delivered: $129/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Omnifuel Technologies, Inc. Citrus Heights, CA
Brief Description of the Technology	The Omnifuel technology uses fluid bed gasification. Following pre-processing to remove recyclables or size the feed, lime is added to the refuse-derived fuel (RDF) for absorption of sulfur and chlorine compounds in the syngas. The RDF is fed into the gasifier. Inside the gasifier, a bubbling bed of olivine sand is used to provide mixing and contact of the RDF with the gasifying air. The RDF is converted to syngas at 1,500 °F, with some ash and tar remaining. The stream exits the top of the gasifier into a primary cyclone, where most of the particulate matter is removed and recycle to the gasifier. The syngas stream enters an air preheater, where heat from the syngas is used to preheat the fluidizing air. The cooled syngas stream enters a secondary cyclone for removal of remaining ash, then to a carbon adsorption bed for mercury removal and a wet scrubber for removal of ammonia. The clean syngas then is piped to a boiler for combustion, producing steam for power generation.
Project Partners	None noted.
Technical and Financial Resources (Credibility)	The principals of Omnifuel have long-term experience with MSW pre-processing and recovery of recyclables, as well as with gasification. Omnifuel states “Company principals are experienced in commercial relationships. Most system components are proven, commercially available and carry vendor warranties. Providing suitable fuel supply and energy purchase commitments are provided, and the project has a favorable return, debt and equity funds are expected to be available.” No financial information is available, and financial credibility is questionable.
For the Existing Facilities	
Facility Name	There are no facilities in operation. All prior Omnifuel gasification facilities have been shut down.
Location	
Owner	
Technology	
Throughput, TPY	
Feedstock	
Start-up Date	
Capital Cost	
Annual O & M Cost	
Products	
By-products	
Residuals	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	26,883 from MRF, then through pre-processing to create 20,700 of RDF
Description of Preprocessing System	Minor modifications to the existing MRF will be needed to provide for removal of 23% of the existing MRF residuals to produce the RDF.
Description of Conversion Unit	The Omnifuel technology uses fluid bed gasification. The RDF is fed directly into the 10' diameter, refractory-lined gasifier. Lime is added for absorption/removal of sulfur and chlorine compounds. Inside the gasifier, a bubbling bed of olivine sand is used to provide mixing and contact of the RDF with the hot gasifying air. The RDF is converted to syngas at 1,500 °F, with some ash and tar remaining. The syngas stream exits the top of the gasifier into a primary cyclone, where most of the particulate matter is removed and recycled to the gasifier. The syngas is expected to contain nitrogen, sulfur and chlorine compounds, as well as heavy metals. The lime added to the RDF will capture and remove a large portion of the sulfur and chlorine compounds. The chlorine compounds are not converted to dioxins during gasification. The syngas stream enters an air preheater, where heat from the syngas is used to preheat the fluidizing air. The cooled syngas stream enters a secondary cyclone for removal of remaining ash, then to a carbon adsorption bed for mercury removal and a wet scrubber for removal of ammonia. The clean syngas flows to the boiler for combustion, producing steam for power generation.
Description of Energy Production Systems	The boiler generates steam at 750 psi and 850 °F. It is piped to a 2.5 MW steam turbine for power generation. Net generation is 2.3 MW.
Description of By-Products Processing & Handling Systems	None required.
Feedstock Requirements	Composition: treated MRF residuals
	Size: 3 inches
	Moisture Content: Not specified
Diversion Rate, %	70

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: The syngas is treated and cleaned prior to combustion, using lime addition to the RDF feed for capture and removal of sulfur and chlorine compounds. Ash removal is accomplished by the secondary cyclone. Mercury removal is accomplished with a carbon adsorption bed, and ammonia is removed in a wet scrubber. NO_x is controlled by removal o ammonia (which would be converted to NO_x during combustion) and low-NO_x burners in the boiler.
	Water: No discharge noted.
	Solid Residue: Additional MRF residues and ash from the process (until a market can be found)
	Odor: A negative pressure in the building will be used, and the air will be routed either through the gasifier or an in-ground biological filter.
	Noise: Trucks
	Other: Not identified
Description of Products and By-Products	Products: Electricity
	By-Products: None
Quantity of Products and By-Products, TPY	Products: Electricity: 19,000 MWh
	By-Products: None
Area Requirement, acres	<1
Utility Requirements	Natural Gas: Needed for start-up. No amount specified.
	Fuel Oil: Not required.
	Water: Needed for employee use, boiler make-up, and cooling tower. Volume not specified.
	Sewer: Employee use only.
	Electricity: 1,656 MWh
Composition of Residuals Generated by the Facility	Hazardous: Cyclone ash
	Non-Hazardous: Additional MRF residues
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 2,070
	Non-Hazardous: 6,183
Mass Balance, TPY	Material Delivered: 26,883
	Material Recycled: 0
	Material Disposed: 8,253
	Products Generated: electricity: 19,000 MWh
	By-Products Generated: None

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Costs & Revenues	Capital: $7,000,000 ($260/TPY)
	Annual O&M: $750,000
	Annual Capital Recovery: $1,040,000
	Annual Revenue Generated: $857,000
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $933,000
	Net cost/ton MSW delivered: $35/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Pan American Resources Pleasanton, CA
Brief Description of the Technology	PAR's technology is the Lantz Converter using "Destructive Distillation", which is essentially a pyrolysis process. Metals are removed by electromagnets and eddy current separators, followed by a shredder. The shredded material is then dried to 5% moisture, using the off-gases produced from combustion of the syngas used to provide the indirect heat for pyrolysis. The prepared MSW is subjected to pyrolysis at 1,200 °F, forming syngas and a carbon char. The syngas is cleaned of particulate matter, acid gases, and mercury, and is then combusted in a boiler to make steam for power generation. The indirect heat for pyrolysis is supplied by a portion of the syngas.
Project Partners	M3 Engineering & Technical Corp. (facility design), Schuff Steel (fabrication of the converter), Oxford Research Institute (risk analysis and ergonomic solutions for industrial facilities)
Technical and Financial Resources (Credibility)	The team likely has the technical capabilities for pre-processing and the conversion unit. Capabilities for power generation are not specified. PAR is the developer/owner of the technology, and has only one employee (John Toman) and no operating capital. PAR's technical and cost proposal is based on a proposal submitted to Alameda County several years ago for a 500 TPD facility. PAR would require a put or pay MSW contract with the County in order to finance the project. PAR states that "Since PAR has no commercial operating facilities, the current management has no experience with financial guarantees and security arrangements other than that which residues with PAR's partners."
For the Existing Facilities	
Facility Name	While PAR has had several facilities in the past (up to 100 TPD), there are no operating facilities at this time.
Location	
Owner	
Technology	
Throughput, TPY	
Feedstock	
Start-up Date	
Capital Cost	
Annual O & M Cost	
Products	
By-products	
Residuals	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	54,860
Description of Preprocessing System	PAR proposes to locate its facility at a transfer station, instead of at a MRF. The preprocessing system includes an electromagnet for recovery of ferrous metals and an eddy current separator for non-ferrous metals, as well as a shredder. The shredded feedstock is dried from 25% to 5% moisture prior to being fed into the converter. The water evaporated in the converter is sent to a cyclone to remove any particulate matter, then it passes through a condenser and a charcoal filter to produce makeup water for the entire process.
Description of Conversion Unit	The single Lantz Converter is rated at 100 TPD. It incorporates a rotating horizontal retort with burners to provide the indirect heat needed for pyrolysis. The dried feedstock from the dryer is ram-fed into the converter, where pyrolysis occurs over a period of 15 minutes at 1,200 °F. A portion of the syngas is combusted to provide this indirect heat. The syngas is combusted in a boiler at up to 3,000 °F. A char ash mixture is removed from the converter by a Holo-Flite tube, which uses a screw inside a cool water heat exchanger (to keep the mixture from auto-igniting when it contact outside air) for disposal.
Description of Energy Production Systems	The syngas is combusted in a boiler, producing steam for power generation. PAR proposes to use a steam turbine generator, producing 2 MW net. Flue gas from the boiler flows to a Hydrosonic scrubber, which is used to remove non-condensable vapors, particulate matter and acid gases.
Description of By-Products Processing & Handling Systems	No post-processing is described.
Feedstock Requirements	Composition: MSW
	Size: Shredded to 1 inch size prior to entering dryer.
	Moisture Content: 25% in MSW is reduced to 5% after dryer
Diversion Rate, %	86
Environmental Issues	Air: Based on PAR's testing, 90% of chlorine from plastics and 30% of sulfur compounds are chemically bound to the carbon char. In addition, flue gas from the boiler and non-condensable gases from the process are sent through a Hydrosonic wet scrubber for removal of air toxics, particulate matter, and acid gases. The system incorporates an 18 inch diameter flare stack, which would be a permitting issue.
	Water: The system has no water discharge.
	Solid Residue: Char/ash mixture
	Odor: Tipping hall will be kept under negative pressure, with air flow through deodorizing filter system.
	Noise: Trucks
	Other: None determined

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Description of Products and By-Products	Products: Electricity
	By-Products: Metals
Quantity of Products and By-Products, TPY	Products: Electricity: 17,082 MWh
	By-Products: None
Area Requirement, acres	5
Utility Requirements	Natural Gas: For start-up. Quantity not provided
	Fuel Oil: None
	Water: For start-up only, then water recovery system provided make-up.
	Sewer: Domestic use only
	Electricity: Internal load of 833 kW, or total of 6,567 MWh
Composition of Residuals Generated by the Facility	Hazardous: None
	Non-Hazardous: Char/ash mixture
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: Char/ash: 7,884
Mass Balance, TPY (assume 90% availability)	Material Delivered: 54,860
	Material Recycled: 5,486
	Material Disposed: 7,884
	Products Generated: Electricity: 17,082 MWh
	By-Products Generated: None
Costs & Revenues	Capital: $9,936,167 ($181/TPY)
	Annual O&M: $2,526,681
	Annual Capital Recovery: $859,716
	Annual Revenue Generated: $821,065
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $2,565,332
	Net cost/ton MSW delivered: $47/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Plasma Environmental Technologies Burlington, ON
Brief Description of the Technology	Plasma gasification - No information addressing the questionnaire was provided. PET only provided a 2 page letter discussing a test program they are working on, and a 4 ton/day demo plant they are building.
Project Partners	None
Technical and Financial Resources (Credibility)	No data provided
For the Existing Facilities	
Facility Name	
Location	
Owner	
Technology	
Throughput, TPY	
Feedstock	
Start-up Date	
Capital Cost	
Annual O & M Cost	
Products	
By-products	
Residuals	
For the Proposed Facility	
Throughput, TPY	
Description of Preprocessing System	
Description of Conversion Unit	
Description of Energy Production Systems	
Description of By-Products Processing & Handling Systems	
Feedstock Requirements	Composition:
	Size:
	Moisture Content:
Diversion Rate, %	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air:
	Water:
	Solid Residue:
	Odor:
	Noise:
	Other:
Description of Products and By-Products	Products:
	By-Products:
Quantity of Products and By-Products, TPY	Products:
	By-Products:
Area Requirement, acres	
Utility Requirements	Natural Gas:
	Fuel Oil:
	Water:
	Sewer:
	Electricity:
Composition of Residuals Generated by the Facility	Hazardous:
	Non-Hazardous:
Quantity of Residuals Generated by the Facility, TPY	Hazardous:
	Non-Hazardous:
Mass Balance, TPY	Material Delivered:
	Material Recycled:
	Material Disposed:
	Products Generated:
	By-Products Generated:
Costs & Revenues	Capital:
	Annual O&M:
	Annual Capital Recovery:
	Annual Revenue Generated:
	Net annual cost: [(O&M + Capital Recovery) - Revenues] :
	Net cost/ton MSW delivered:

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Primenergy, LLC Tulsa, OK	Renewable Resources Alliance, LLC Paul Relis	
Brief Description of the Technology	Pre-processing is used to prepare a refuse-derived fuel called Post-Recycled Municipal Biomass (PRMB™). The PRMB system includes mechanical and manual systems for removal of paper, glass, metals, and plastics. The PRMB feedstock is metered into the gasifier. Primenergy uses gasification technology developed by PRM Energy Systems, Inc. The fixed-bed gasifier operates at about 1,500 °F, converting the MSW to syngas. The syngas enters a hot gas cyclone, where fly ash is removed. Bottom ash is removed from the bottom of the gasifier. The syngas is then combusted in a large combustion tube, and the hot gases flow through a waste heat boiler for steam production. The steam is piped to a steam turbine generator for production of electricity. Flue gases are treated with injection of lime and activated carbon, with spent materials removed in a fabric filter, followed by a Selective Catalytic Reduction (SCR) system.		
Project Partners	Affiliates of RRA (CR&R, Community Recycling), Nexant Corp. (gasification technical support), Nixon Peabody (energy contracting legal), CH2M Hill (engineering).		
Technical and Financial Resources (Credibility)	RRA's affiliates hold more than 30 municipal franchises for MSW; they form one of the largest waste and recycling companies in California. Community Recycling has the largest composting facility in California. Both are well capitalized. RRA is capable of obtaining financing for the project. CR&R has 1,000 employees, and provides much of the design for its facilities in-house. It has developed the PRMB system. Primenergy is a large equipment manufacturer, with almost 20 gasifiers in operation worldwide. It has in-house technical expertise for design of gasification facilities, including associated material handling equipment. The partnership has extensive technical and financial capabilities. CR&R has raised >$25,000,000 in bond financing from the California Pollution Control Finance Authority and has an available credit line of $105,000,000, which is guaranteed by the underlying municipal waste franchises.		
For the Existing Facilities			
Facility Name	CR Transfer	Gasification and Thermal Energy Conversion System	Sewage Sludge Gasification and Drying Plant
Location	Stanton, CA	Stuttgart, AR	Philadelphia, PA
Owner	CR&R Inc.	Riceland Foods, Inc.	EcoTechnology, Inc.
Technology	MSW separation system including trommels and screens, material floating devices, grinding equipment to produce PRMB.	PRM Energy Systems, Inc. gasification	PRM Energy Systems, Inc. gasification
Throughput, TPY	500,000	180,000	84,000

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Feedstock	MSW	Rice hulls	75% moisture sewage sludge
Start-up Date	1990	1996	March 2005
Capital Cost	$14,000,000	$22,000,000	$6,500,000
Annual O & M Cost	$4,800,000	~$1,500,000	$600,000
Products	Recyclables: metals, fibers, glass, C&D materials, PRMB, wood waste fuel	Steam and electricity (12.8 MW gross/11.6 MW net) for milling rice plant	90% reduction and thermal degradation of sewage sludge. Ash is returned to compost made from sewage sludge.
By-products	N/A	None	None
Residuals	50% sent to landfill	28% of feed is sent to landfill (25% of rice hull is high silica ash). Ash is now being marketed.	None
For the Proposed Facility			
Throughput, TPY	35,000		
Description of Preprocessing System	CR&R (RRA's affiliate) is designing its new MRF (and PRMB production facility) for installation at the Perris Facility in Riverside County, and proposes that the Primenergy conversion and power generation system be located there. Pre-processing involves preparation/sorting of MSW to recover ~30% of raw MSW for recycling. Steel and aluminum would be recovered at nearly 100% and additional paper, plastics and organic materials would be sorted for recycling. Recyclables would be returned to recycling centers. Remaining material, mostly marginal paper and mixed plastics, would be refined and processed into PRMB.		
Description of Conversion Unit	4.16 TPH of PRMB is fed into a single KC-16 gasifier, where gasification of the feedstock occurs at about 1,500 °F, producing syngas. The syngas from the gasifiers flows through a hot gas cyclone for removal of fly ash. The cleaned syngas is then combusted in the combustion tube at 2,400 °F. The hot flue gas flows through the waste heat boiler, where steam is produced for power generation. The cooled flue gases are treated in an extensive emission control system. Lime is injected into the flue gases for removal of acid gases, including SO_2 and HCl. Activated carbon is injected for adsorption of heavy metals, including vaporized mercury. The reaction products and particulate matter in the flue gas stream are then removed in a fabric filter. NO_x emissions are controlled by using Selective Catalytic Reduction (SCR). The cleaned flue gases are exhausted through a stack.		
Description of Energy Production Systems	The hot flue gases enter the waste heat boiler, where steam is produced. The steam is piped to a steam turbine generator, producing 3.08 MW gross/2.57 MW net.		

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Description of By-Products Processing & Handling Systems	No post-processing required.
Feedstock Requirements	Composition: MSW converted to PRMB (mostly paper and plastic)
	Size: -3/8 inch
	Moisture Content: 25%
Diversion Rate, %	99
Environmental Issues	Air: The combustion tube incorporates staged combustion for NO_x control. Air emission control system includes injection of lime for removal of acid gases, and activated carbon for removal of mercury and other contaminants. Spent materials and fly ash are collected in a fabric filter. The cleaned gases then flow through the SCR system for NO_x removal.
	Water: Cooling tower blowdown (if wet cooling tower is used).
	Solid Residue: Fly ash and reacted by-products from emission control system. Bottom ash assumed to be marketable (testing needed to confirm).
	Odor: CR&R incorporates an extensive biofilter and deodorizer misting system into its facilities for odor control. It has designed and installed the largest biofilter in California.
	Noise: Trucks
	Other: None identified.
Description of Products and By-Products	Products: Electricity
	By-Products: Bottom ash
Quantity of Products and By-Products, TPY	Products: Electricity: 21,580 MWh
	By-Products: Bottom ash: 3,872
Area Requirement, acres	1 (does not include PRMB facility already planned for construction)
Utility Requirements	Natural Gas: for building heat and start-up. Quantity not specified.
	Fuel Oil: Not required.
	Water: Potable water for boiler feedwater make-up, cooling tower make-up (if wet cooling tower used), employee usage. Quantity not specified.
	Sewer: Domestic use.
	Electricity: 4,276 MWh
Composition of Residuals Generated by the Facility	Hazardous: Fly ash and spent reactants from emission control system.
	Non-Hazardous: Bottom ash, if it is not saleable.
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 151
	Non-Hazardous: 0 if bottom ash is saleable; 3,872 if bottom ash is not saleable and goes to landfill

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Mass Balance, TPY	Material Delivered: 35,000 (PRMB)
	Material Recycled: 0 (recyclables from PRMB production facility not included here)
	Material Disposed: 151
	Products Generated: Electricity; 21,580 MWh
	By-Products Generated: Bottom ash: 3,872
Costs & Revenues	Capital: $15,500,000
	Annual O&M: $1,557,000
	Annual Capital Recovery: $2,583,000
	Annual Revenue Generated: $1,067,900
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $3,072,100
	Net cost/ton MSW delivered: $87/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Rigel Resource Recovery and Conversion Company Baltimore, MD
Brief Description of the Technology	Rigel proposes to integrate autoclaving, MRF, plasma gasification, and power generation technologies. The MRF would utilize a Tempico Rotoclave, an autoclave that uses steam to physically reduce the volume of the MSW, and sterilize it. The output of the Rotoclave is then sent to a MRF for removal of metals and plastics. (Not known why Rigel has decided to put a MRF to treat MRF residuals). The MRF output, along with unsorted MSW, is sent to the plasma gasification system, supplied by Recovered Energy Inc., and using Westinghouse Plasma Corporation's plasma gasification technology. The syngas would be combusted in a gas turbine, and steam production in the process and from a heat recovery steam generator would drive a steam turbine. Rigel has not developed this type of facility before. Other integrated facilities (which may be added later) may include a glass plant using the recovered glass from the process, as well as a paper manufacturing plant using pulp recovered from the MSW treated in the Rotoclave.
Project Partners	Tempico (Rotoclave facility), Recovered Energy, Inc. (plasma gasification facility), Westinghouse Plasma Corporation (plasma torch design).
Technical and Financial Resources (Credibility)	Rigel is a start-up management company, which is being set up as an LLC. Its shareholders are the individuals who have come together to promote and develop this combination of technologies. Many of the individuals are former employees of Orion Power Holdings, a company that developed gas-fired combined cycle power plants in the U.S. Orion was acquired by Reliant Resources in 2002. At this time, Rigel has no assets, and has developed no projects. Rigel and its partners likely have the technical expertise to develop this project. While the ex-Orion staff has significant experience in obtaining financing for power projects (over $1 billion of projects), Rigel itself has no track record or financial history.
For the Existing Facilities	
Facility Name	No facilities using this combination of technologies exist. Rigel has not developed any projects.
Location	
Owner	
Technology	
Throughput, TPY	
Feedstock	
Start-up Date	
Capital Cost	
Annual O & M Cost	
Products	
By-products	

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Residuals	
For the Proposed Facility	
Throughput, TPY	1,095,000 (3,000 TPD is the minimum economical size for this facility, according to Rigel)
Description of Preprocessing System	The facility would use two Rotoclaves to process 350 TPD of MSW. The Rotoclaves use steam at 275-300 °F to treat 350 TPD of the incoming MSW for about 2 hours, reducing its volume by up to 2/3 and sterilizing it. The output from the Rotoclaves is sent to a MRF for recovery of ferrous and non-ferrous metals, and high-value plastics. The output is then conveyed to the plasma gasification system, where it is mixed with unprocessed MSW.
Description of Conversion Unit	Rigel proposes to use the Recovered Energy Inc.'s plasma gasification system. This incorporates Westinghouse Plasma Corporation plasma torches (number of torches not specified) and reactor design. To treat the 3,000 TPD, there are six 500 TPD reactors. In the reactor, the plasma torches create a hot gas at up to 8,000 °F. The MSW is heated to over 3,000 °F, and the organic portion of the MSW is converted to syngas. The metals and inorganic components form molten metal and molten slag, respectively. These molten components are tapped from the bottom of the reactor, cooled in a water bath, and recovered in solid form. The metals can be sold to metal processors. The slag forms a glassy, non-hazardous granulate which can be sold for use in making sandblasting grit, roofing tiles, and cement. The hot syngas is cooled in a heat exchanger, producing steam for power generation. The syngas is cleaned of particulates in hot gas cyclone, then to a Turbosonic wet scrubber for removal of HCL (this is concentrated for sale). The syngas then goes through a Turbosonic wet electrostatic precipitator to remove fine particulate, heavy metals, acid gases, and any remaining dioxins and furans. The syngas is combusted in a gas turbine. Flue gases are treated by a SCONOX system to remove NO_x, CO, and non-methane volatile compounds. Sulfur compounds are removed either pre- or post-combustion (to be determined). The hot flue gases from the combustion turbine pass through a heat recovery steam generator, producing additional steam for power generation in the steam turbine.
Description of Energy Production Systems	Hot syngas flows through a heat exchanger, producing steam that flows to a steam turbine. Following clean-up, the cooled, clean syngas is combusted in a gas turbine. The hot exhaust gas flows through a heat recovery steam generator, producing more steam for the steam turbine. Total power generation is listed as 280 MW gross. The net generation is not specified; Rigel expects to be able to export 1 MWh/ton MSW. This equates to a net generation of 125 MW on the basis of 3,000 TPD.
Description of By-Products Processing & Handling Systems	Not required.
Feedstock Requirements	Composition: MSW and MSW from Rotoclave/MRF
	Size: 1 meter maximum
	Moisture Content: No maximum specified.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Diversion Rate, %	~100%, assuming slag is saleable. Rigel notes that about 1% of the original MSW feed needs to be landfilled, but provides no detail on the composition or quantity of that stream.
Environmental Issues	Air: Volatiles from the Rotoclave are condensed and removed. Additional treatment with a charcoal filter may be added if needed. In the conversion unit, extensive syngas cleaning and flue gas cleaning systems are proposed. A hot gas cyclone is used to remove particulates from the syngas. Rigel proposes a Turbosonic emission control system, incorporating particulate controls, acid gas removal (HCL and sulfur compounds, with recovery of concentrated HCl for sale), a wet electrostatic precipitator for removal of fine particulates, liquid particles, heavy metals, acid mists, and any remaining dioxins and furans. After combustion in the gas turbine, the flue gas is treated by the SCONOX process for removal of NO_x, CO and VOCs.
	Water: The Rotoclave/MRF facility would have a wastewater residual (volume not specified). The plasma gasification system actually recovers water from the MSW. This would be cleaned and re-used, allowing for zero-discharge portion in this portion of the facility.
	Solid Residue: Rigel notes that about 1% of the original MSW feed needs to be landfilled, but provides no detail on the composition or quantity of that stream.
	Odor: Rigel proposes to maintain a negative pressure in the tipping building. The air removed is used in the process, destroying odor-causing compounds. Volatiles from the Rotoclave are condensed and removed. Further treatment in a charcoal filter may be added if needed.
	Noise: Trucks
	Other: None identified.
Description of Products and By-Products	Products: Electricity
	By-Products: metals and plastics from pre-processing; slag and metals from gasifier.
Quantity of Products and By-Products, TPY	Products: Electricity: 1,200,000 MWh
	By-Products: Metals: 5,475 Plastics: 7,300 Slag: not specified Metals from gasifier: 125
Area Requirement, acres	35
Utility Requirements	Natural Gas: Needed for gas turbine start-up at rate of 1,600 mmBtu/hour until syngas is available.
	Fuel Oil: None required.
	Water: 29 million gallons/year (Rotoclave requires 1 ton water per ton MSW, in the form of steam)
	Sewer: Not specified
	Electricity: 1,357,800 MWh

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Composition of Residuals Generated by the Facility	Hazardous: None. Rigel notes that about 1% of the original MSW feed needs to be landfilled, but provides no detail on the composition or quantity of that stream.
	Non-Hazardous: None. Rigel notes that about 1% of the original MSW feed needs to be landfilled, but provides no detail on the composition or quantity of that stream.
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 1,095,000
	Material Recycled: 12,900
	Material Disposed: 0
	Products Generated: Electricity: 1,200,000 MWh
	By-Products Generated: Metals: 5,475 Plastics: 7,300 Slag: not specified Metals from gasifier: 125
Costs & Revenues	Capital: $800,000,000
	Annual O&M: $73,050,000
	Annual Capital Recovery: $32,000,000
	Annual Revenue Generated: $56,272,000
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $48,778,000
	Net cost/ton MSW delivered: $44/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Taylor Biomass Energy LLC Montgomery, NY
Brief Description of the Technology	Pre-processing: not required for removal of recyclables from MRF residuals, but used to protect the process from undesirable feed or tramp material. Conversion technology: Taylor proposes to use the FERC SilvaGas process, a unique fluid-bed pyrolysis technology that incorporates combustion of the syngas and the char remaining from pyrolysis. The MSW feedstock enters the reactor though an airlock (oxygen must be kept out for pyrolysis), where it comes into contact with hot fluidizing sand at 1,800 °F and low-pressure steam. The MSW is converted to syngas at 1,545 °F. The hot syngas exits the top of the reactor, and flows through a hot gas cyclone for removal of particulates, sand and pyrolysis char. From there, the syngas goes to the boiler for combustion. The sand, ash and pyrolysis char flow by gravity to the bottom of the combustor, where the char is combusted with air. The hot flue gas exits the top of the combustor at 1,845 °F and flows through another hot gas cyclone, where additional particulates and sand are removed; they are recycled to the bottom of the reactor. This hot sand provides the indirect heat needed for pyrolysis in the reactor. The flue gas enters the heat recovery steam generator for more steam production. Flue gases from the combustor and the boiler are treated in a fabric filer and Selective Catalytic Reaction (SCR) system. Energy Production: Hot flue gases from the boiler and heat recovery steam generator create steam, which is piped to a steam turbine generator for producing electricity.
Project Partners	FERCO (technology license and process design)
Technical and Financial Resources (Credibility)	Taylor Biomass is a small company that is part of the Taylor Holdings Group, Ltd. Their expertise is in recycling and recovery from construction and demolition wastes (see facility descriptions below). Taylor Biomass was set up to market and develop the FERCO SilvaGas technology. While Taylor itself has limited technical capabilities or experience with MSW or MSW conversion technologies, Taylor has provided resumes of other project participants that have significant technical expertise in design and development of power plants and other energy and industrial facilities. While they have technical credibility, Taylor states that “Taylor Biomass Energy, LLC is a small business and does not possess the financial capabilities to complete the design and construction of the Taylor Pre-Processing and gasification plants without access to external funds. Taylor welcomes LA’s resources to accelerate proving the model. Taylor is not in a position to provide a financial guarantee.” Therefore, without outside funding, Taylor is not likely to be able to financially implement the proposed project.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Existing Facilities			
Facility Name	Taylor C&D facility	Battlelle Pilot Scale FERCO Process (shut down)	Vermont Gasification Project (shut down in 2001)
Location	Montgomery, NY	West Jefferson, OH	Burlington Electric McNeil Station, Burlington, VT
Owner	Taylor Holdings Group, Ltd.	Battelle	FERCO
Technology	Screens, conveyors, mills, magnets for recovery of recyclables from C&D waste	FERCO SilvaGas fluid bed pyrolysis	FERCO SilvaGas fluid bed pyrolysis
Throughput, TPY	60,000	10-12 dry TPD pilot plant. Annual throughput not known.	Designed for about 300 tons/day, operated at up to 500 tons/day. Commercial-scale test program of the SilvaGas
Feedstock	C&D waste	Wood, switch grass, source-separated MSW, waste wood, logging residue, paper mill sludges	Woody biomass, wood pellets, chopped pallets, crop residues.
Start-up Date	Early 1990s	Late 1970s (operated >20,000 hours)	1999
Capital Cost	$2,000,000	$2,500,000	$14,000,000
Annual O & M Cost	$1,500,000	Not known	Not known
Products	Wood, metal, aggregates, wallboard, cardboard	Syngas at 450-500 Btu/scf, electricity from Solar gas turbine.	Syngas at 470 Btu/scf piped to power plant's boiler
By-products	Waste rejects used as alternative daily cover for landfill	Cyclone ash at 2-3% of inlet	Cyclone ash at 3% of inlet
Residuals	<5% of inlet goes to landfill	None identified	None identified

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	33,930
Description of Preprocessing System	Since MRF residuals are the feedstock, Taylor does not intend to install a system for recovery of recyclables. Pre-processing will include a mill to reduce the size of the inlet MSW, and magnets and eddy current separators to remove tramp metals.
Description of Conversion Unit	Taylor proposes to use one SilvaGas system rated at 5.2 TPH. The processed MSW enters the reactor though two rotary airlocks, lock hoppers and a feed metering bin. The MSW contacts the hot fluidizing sand and undergoes pyrolysis at 1,545 °F, converting the organic portion to syngas. The syngas stream, with char and ash, exits the top of the reactor and flows through the hot gas cyclone. Char, sand, and fly ash are removed and sent to the combustor. The cleaned syngas is combusted in a boiler, where steam is produced. The cooled exhaust gas is sent to a fabric filter for removal of particulates, then through the SCR system for NO_x removal. The char is combusted in the combustor, and the flue gas exits the top of the combustor. Sand and ash are removed in a hot gas cyclone; the hot sand is returned to the bottom of the reactor to provide the heat needed for pyrolysis of the MSW. The flue gas then flows through another cyclone, where the ash is removed. This ash can be used for construction materials. The flue gas then flows through a heat recovery steam generator, producing steam for power generation. The flue gas from the boiler and the combustor flow through the fabric filter to remove particulate matter and the SCR system for NO_x removal. All cleaned flue gases exit through a stack.
Description of Energy Production Systems	Taylor proposes to use a package boiler to produce steam from the combustion of the syngas, a heat recovery steam generator to produce steam from the combustion of the char, and a steam turbine generator sized to produce 4 MW net. Taylor proposes to utilize some of the low pressure steam to drive a package chiller plant. Since the site is not selected, a user of the chilled water is not identified; this system may not be included.
Description of By-Products Processing & Handling Systems	Not required.
Feedstock Requirements	Composition: MSW
	Size: 4 inches
	Moisture Content: 25%
Diversion Rate, %	99
Environmental Issues	Air: Cyclones and a fabric filter are used to remove particulate matter from syngas and the flue gas. Following the fabric filter, the gas flows through the SCR system for NO_x removal.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	WasteGen (UK) Ltd. Gloucester, U.K.
Brief Description of the Technology	WasteGen licenses TechTrade's rotary kiln pyrolysis technology. The MSW is shredded to 12 inch size, and is fed by screw feeder to the pyrolysis kilns. Indirect heat for pyrolysis is supplied by the recycle of a portion of the hot flue gases combusted downstream in the process. Calcium hydroxide is added into the kiln to bind some of the acid gases such as SO_2 and HCl. Pyrolysis occurs at about 935 °F, producing syngas and leaving behind the inorganic components of the MSW (ash), mixed with unconverted carbon char. The char/ash solids are removed through a water bath system and a wet slag removal system. The mixture is then conveyed from the system, and metals are removed by magnetic and eddy current separators. The char is conveyed into a rotary kiln gasifier, producing syngas and a potentially marketable bottom ash. The syngas is cleaned of its particulate matter, and combusted in the combustion chamber at 2,300 °F. The hot flue gases flow through a boiler, where steam is produced. The steam is piped to a steam turbine generator for the generation of electricity. A portion of the hot flue gases are routed back to the outer jacket of the kiln, in order to provide the indirect heat needed for pyrolysis of the MSW. After the cooled flue gases leave the boiler, sodium bicarbonate and calcium hydroxide are injected into the flue gas stream to capture acid gases such as SO_2 and HCl. Activated carbon is also injected, to adsorb heavy metals, such as vaporized mercury. The particulates and reaction products are removed in a fabric filter, and the cleaned flue gases are exhausted through a stack.
Project Partners	TechTrade GmbH (technology license and pyrolysis system design) and Shaw Stone & Webster (overall facility design and construction)
Technical and Financial Resources (Credibility)	WasteGen licenses the technology from Tech Trade, and relies on TechTrade for its technical capabilities. TechTrade staff are the original inventors of the technology and have provided the detailed design for all WasteGen facilities. Together with Shaw Stone & Webster, there are sufficient design and engineering capabilities to implement the project. WasteGen states that "It should be noted that any supply contract would be with Shaw Stone & Webster of Baton Rouge, Louisiana who will provide the EPC Contract for the plant. They will be the prime contracting party with Los Angeles for the supply of our technology." Shaw Stone & Webster would be responsible for providing the project guarantees. Together, the team has the ability to provide the technical and financial resources to implement the project.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Existing Facilities			
Facility Name	Municipal Pyrolysis Plant	RWE Pyrolysis Unit	Herne Soil Treatment BRZ Herne
Location	Burgau, Germany	Hamm-Uentrop, Germany	Bochum, Germany
Owner	Günzburg Council	RWE Energie GmbH	SITA
Technology	TechTrade rotary kiln pyrolysis with power generation	TechTrade rotary kiln pyrolysis – syngas goes to existing power plant boiler and is co-fired with coal	TechTrade rotary kiln pyrolysis
Throughput, TPY	40,000	110,000	75,000
Feedstock	MSW	MSW	Dioxin/furan contaminated soils
Start-up Date	1984	2001	1992
Capital Cost	Not known	$31,250,000	$25,000,000
Annual O & M Cost	$3,750,000	$2,500,000	$5,000,000
Products	Electricity (2 MW) and steam to greenhouse	Electricity (12 MW) - syngas is co-fired in power plant boiler for producing electricity	75,000 TPY usable soil
By-products	None	None	None
Residuals	Char/ash mixture (20,000 TPY) and fabric filter ash	8,000 (bottom ash)	None

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	100,000
Description of Preprocessing System	The MSW is shredded to 12 inch size, and is fed by screw feeder to dryers to reduce the moisture to <20%. Drying is accomplished using process steam.
Description of Conversion Unit	WasteGen proposes to use 2 rotary kilns rated at ~8 TPH each. Calcium hydroxide is added to the MSW to capture acid gases later in the process. The shredded, dried MSW is fed to the 2 pyrolysis kilns, where it is thermally decomposed to syngas at 935 °F, leaving behind the inorganic components as ash, in a mixture with the unconverted carbon char. The char/ash mixture enters the carbon recovery unit, a rotary gasification kiln, where the carbon char is gasified, producing more syngas (this is a new process addition to the basic WasteGen pyrolysis technology, although the technology is commercially available). Bottom ash is produced, which is likely to be saleable/usable since it will no longer contain char. The syngas is cleaned of particulate matter in a hot gas cyclone, then combusted in the combustion chamber at 2,300 °F. A portion of the hot flue gas is routed back to the outer annuli of both of the kilns, providing the indirect heat required for pyrolysis. Urea is injected to convert a portion of the NO_x to nitrogen. The hot flue gases flow through the boiler, and steam is produced for power generation. After leaving the boiler, the cooled flue gas is injected with calcium hydroxide and sodium bicarbonate slurries in order to capture acid gases in the flue gas, such as SO_2 and HCl. Activated carbon is also injected to adsorb heavy metals, such as vaporized mercury. The flue gases then flow through a fabric filter, where particulate matter and byproducts from reaction with the acid gases are captured and removed. The cooled, cleaned flue gases are exhausted through a stack.
Description of Energy Production Systems	The steam is piped to the single steam turbine generator, producing 12 MW gross, and 9 MW net of electricity.
Description of By-Products Processing & Handling Systems	Magnetic and eddy current separators will recover ferrous and non-ferrous metals from the bottom ash for recycling.
Feedstock Requirements	Composition: MSW
	Size: Shredded to 12 inch size
	Moisture Content: Dried to 20% maximum moisture
Diversion Rate, %	99

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: the process includes an extensive air emission control system, including urea injection in the boiler for reduction of NO_x emissions, lime and sodium bicarbonate injection for control of acid gases, a fabric filter for removal of particulate matter and reaction products, and activated carbon injection for removal of mercury and other heavy metals.
	Water: No wastewater discharge identified.
	Solid Residue: Fly ash from the fabric filter.
	Odor: The tipping hall is maintained under negative pressure, with the air used in the combustor, where odor-causing compounds are destroyed.
	Noise: Trucks
	Other: None identified
Description of Products and By-Products	Products: Electricity
	By-Products: Bottom ash, metals. WasteGen lists steam export for sale; since the site is not selected, no user is confirmed, so this data is not included in the evaluation.
Quantity of Products and By-Products, TPY	Products: Electricity: 67,500 MWh
	By-Products: Bottom ash: 30,000 Metals recovered from bottom ash: 2,200
Area Requirement, acres	5
Utility Requirements	Natural Gas:
	Fuel Oil: Required for heating the kilns at start-up. Rate of 1.75 gallons oil/ton MSW, or ~25 gallons/hour
	Water: 4.8 million gallons/year for boiler water make-up
	Sewer: Employee use only
	Electricity: 21,600 MWh
Composition of Residuals Generated by the Facility	Hazardous: Fabric filter ash
	Non-Hazardous: None
Quantity of Residuals Generated by the Facility, TPY	Hazardous: 1,031
	Non-Hazardous: None
Mass Balance, TPY	Material Delivered: 100,000
	Material Recycled: Metals: 2,200
	Material Disposed: 1,031
	Products Generated: Electricity: 67,500 MWh
	By-Products Generated: Bottom ash: 30,000

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Costs & Revenues	Capital: $60,000,000 ($600/TPY)
	Annual O&M: $3,427,000
	Annual Capital Recovery: $7,300,000
	Annual Revenue Generated: $3,037,500
	Net annual cost: [(O&M + Capital Recovery) - Revenues] : $7,689,500
	Net cost/ton MSW delivered: $77/ton

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Green Energy Corporation Englewood, CO
Brief Description of the Technology	The technology is designed for commercial applications to produce fuels and chemicals from feed stocks normally considered negative or low-value waste. Preprocessing consists of grinding the feedstock to one inch or less. An added benefit is that the volume of most "waste" feed stocks will be reduced by 95% or more leaving only a benign clay-like ash. The BCT reactor produces green, or alternative, energy in the form of synthesis gas that can be catalytically converted to ethanol or can be used to fuel an internal combustion engine or micro-turbine to generate electricity. The BCT process offers additional environmental benefits as it promises to use as feed stock large volumes of waste products such as bio-solids, agricultural waste products, municipal solid waste, sewage sludge, and many other carbonaceous wastes. The gasification process converts any carbon-containing material into synthesis gas composed primarily of carbon monoxide, hydrogen and methane, which can be used as a fuel to generate electricity when combined with a turbine or internal combustion engine generator unit, or used as a basic chemical building block for a large number of applications in the automotive fuels, petrochemical and refining industries. The BCT steam reforming gasification process is a form of thermal decomposition in an environment with limited or no oxygen. The technology has the ability to treat a wide variety of gaseous, liquid and solid feedstock. Gasification customarily adds value to low or negative-value feedstock by converting it to marketable fuels and products. Conventional fuels such as coal and oil, as well as low or negative-value materials and waste such as petroleum coke, heavy refinery residuals, secondary oil-bearing refinery materials, municipal sewage sludge, hydrocarbon contaminated soils and chlorinated hydrocarbon products have all been used in gasification operations. The syngas can also be processed using commercially available technologies to produce products such as fuels, chemicals, fertilizer or industrial gases. The ability to produce ethanol cheaply and quickly from synthesis gas is of equal and perhaps even greater significance than the breakthroughs represented by the gasifier. The proprietary Biomass Conversion System ("System") is comprised of the BCT Gasifier mated to our proprietary ethanol reactor. The System features a proprietary catalyst, and other trade secret elements. The System is highly efficient and can generate up to 20,000 GPD of ethanol from 400 wet (200 dry) tons per day of any kind of carbonaceous material.
Project Partners	Zambrana Engineering, Inc. headquartered in St Louis Missouri Bioconversion Technologies, LLC
Technical and Financial Resources (Credibility)	No technical or resource describe except the resume of key management personnel. Green Energy processed different carbonaceous material and tested MSW.

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Existing Facilities			
Facility Name	BCT Bioconversion Technology	BCT Bioconversion Technology	BCT Bioconversion Technology
Location	6535 North Washington Street Denver, Colorado 80202	6535 North Washington Street Denver, Colorado 80202	6535 North Washington Street Denver, Colorado 80202
Owner	Bioconversion Technologies, LLC.	Bioconversion Technologies, LLC.	Bioconversion Technologies, LLC.
Technology	Staged Temperature Reaction Process Gasifier	Staged Temperature Reaction Process Gasifier	Staged Temperature Reaction Process Gasifier
Throughput, TPY	1 ton/day Test and Pilot System	5 ton/day Permanent Test/Demonstration System	15 tons/day SAS System-staged for delivery to client
Feedstock	Various Carbonaceous feedstock	Various Carbonaceous feedstock	Wood waste System
Start-up Date	1988		
Capital Cost	3,000,000		
Annual O & M Cost			
Products	Electricity/Gas/Syngas		
By-products			
Residuals	10% to the landfill		

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Throughput, TPY	39,600
Description of Preprocessing System	The MSW is shredded to one-inch minus size, and containing a maximum of 40% moisture. Variability of the different types of carbonaceous material have little impact on the systems operation.
Description of Conversion Unit	Green Energy Corp. acquired a Technology License Agreement from Bio-Conversion Technology, LLC. of Denver, Colorado to market the patented BCT Gasifier Technology and reactors based on this technology (Steam Reforming Pyrolysis). Green Energy will design and staff its own marketing and sales department to develop, own and operate gasification units for company-owned projects or the sale of BCT Gasifier machines to third parties. The BCT reactor produces green, or alternative, energy in the form of synthesis gas that can be catalytically converted to ethanol or can be used to fuel an internal combustion engine or micro-turbine to generate electricity. The BCT process offers additional environmental benefits as it promises to use as feed stock large volumes of waste products such as bio-solids, agricultural waste products and sewage sludge. The BCT Gasification Reactor is more efficient than competing processes as it produces fewer residues and eliminates the discharge of noxious emissions. The BCT Technology has been field tested and demonstrated to work outside of the laboratory. Green Energy Corp will seek to sell and install its products in order to solve environmental problems resulting from society's ever-increasing generation of waste. The ability of Green Energy to process a wide variety of waste materials and to produce a product (energy) that is in ever-increasing demand provides a solid foundation for the building of a successful business.
Description of Energy Production Systems	The proposed facility will produce sygas, a mixture of hydrogen, carbon monoxide, and methane. This gas can be used as is, to fuel an internal combustion engine or micro-turbine that can power an electricity generator set. Or the gas can be catalytically converted to farm ethanol if the gasifier connected to alcohol plant.
Description of By-Products Processing & Handling Systems	The small solid residue is benign, with trace minerals that in some cases are suitable for use as fertilizer or animal feed supplement.
Feedstock Requirements	Composition: Carbonaceous material or MSW
	Size: Shredded to one-inch minus
	Moisture Content: Maximum 40%
Diversion Rate, %	90

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: the process is a completely closed process except for the negligible emissions of the gasifier heat source. The syngas is going through a Cyclone, Quench and Cooling, Final Chilling, Sygas Compression, and Excess Hydrogen Removal. This process cleans the syngas.
	Water: Negligible amount of non-hazardous. Can be disposed in a regular sanitary sewer.
	Solid Residue: Approximately 10% or less non-hazardous ash.
	Odor: The system is a closed process, which eliminate odorous discharge.
	Noise: Trucks
	Other: None identified
Description of Products and By-Products	Products: Syngas, Electricity, and/or ethanol
	By-Products: Bottom ash, metals.
Quantity of Products and By-Products, TPY	Products: Electricity: 42,400 MWh
	By-Products: Bottom ash: 2,040
Area Requirement, acres	2 acres
Utility Requirements	Natural Gas: 5000 therms/hour (for initial start up only)
	Oil: None
	Water: up to 150 gallon/day (make-up)
	Sewer: Negligible
	Electricity: kW
Composition of Residuals Generated by the Facility	Hazardous: None
	Non-Hazardous: Ash can be disposed in a regular landfill
Quantity of Residuals Generated by the Facility, TPY	Hazardous: None
	Non-Hazardous: Ash 2040
Mass Balance, TPY	Material Delivered: 39,600
	Material Recycled: Metals: 2,160
	Material Disposed: 30,000
	Products Generated: Electricity: 42,400 MWh
	By-Products Generated: Bottom ash: 2,040

TABLE A-4 (CONTINUED)
SUMMARY OF RESPONSES FROM THE
THERMAL CONVERSION TECHNOLOGY SUPPLIERS

Costs & Revenues	Capital: $10,250,000 ($258/TPY)
	Annual O&M: $1,510,000
	Annual Capital Recovery: $2,181,785
	Annual Revenue Generated: $ 1,908,000 (Only from electricity)
	Net annual cost: [(O&M + Capital Recovery) - Revenues]: $1,783,785
	Net cost/ton MSW delivered: $45/ton

TABLE A-5
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

TABLE A-5
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Arrow Ecology & Engineering Overseas Ltd. Wheeling, WV
Brief Description of the Technology	Arrow Ecology has patented the ArrowBio process for anaerobic digestion of solid waste. The waste first goes through a wet preprocessing chain to remove recyclables and undesirable compounds. In fact, the first preprocessing step consists of submerging the waste. The conversion feed resulting from this process goes into an acidogenic reactor for a brief time. The dissolved and suspended effluent from that reactor is led to a wastewater digester, of the UASB type (Upflow Anaerobic Sludge Blanket). Liquid effluent can be cleaned up to high quality irrigation water.
Technical and Financial Resources (Credibility)	Arrow Ecology Ltd., the parent company, is a professional environmental services and contracting/implementation company providing a comprehensive full service approach to environmental problems and regulatory compliance. The company offers a wide range of environmental and industrial services. The company's financial condition is good; a supportive statement from Bank Leumi was provided.
For the Existing Facilities	
Facility Name	Tel Aviv ArrowBio facility
Location	Tel Aviv, Israel
Owner	Arrow Ecology & Engineering Dan Ltd.
Technology	ArrowBio process
Throughput	31,000 tpy
Feedstock	Mixed unsorted MSW
Start-up Date	December 2002
Capital Cost	$10 million
Operating Cost	$385,000/year
Products	Biogas, electricity (700-800 kW net), organic soil amendment (10-15 tpd), water (2500 gal/day)
By-products	Metals, plastics, glass, stones
Residuals	25 tpd

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	31,000 tpy
Description of Preprocessing Systems	The black bin waste is dropped onto a tipping floor, from where it is pushed into a vat of recirculated water. MSW components are separated gravitationally in the vat. From then on, most of the preprocessing occurs in water. During preprocessing, some recyclables are recovered, and undesirable residue is removed.
Description of Conversion Unit	The resulting conversion feed is introduced into an acidogenic reactor where it spends a few hours. From there, it is pumped to the UASB digesters to be biogasified. The digester operates at approximately 4% dry matter. A large inventory of water is recirculated between the various processes
Description of Energy Production Systems	Biogas from the UASB digester fuels generators with appropriate emissions controls
Description of By- products Processing & Handling Systems	The solid residue from the acidogenic and UASB reactors is very stable and requires very little curing
Feedstock Requirements	Composition: MSW
	Size: no limits
	Moisture Content: no limits
Diversion Rate	79%
Environmental Issues	Air: will comply with local regulations
	Water: 1500-2000 gallons per day to the sewer
	Solid Residue: will be landfilled
	Odor: controlled by largely submerged pretreatment
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: Electricity
	By-Products: Metals, mixed plastics, glass, soil amendment, water
Quantity of Products and By-Products	Products: 6.4 million kWh/yr
	By-Products (tpy): metals (800), mixed plastics (3300), glass (500), soil amendment (10,300), water (2800)
Area Requirement	3 ac

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: not needed
	Fuel Oil: not needed
	Water: some dilution water may be needed
	Sewer: 1500-2000 gpd
	Electricity: not needed
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 6500 tpy
Mass Balance	Material Delivered: 31,000 tpy
	Material Recycled: 4600 tpy
	Material Disposed: 6500 tpy
	Product Generated: 800 kW; 10,000 tpy organic soil amendment
Cost	Capital: $16 million, excluding land
	O&M: $1.0 million/year
	Revenue Generated: $383,000/year

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Bioengineering Resources, Inc. (BRI) Emmaus Road, Fayetteville
Brief Description of the Technology	Gasification/Fermentation (Gasification of MSW to produce synthesis gas, followed by fermentation of the synthesis gas to ethanol. Waste heat from the process is converted to steam and electricity.)
Technical and Financial Resources (Credibility)	Audited statement of income provided for the year 2000 shows $3.3 million operating income, and $1.0 million net operating income. BRI is working with engineering companies (Parsons, etc.) that routinely provide equipment guarantees and performance bonds.
For the Existing Facilities	
Facility Name	BRI pilot facility
Location	Fayetteville, AR
Owner	BRI
Technology	Gasification/fermentation pilot demonstration
Throughput	1.5 US tpd
Feedstock	Wood, corn stover, tires, RDF
Start-up Date	Thermal gasifier – 2003; fermenter – 1991
Capital Cost	$4.5 million
Operating Cost	$1.5 million/year
Products	Ethanol, steam
By-products	None listed.
Residuals	None listed. Probably include gasifier residues (ash, slag), and fermenter excess solids

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	96,500 tpy
Description of Preprocessing Systems	"Some size reduction"; suggest drying using process steam.
Description of Conversion Unit	BRI has selected a two-stage gasifier that raises the syngas temperature to over 2000°F in the second stage to enable cracking of any heavy hydrocarbons to CO and H_2, maximizing the ethanol yield. There are hundreds of these units in operation with a demonstrated reliability of 95 percent. The hot gases are then cooled to 100° F and introduced into the fermenter where ethanol is produced. Nutrients are added to provide for cell growth and automatic regeneration of the biocatalyst. A dilute, aqueous stream of ethanol is continuously removed through a membrane that retains cells for recycle to maximize reaction rates. Anhydrous ethanol is produced by conventional distillation followed by a molecular sieve, using the waste heat from the process. Water, with nutrients, is recycled from the distillation bottoms back to the fermenter. The selected gasifier (maximum unit size 125 tons/day) is capable of handling RDF as produced at the County's MRFs with no additional sorting. Metals and glass simply pass through the gasifier, along with the ash, while the organic fractions are converted to carbon monoxide and hydrogen, and thus serve as the raw materials for ethanol production. Multiple trains of gasification and fermentation are used to achieve the desired capacity. Two modules are proposed for the initial demonstration in Los Angeles to provide operating flexibility. Additional modules will be added later to improve the economic feasibility.
Description of Energy Production Systems	There are two sources of waste heat in this process: a) the cooling of the hot syngas and b) the combustion of the unconverted CO, H_2 and hydrocarbons in the exhaust gases from the fermenter. Steam can be generated from these waste heat sources and introduced into a turbine to generate electricity. The turbine exhaust steam can then be used as a source of heat for ethanol purification, feedstock drying, air pre-heating, etc. Alternatively, the unused syngas may be burned in an engine / generator to produce power with exhaust heat available for process needs. This syngas may be supplemented with natural gas to raise the heating value, where necessary.
Description of By- products Processing & Handling Systems	Anhydrous ethanol is produced by conventional distillation followed by a molecular sieve, using the waste heat from the process. Water, with nutrients, is recycled from the distillation bottoms back to the fermenter.
Feedstock Requirements	Composition: Not specified, but the constraints should be similar to those of any thermal gasification process
	Size: same comment
	Moisture Content: same comment
Diversion Rate	85%

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: typical emissions of syngas combustion with air pollution controls
	Water: 65 gpm ((94,000 gal/day)
	Solid Residue: It is assumed that unsorted MSW would be fed to the gasifier, therefore, all ash, metal, glass (15-20% of the MSW) that is unconverted in the gasifier would be landfilled.
	Odor: not listed, probably not significant
	Noise: not listed, probably not significant
	Other: not listed
Description of Products and By-Products	Products: Fuel ethanol, electricity
	By-Products: steam (if not used in power generation)
Quantity of Products and By-Products	Products: 8.2 million gal ethanol/year, 9.3 million kWh/year (1.2 MW) net
	By-Products:
Area Requirement	2.2 ac
Utility Requirements	Natural Gas: none
	Fuel Oil: none
	Water: 190 gpm
	Sewer: 65 gpm wastewater
	Electricity: none
Composition of Waste Generated by the Facility	Hazardous: not listed
	Non-Hazardous: not listed
Quantity of Waste Generated by the Facility	Hazardous: not listed
	Non-Hazardous: 43 tpd
Mass Balance	Material Delivered: 96500 tpy
	Material Recycled: none
	Material Disposed: 14,400 tpy
	Product Generated: 8.2 million gal ethanol/year, 9.3 million kWh/year (1.2 MW) net
Cost	Capital: $26.6 million
	Operational: $3.9 million
	Revenue Generated: $12.7 million, mainly from the sale of ethanol at $1.50/gal

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name,	Canada Composting Inc. Ontario, Canada
Brief Description of the Technology	CCI holds the exclusive license for the BTA process in Canada and the U.S. The BTA process is a solid waste AD process that was developed in Germany in the 1980's. Its particularities include the use of wet pulping to prepare the facility feed for anaerobic digestion. This converts the feed into a slurry, which is pumped to the anaerobic digester. The latter is operated in the liquid phase; various digester designs are used. Generally, the digester effluent is dewatered, aerobically matured, and marketed as compost.
Technical and Financial Resources (Credibility)	CCI is a privately held company, with approximately 45 shareholders having invested $8 Million Canadian since it was founded in 1992. Specific financial statements are confidential. The company is solvent and continues to grow the revenue base that will support expansion into the marketplace. Current operations are supported by revenue generated with existing operations and support contracts, license fees and from global consulting activities. The company has never had to defend (or settle) a lawsuit, forfeit a bond, or had a contract cancelled.
For the Existing Facilities	
Facility Name	City of Toronto/Dufferin pilot plant
Location	Toronto, Ontario
Owner	City of Toronto
Technology	BTA process
Throughput	28,000 tpy
Feedstock	Source-separated organics
Start-up Date	2001
Capital Cost	$13 million
Operating Cost	NA
Products	Biogas, currently flared
By-products	Compost
Residuals	4100 tpy

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	25,000tpy (per RFQ request, CCI considers this a pilot plant)
Description of Preprocessing Systems	The tipping floor operator will first remove large non-processable objects. Then the waste is subjected to dry pretreatment. It is first loaded on a trommel screen. Garbage bags are broken up, and the majority of the organics report to the undersize fraction, from which ferrous metals and aluminum are removed using magnetic removal and an eddy current generator. At this point, the waste enters the wet pretreatment phase; it is conveyed to one of the pulpers, which separates the waste into: a) a light fraction (plastic textiles, etc.); b) a heavy fraction (stones, glass, metal, batteries, etc.); and c) an organic suspension. The latter is degritted in a hydrocyclone. The resulting conversion feed goes to buffer storage and is then fed to a digester operating in the liquid phase, where it is biogasified.
Description of Conversion Unit	Several digester designs have been used. They have in common that they operate in the liquid phase and are completely mixed.
Description of Energy Production Systems	The biogas will be converted to electricity in typical IC engine generators.
Description of By- products Processing & Handling Systems	For this application, CCI typically partners with an experienced producer and marketer of compost products and the approach applied is outdoor piles. This approach is relatively easy to manage and has the advantage of using standard excavation machinery. Using this approach, CCI can annually compost about 20,000 tons of waste per hectare of platform; a higher output than normally obtained by windrow composting systems.
Feedstock Requirements	Composition: MSW
	Size: no limits
	Moisture Content: no limits
Diversion Rate	56%
Environmental Issues	Air: will comply with local regulations
	Water: 6200 tpy
	Solid Residue: will be landfilled
	Odor: controlled by operating inside a negative pressure building
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: Electricity
	By-Products: Compost, recyclables
Quantity of Products and By-Products	Products: 3.4 million kWh/yr
	By-Products (tpy): compost (4600)
Area Requirement	NA (The 130,000 tpy Newmarket, ON, CCI facility takes up less than 6 ac)

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: for startup/backup
	Fuel Oil: for rolling stock; at Dufferin/Toronto: $900/month
	Water: 800 gpd, primarily for mixing in flocculants
	Sewer: 1.2 million gal/year
	Electricity: for startup/backup
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 11,000 tpy
Mass Balance	Material Delivered: 25,000 tpy (per RFQ: 100 tpd, 5 days/week)
	Material Recycled: 2700 tpy
	Material Disposed: 11,000 tpy
	Product Generated: 400 kW; 4600 tpy compost
Cost	Capital: $24.4 million, excluding land
	O&M: $2.6 million/year
	Revenue Generated: $280,000/year

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	GRL Investments Pty Limited (Global Renewables) Australia
Brief Description of the Technology	Global Renewables' Urban Resource-Reduction, Recovery and Recycling (UR-3R) process contains 4 basic elements: • Mechanical Separation; • ISKA percolation; • Composting and refining using the SCT process; and • Renewable energy recovery in the form of biogas. In the UR-3R Process® waste resources become cleaner at every stage of the process. Shredding and mixing are minimized; separation processes are maximized using both mechanical and natural biological technologies. Waste is treated gently to enhance recovery of resources such as glass and paper, and to avoid mixing contaminants into the organics or turning high value materials (e.g. plastics) into comparatively low value materials (e.g. fuel). Resources that have a higher recovery cost than their current net value are inerted for either safe landfill disposal or separate storage.
Technical and Financial Resources (Credibility)	Global Renewables was formed in 2000 and is wholly owned by GRD Limited (GRD), which is listed on the Australian and New Zealand Stock exchanges and has a market capitalization of $380 million. Besides Global Renewables, GRD wholly owns GRD Minproc, a leading Australian resource and process engineering company, which has completed over 200 projects in 30 countries ranging in value from $4 million to $200 million with a total value exceeding $12 billion. GRD Minproc carries out the detailed design, construction management, and commissioning of Global Renewables' facilities. GRD also owns a 56% share in OceanaGold, a major gold producer. Global Renewables' UR-3R process includes anaerobic digestion using the German ISKA process, for which they hold the license in Australasia and Asia. Global Renewables also has an alliance with Sorain Cecchini Tecno SRL (SCT) from Italy, which has expertise in the separation and aerobic composting of MSW. In the UR-3R process, the SCT process is used for the aerobic treatment that follows AD; Global Renewables has the SCT license for the Asia-Pacific region.

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Existing Facilities	
Facility Name	Eastern Creek UR-3R Facility
Location	Eastern Creek, NSW, Australia
Owner	GRL Investments Pty Limited (Global Renewables)
Technology	UR-3R process
Throughput	Designed for 190,000 tpy (in start-up)
Feedstock	Residual mixed MSW
Start-up Date	September 2004
Capital Cost	$55 million
Operating Cost	Confidential
Products	Biogas, electricity (17 million kWh/yr estimated), organic growth media (40,000 tpy estimated)
By-products	Metals, plastics, glass, paper, mixed plastic
Residuals	28,000 tpy estimated
For the Proposed Facility	
Capacity	250,000 tpy
Description of Preprocessing Systems	Not specified, but uses current preprocessing technology and excludes shredding
Description of Conversion Unit	The conversion feed goes to an ISKA percolator where it is sprayed with hot process water. This generates a percolate solution, which is biogasified in a hybrid packed-bed low solids digester. Solid residue from the percolator is dewatered in a press; the filtrate liquid goes to the digester, while the cake is screened and the undersize fraction goes to aerobic composting
Description of Energy Production Systems	Biogas from the ISKA system fuels generators with appropriate emissions controls
Description of By- products Processing & Handling Systems	Composting occurs in a large mixed compost bay inside a building under negative pressure. The initial 2-week intensive composting phase is followed by 8 weeks of windrow maturation. The final product is screened before being marketed
Feedstock Requirements	Composition: MSW
	Size: no limits
	Moisture Content: no limits
Diversion Rate	75%

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: will comply with local regulations
	Water: no discharge
	Solid Residue: will be landfilled
	Odor: controlled by operating buildings at negative pressure and treating exhaust with biofilter
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: Electricity
	By-Products: Hard recyclables (paper, cardboard, glass, PET, HDPE, mixed plastic, film plastic, ferrous & non-ferrous metals) and high grade compost
Quantity of Products and By-Products	Products: 2.8 MW (based on attached brochure)
	By-Products (tpy): Glass: 2500; PET & HDPE: 6750; plastic, film & mixed: 16,500; metals: 6750; paper & cardboard: 43,000; alternative daily cover: 44,750; OGM (compost): 21,000.
Area Requirement	Not provided. Existing facility takes up 11 ac and is designed to process 190,000 US tpd, so the Los Angeles facility may take up 14 acres
Utility Requirements	Natural Gas: not needed
	Fuel Oil: not needed
	Water: not needed
	Sewer: not needed
	Electricity: not needed
Composition of Waste Generated by the Facility	Hazardous: none, because will it be separated in preprocessing
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous:
	Non-Hazardous: 17,500 tpy of rejects, 44,750 tpy of alternative daily cover (ADC) as listed under byproducts
Mass Balance	Material Delivered: 250,000
	Material Recycled: 120,000 tpy, including ADC
	Material Disposed: 17,500 tpy of rejects, not including ADC
	Product Generated: 2.8 MW; 21,000 tpy OGM (compost)
Cost	Capital: $50 to 70 million, excluding land
	Operational: not provided, but tipping fee estimated at US$50 to 63 per US ton including profit but not residue landfilling, which would add $10 to these numbers (assuming landfilling costs at $40/ton and no ADC accepted)
	Revenue Generated: not provided

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Organic Waste Systems Belgium
Brief Description of the Technology	OWS has patented the DRANCO (Dry Anaerobic Composting) anaerobic digestion process. In this process, the digester feed is mixed with a large amount of recirculating digester effluent. The resulting mix is pumped to the top of the cylindrical digester where it is introduced into the digester. The contents have approximately 40 percent dry matter; they make their way down through the digester in a few days. Subsequently, most of the contents are recirculated to the top, so that the average residence time of the feed is 3 to 4 weeks. The fraction of the effluent removed from the digester (digestate) is aerobically matured using a static pile process and sold as compost
Technical and Financial Resources (Credibility)	Organic Waste Systems (OWS) is a stock company under Belgian law, constituted in 1988 with a capital of 1.2 million Euros, and specialized in biological treatment of solid and semisolid wastes. OWS has 40 employees and historical revenue of about 10 million Euros per year, although revenues are expected to rise to 15 to 18 million Euros (20 to 25 million U.S. Dollars) in 2004 and 2005 due to the construction of several new facilities. OWS developed the DRANCO process. OWS has constructed several commercial DRANCO plants worldwide, and has a significant backlog of facilities in the design and construction stages. A copy of the 2003 annual report was provided.
For the Existing Facilities	
Facility Name	Brecht II
Location	Brecht, Belgium
Owner	IGEAN (a regional association of municipalities)
Technology	DRANCO process
Throughput	53,000 tpy
Feedstock	Source-separated organics, some industrial waste
Start-up Date	2000
Capital Cost	$20 million
Operating Cost	NA
Products	Biogas, electricity (850 kW net)
By-products	Compost (28,000 tpy)
Residuals	9,000 tpy

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	25,000 tpy (per RFQ request, 100 tpd, 5 d/wk)
Description of Preprocessing Systems	Delivered waste is conveyed to a hammer mill, then subjected to magnetic separation, 40 mm rotating screen, and non-ferrous magnet. The resulting feed goes to the dosing unit, where it is mixed with recirculated digester contents and heated with low pressure steam to 120-130 °F; some ferric chloride is added to reduce the H_2S content of the biogas.
Description of Conversion Unit	The resulting mix is pumped into the top of the digester using a cement pump. As the material works its way down the digester, it is subjected to intense anaerobic digestion at 120°-130° F at a dry matter content of approximately 40 percent. It takes about 3-4 days for the material to arrive at the bottom of the digester. There, it is withdrawn, and a small part is removed and sent to post-processing, while most of it is recirculated after being mixed with fresh feed, iron chloride, etc. As a result, the conversion feed spends an average of 25 days in the digester. There will be one 56,000-ft^3 steel digester, approximately 35 feet in diameter.
Description of Energy Production Systems	The biogas flows into a buffer storage tank, and then it is sent to blowers, which convey it to the IC engine generators with appropriate emissions controls. Some of the heat of the exhaust gases is used to generate steam to preheat conversion feed in the mixing chamber.
Description of By- products Processing & Handling Systems	The digestate is wet screened, then dewatered in a centrifuge; the centrate liquid is recycled. The cake is aerobically cured using an enclosed static pile process. OWS offers an option to install further wet separation to recover marketable fibers and sand.
Feedstock Requirements	Composition: MSW; C/N ratio >25, no high salt wastes; avoid high sulfur materials like drywall; no stringers.
	Size: no limits, but <4" preferred
	Moisture Content: preferably less than 70% moisture
Diversion Rate	61%
Environmental Issues	Air: will comply with local regulations
	Water: no significant amount of wastewater expected
	Solid Residue: will be landfilled
	Odor: controlled by operating inside a negative pressure building and treating the exhausted air.
	Noise: no issue expected; 60 dB expected outside the DRANCO process buildings.
	Other: none identified
Description of Products and By-Products	Products: Electricity
	By-Products: Compost, recyclables

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Quantity of Products and By-Products	Products: 4.5 million kWh/yr
	By-Products (tpy): compost (10,000), ferrous metals (1000)
Area Requirement	1 ac
Utility Requirements	Natural Gas: not listed
	Diesel: 1650 gal/yr
	Water: 2000 m3/yr (2000 gpd)
	Sewer: no significant wastewater discharge
	Electricity: for startup/backup
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 10,000 tpy
Mass Balance	Material Delivered: 25,000 tpy (per RFQ: 100 tpd, 5 days/week)
	Material Recycled: 1000 tpy (more if wete sorting implelemted)
	Material Disposed: 10,000 tpy
	Product Generated: 500 kW; 10,000 tpy compost
Cost	Capital: $23.6 million, excluding land (wet separation option: $0.5 million)
	O&M: $1.95 million/year
	Revenue Generated: $660,000/year

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name, Contact, Address, Telephone, Email	Waste Recovery Systems, Inc./Valorga Monarch Beach,
Brief Description of the Technology	Valorga international has patented the Valorga anaerobic digestion process. In this process, a solid or semi-solid waste feed is injected near the bottom of a cylindrical digester. The Valorga digesters have a vertical partition running from one wall across the center over approximately 2/3 of the diameter. The waste feed is introduced on one side of the partition and is removed from a port on the other side, to ensure a minimum residence time in the digester. During their transit, the contents are mixed via pulsed injections of pressurized biogas from the bottom of the digester. Typically, the waste resides in the digester for 3 to 4 weeks, at a dry solids content of 30 to 40%. The digester effluent is dewatered, aerobically matured, and marketed as compost.
Technical and Financial Resources (Credibility)	WRSI successfully secured commitments for financing for both private and public municipal projects ranging in value from $5.0 million to $110 million, upon favorable terms and conditions. Relationships established over many years with Wall Street investment banking firms have enabled WRSI to secure financial commitments for the construction of a 450 TPD Valorga facility in Southern California within the last year. WRSI has received notification that the WRSI/Valorga International/Shaw-Emcon group has been selected by a major waste management firm to build, own, and operate a facility to process a significant daily quantity of MSW in the Western US for a period of 20 years. Shaw-Emcon will be the EPC contractor for the project, guaranteeing a fixed price construction contract and mechanical completion. Valorga International will provide a guarantee for the process. WRSI will operate the facility with the technical support of Valorga International and one of its shareholder companies, URBASER, a major Spanish construction and solid waste processing firm.
For the Existing Facilities	
Facility Name	Ecoparc 2
Location	Barcelona, Spain
Owner	Ecoparc del Besos.
Technology	Valorga process
Throughput	132,000 tpy
Feedstock	Source-separated organics + MSW
Start-up Date	2004
Capital Cost	$70 million
Operating Cost	NA
Products	Biogas, electricity (3750 kW net), compost (65,000 tpy), water (15,500 tpy)
By-products	Recyclables
Residuals	65,000 tpy

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	28,600 tpy (per RFQ request, a larger size would be more cost-effective, according to WRSI/Valorga)
Description of Preprocessing Systems	A combination of mechanical sorting /screening equipment and hand-picking, followed by low-speed shredding of the purified digester feed. The conversion feed is delivered to a mixing chamber where process water can be added as needed, steam is injected to heat the feed, and some amount of digester effluent is added. The resulting slurry is pumped into the digester during operating hours using a robust piston pump.
Description of Conversion Unit	As discussed above, the digester contents are mixed with injections of pressurized biogas On average, waste feed spends approximately 30 days in the digester, where it is subjected to intense anaerobic digestion. There will be one 110,000-ft^3 concrete digester, approximately 57 feet high and 50 feet in diameter.
Description of Energy Production Systems	The biogas flows into a buffer storage tank, and then it is sent to blowers, which convey it to the IC engine generators with appropriate emissions controls. Other than chilling and condensate collection, no further treatment of the gas is needed. Some of the heat of the exhaust gases is used to generate steam to preheat conversion feed in the mixing chamber.
Description of By- products Processing & Handling Systems	The digestate will be aerobically cured using an in-vessel process.
Feedstock Requirements	Composition: MSW
	Size: no limits
	Moisture Content: no limits
Diversion Rate	76%
Environmental Issues	Air: will comply with local regulations
	Water: 8300 tpy
	Solid Residue: will be landfilled
	Odor: controlled by operting inside a negative pressure building
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: Electricity
	By-Products: Compost, recyclables
Quantity of Products and By-Products	Products: 2.8 million kWh/yr
	By-Products (tpy): compost (6400), recyclables (4900)
Area Requirement	7 ac

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Utility Requirements	Natural Gas: for startup/backup
	Fuel Oil: not needed
	Water: washdown, sanitary
	Sewer: 5000 gpd
	Electricity: for startup/backup
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 6800 tpy
Mass Balance	Material Delivered: 29,000 tpy (per RFQ: 100 tpd, 5.5 days/week)
	Material Recycled: 4900 tpy
	Material Disposed: 6800 tpy
	Product Generated: 320 kW; 6400 tpy organic soil amendment
Cost	Capital: $9 million, excluding land
	O&M: $1.14 million/year
	Revenue Generated: $378,000/year

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	ABT-Haskell, LLC. Saint Augustine, Florida
Brief Description of the Technology	ABT has patented the AirLance™ in-vessel aerobic composting process. Air is injected and extracted via what is essentially a dense array of giant injection needles into a deep mass of composting sewage biosolids (sludge) and woodchips. The process occurs inside large 26-ft cubical composting cells with built-in screw conveyors. This system optimizes composting conditions, maximizing conversion rates and minimizing footprint. It is completely enclosed.
Technical and Financial Resources (Credibility)	ABT-Haskell LLC is a joint venture of American Bio Tech (ABT) and The Haskell Company (Haskell) that utilizes ABT's AirLance™ composting technology and The Haskell Company's recognized design-build expertise. The AirLance™ Enclosed in-vessel composting technology has been utilized for more than 17 years. The Haskell Company's (THC) role in the project is to secure permitting, financing, design-build the facilities, and provide project and construction management. As an integrated design-build contractor this is THC's core business, in support of which it may utilize local services and businesses as required. Founded in 1965, The Haskell Company ranks among the foremost design-build organizations in the U.S. With more than 1,250 employees and annual sales that exceed $650 million, The Haskell Company provides complete architectural, engineering, construction, real estate and facility management services on a single-responsibility basis. The geographical scope of Haskell's work spans the Western Hemisphere, including Canada, the Caribbean and Latin America.
For the Existing Facilities	
Facility Name	Schenectady biosolids composting project
Location	Schenectady, NY
Owner	City of Schenectady
Technology	AirLance
Throughput	70 tpd biosolids + 35 tpd waste wood (38,000 tpy total assuming 7d/wk)
Feedstock	Biosolids + waste wood
Start-up Date	1987
Capital Cost	$5.5 million
Operating Cost	NA
Products	Compost (62 tpd; 23,000 tpy assuming 7d/wk)
By-products	none
Residuals	NA

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	100,000 tpy (274 tpd, 7 d/wk))
Description of Preprocessing Systems	The MRF will supply organic waste and waste wood that are relatively free of inerts, plastics, etc. The organics will be macerated into a slurry, while the waste wood will be shredded into chips. The two will be judiciously mixed and fed to the composting system.
Description of Conversion Unit	On a daily basis, a layer of composted material is removed from the bottom of the reactor cells and a fresh layer of proportioned and mixed feed material is placed on the top, allowing the vertical, plug flow operation. The plug flow concept assures compost material cannot short circuit and maintains uniform thermophilic decomposition sustained by the AirLance™ system. The internal temperature of the composting biomass is consistently maintained between 55°C and 70°C during the entire process. In each of the compost cells, a series of alternating pressure and vacuum AirLances™ are installed to provide the necessary air supply and waste product removal to sustain the efficient, high rate thermophilic decomposition of the organic matter. Air supply is monitored and metered into the pressure AirLances™ and likewise out of the vacuum AirLances™. More air is removed from the cell than is injected to keep odors and emissions from leaving the building enclosure before scrubbing.
Description of Energy Production Systems	There is no energy production in aerobic composting
Description of By- products Processing & Handling Systems	In a daily operation that runs concurrently with the infeed sequence, a traveling screw reclaimer that operates on a parallel rail system, undercuts and removes a layer of the composted material at the bottom of the reactor cells, discharging onto the reactor outfeed belt conveyor. The compost is loaded onto trucks and distributed.
Feedstock Requirements	The proposed AirLance™ Composting Facility requires organic wastes and carbonaceous wastes that are relatively free of metals, glass and other inert particles.
	Size: not specified
	Moisture Content: not specified
Diversion Rate	Not specified, assumes all residue removal will occur at the MRF, no compost post-treatment assumed. Counting the residuals separated at the MRF, the diversion rate should be in the 60 to 80% range.
Environmental Issues	Air: will comply with local regulations
	Water: 20 - 40 gpm
	Solid Residue: not specified
	Odor: controlled by operating inside a negative pressure building and treating the exhausted air.
	Noise: no issue expected
	Other: none identified

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Description of Products and By-Products	Products: Compost
	By-Products: none
Quantity of Products and By-Products	Products: Compost (83,000 tpy/227 tpd)
	By-Products: NA
Area Requirement	6.5 ac
Utility Requirements	Natural Gas: not needed
	Diesel: for moving equipment
	Water: 10 gpm (14,000 gpd)
	Sewer: 20-40 gpm (30,000 to 55,000 gpd)
	Electricity: not listed, but should be substantial
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: negligible after MRF (separation occurs at MRF)
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: negligible
Mass Balance	Material Delivered: 100,000 tpy organics + 50,000 tpy wood waste = 150,000 tpy
	Material Recycled: no recycling
	Material Disposed: no solid material after MRF; 67,000 tpy of condensate
	Product Generated: 83,000 tpy compost
Cost	Capital: NA
	O&M: NA
	Revenue Generated: NA

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	HotRot Composting Systems Santa Barbara, CA
Brief Description of the Technology	The HotRot system is an in-vessel aerobic composting process. Waste is slowly moved along a tunnel via tines on a longitudinal shaft; the tines double as air injectors.
Technical and Financial Resources (Credibility)	HotRot provided financial reports indicating over $4 million in sales in the first quarter of 2005. They have substantial major shareholders.
For the Existing Facilities	
Facility Name	Seamer Carr landfill site
Location	Scarborough, England
Owner	HotRot Composting Systems Limited/Wastec Waste Separation
Technology	HotRot
Throughput	15 tpd, 5400 tpy
Feedstock	Organics from MRF
Start-up Date	2004
Capital Cost	$1.3 million
Operating Cost	NA
Products	Compost (7.5 tpd; “gray” compost suitable for landfill cover and restoration)
By-products	None
Residuals	Zero
For the Proposed Facility	
Capacity	100 tpd
Description of Preprocessing Systems	The MRF will supply organic waste that is relatively free of inerts, plastics, etc.
Description of Conversion Unit	The process is continuous, with a residence time of 14-20 days. HotRot provides a complete suite of processing equipment.
Description of Energy Production Systems	There is no energy production in aerobic composting
Description of By- products Processing & Handling Systems	Screening and curing are optional but probably required to generate marketable compost.
Feedstock Requirements	pH 6-8; C/N ratio 8-40 to 1; no CCA-treated wood; no liquids.
	Size: 2” or less for yard waste, 10”or less for paper and cardboard
	Moisture Content: 40-60% in the resulting feed blend
Diversion Rate	90 to 95% after MRF.

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: will comply with local regulations
	Water: not expected
	Solid Residue: landfill refuse
	Odor: completely controlled, exhausted air treated in biofilter.
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: Compost
	By-Products: none
Quantity of Products and By-Products	Products: Compost (40-50 tpd)
	By-Products: NA
Area Requirement	2.5 ac
Utility Requirements	Natural Gas: not needed
	Diesel: for moving equipment
	Water: washdown and sanitary
	Sewer: some need for washdown and condensate traps
	Electricity: 1200 kW
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: landfill refuse
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 5-10 tpd
Mass Balance	Material Delivered: 100 tpd
	Material Recycled: no recycling after MRF
	Material Disposed: 5-10 tpd
	Product Generated: 40 to 50 tpd compost
Cost	Capital: 7.7 million
	O&M: $670,000/yr
	Revenue Generated: $280,000 (assuming $20/ton compost)

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	International Bio-Recovery Corp. (IBR) North Vancouver, Canada
Brief Description of the Technology	Food waste is slurried and aerobically digested with air injection inside a closed vessel using the EATAD process (Enhanced AutoThermal Aerobic Digestion); BRI has exclusive patent rights to its key components, the Shearator and the digester. The resulting biooxidation is exothermic and the resulting heat raises the slurry temperature to pasteurizing levels (> 160 °F). The digested effluent is formulated into a) a dry pelletized fertilizer, and b) a liquid fertilizer; both are marketed under the name Genica.
Technical and Financial Resources (Credibility)	IBR has been operating their North Vancouver plant since 1997. In their SOQ, they offer a $200,000 bid bond, a bank letter of guarantee, and surety.
For the Existing Facilities	
Facility Name	North Vancouver facility
Location	North Vancouver, BC, Canada
Owner	IBR
Technology	EATAD process
Throughput	Design: 120 tpd; actual: 30 tpd?
Feedstock	Food waste
Start-up Date	1997
Capital Cost	NA
Operating Cost	NA
Products	Solid and liquid fertilizer
By-products	None
Residuals	NA

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	100,000 tpy
Description of Preprocessing Systems	Maceration to prepare slurry; pH adjustment if necessary
Description of Conversion Unit	Feed first goes to startup digesters where it is aerated to 140°F and pH-stabilized, then inoculated with recirculated effluent. Next it goes to the main digesters. Effluent is screened, flocculant added, and mechanically dewatered, pelletized, and bagged. The filtrate is clarified, concentrated and decanted into totes as liquid fertilizer. The whole process takes 6 days. Condensate is recycled. If the feed contains more than 70% water, there will be a net wastewater discharge.
Description of Energy Production Systems	There is no energy production
Description of By- products Processing & Handling Systems	See description of conversion unit
Feedstock Requirements	Composition: food waste or similar
	Size: no limits
	Moisture Content: no limits, but >70% will generate net wastewater
Diversion Rate	NA
Environmental Issues	Air: will comply with local regulations
	Water: no discharge if feed <70% moisture
	Solid Residue: will be landfilled
	Odor: controlled by operating buildings at negative pressure and treating exhaust with biofilter
	Noise: no issue expected
	Other: none identified
Description of Products and By-Products	Products: pelletized and liquid fertilizers
	By-Products: NA
Quantity of Products and By-Products	Products: 36,000 to 56,000 tpy (estimated from rest of mass balance)
	By-Products (tpy): NA
Area Requirement	4-5 ac
Utility Requirements	Natural Gas: 57,000 MMBtu/yr or 57 million scf/yr
	Fuel Oil: NA
	Water: NA
	Sewer: 8000 to 13,000 gpd
	Electricity: 1200 kW

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: non-putrescible landfill material
Quantity of Waste Generated by the Facility	Hazardous: NA
	Non-Hazardous: 14,000 tpy
Mass Balance	Material Delivered: 100,000 tpy
	Material Recycled: NA
	Material Disposed: 14,000 tpy of rejects
	Product Generated: 36,000 to 56,000 tpy of liquid and pelletized fertilizer
Cost	Capital: NA
	Operational: not provided, but tipping fee estimated at $25 to $55 per US ton
	Revenue Generated: not provided

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Firm Name	Wright Tech Systems Inc. Canada
Brief Description of the Technology	Wright Environmental developed the Biodryer™ in-vessel biological drying technology based on its tunnel composting process. In the Biodryer, the processed material is dried to less than 15% moisture by using metabolic heat; the resulting dry material can be used as biomass fuel. Biological drying is an order of magnitude cheaper than conventional thermal drying, it does not require air pollution control equipment, and the air permitting is much simpler. The Biodryer can easily be retrofitted into a composter, should the client decide to produce compost rather than biomass fuel.
Technical and Financial Resources (Credibility)	Wright Environmental Management, Inc. (project lead) was incorporated in 1992, and has installed dozens of its patented tunnel composting systems across North America and Europe. Canadian Commercial Corporation (CCC) (prime contractor) is a Crown corporation established by the Government of Canada, which acts as the prime contractor when the client prefers a commitment from the Government of Canada. It will provide the contract guarantees and assurances. Machinex (subcontractor) designs and manufactures preprocessing equipment; it has installed over 200 turnkey installations throughout North America and Europe. It will provide the conveyor system. The SHAW Group (sub-contractor) will provide the necessary engineering, construction and permitting services and if required by the City, the operation and maintenance of the organic waste facility as well. Lundell Manufacturing Inc. (sub-contractor) is a leading manufacturer of pelletization and material handling systems for fuel applications. They would provide the air classifier and shredder for the back end.
For the Existing Facilities	
Facility Name	Inverboyndie facility
Location	Inverboyndie, Nr Banff, Scotland
Owner	Aberdeenshire Council
Technology	Wright in-vessel composting
Throughput	100 tpd/36,500 tpy
Feedstock	MSW
Start-up Date	2001
Capital Cost	$2.0 million
Operating Cost	$ 743,000/year
Products	Compost, used for landfill restoration
By-products	none
Residuals	Up to 60% of input

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

For the Proposed Facility	
Capacity	26,000 tpy (100 tpd, 5 d/wk)
Description of Preprocessing Systems	Assumes all necessary separations will be conducted by the MRF. Preprocessing will be limited to blending, moisture control, and conveying.
Description of Conversion Unit	The Biodryer is an in-vessel tunnel system that is fully enclosed. It has automated controls to ensure the ideal conditions are in place to optimize decompositions and thus provide the heat for the drying process. The waste material remains in the biodryer for a 14-day cycle. It moves continuously through the tunnel during the eight operating hours of each shift. The floor trays in the tunnel are cycled through the tunnels and are advanced as a new clean tray is added. Exhaust fans remove water vapor and gases from the decomposing mass. This airflow is sent to an external biofilter, which cleans the air and water. The reduction of moisture content is the process of bio-drying by microbial exothermic reaction. The heat from aerobic decomposition in the first stage is used to dry the mass in the second stage of the biodryer. The heat is transferred between the stages by a heat exchanger. There are neither fossil fuels required nor any emissions that require permits. No NO_x nor SO_x are generated.
Description of Energy Production Systems	There is no energy production in aerobic composting
Description of By- products Processing & Handling Systems	As the dried material is discharged from the tunnels it falls onto a reclaim conveyor that is in line with the discharge of all tunnels. This material is then transferred by conveyor to the final processing stages. A shredder breaks up the dried mulch. The mulch is then passed through an air classifier. Here, the metal, glass, plastic and “other” components are separated from the remaining dry organic material. The final cleaned dry biomass fuel is then stored in piles in a bunker until delivered to market. It does not emit an odor since there is no moisture content to promote decomposition nor bacterial growth. Ferrous metals can be separated mechanically by a magnetic separator and recycled as scrap metal; this would generate an additional revenue stream. The fuel may be pelletized as an option as well depending on the needs of the market.
Feedstock Requirements	No limits
	Size: shorter than conveyor belt width
	Moisture Content: flexible
Diversion Rate	90% post-MRF

TABLE A-5 (CONTINUED)
SUMMARY OF RESPONSES FROM THE BIOLOGICAL/CHEMICAL CONVERSION TECHNOLOGY SUPPLIERS

Environmental Issues	Air: will comply with local regulations
	Water: low-strength condensate
	Solid Residue: 10 tpd (10% of input)
	Odor: controlled by operating inside a negative pressure building and treating the exhausted air.
	Noise: well defined; no issue expected
	Other: none identified
Description of Products and By-Products	Products: RDF
	By-Products: none
Quantity of Products and By-Products	Products: RDF (10,000 tpy/39 tpd)
	By-Products: NA
Area Requirement	1.5 ac for process equipment, need to add parking, roads, etc.
Utility Requirements	Natural Gas: not needed
	Diesel: not used, propane used for moving equipment because of indoor operation
	Water: washdown, sanitary, dust control
	Sewer: 12,000 gpd
	Electricity: not specified, but should be substantial
Composition of Waste Generated by the Facility	Hazardous: none
	Non-Hazardous: dried landfill refuse
Quantity of Waste Generated by the Facility	Hazardous: not applicable
	Non-Hazardous: 10 tpd of dried waste
Mass Balance	Material Delivered: 26,000 tpy
	Material Recycled: no recycling
	Material Disposed: 10 tpd
	Product Generated: 10,000 tpy compost
Cost	Capital: $6.9 million
	O&M: $546,000/year
	Revenue Generated: $446,000/year

TABLE A-6
RANKING OF THE TECHNOLOGY SUPPLIERS
AND JUSTIFICATION OF PERFORMANCE LEVELS ASSIGNED

CHANGING WORLD TECHNOLOGIES, INC.

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	CWT has tested many different biomass feedstocks, including food wastes, mixed plastics, tires, oil residual, waste grease, but not straight MRF residuals or unsorted MSW.	25	
Need to Scale Conversion Unit to 100 TPD Size	Present operating unit in Carthage, MO has a throughput of 250 TPD. No scale-up is required.	100	
Engineering the Complete System	CWT has designed, constructed, and now operates one commercial scale facility using its technology.	75	
Marketability of Conversion Products	CWT's proposed facility would primarily produce liquid fuels, and will combust some of the fuels for internal steam use, with some potential generation of electricity as needed.	66	
Existing Operational Experience	CWT has had a demo plant in operation for over 5 years; its commercial plant has been in operation for 6 months.	75	
Economics	Capital and O&M costs, as well as product revenues, are based on 6 years of pilot plant experience and full-scale commercial facility. Capital costs on a $/TPY are greater than for the larger commercial plant, which would be expected. Details of Attachment 2 not provided. CWT failed to include significant costs for purchase off the grid of 1 MW of power to run the facility, but net costs are still low once they are added in. The cost is based on commercial unit processing other feedstock.	0	
Landfill Diversion	The process converts essentially 100% of the feedstock to marketable products. If additional equipment is required to remove metals and glass from the MRF residuals, that would provide additional marketable by-products.	100	
Supplier Credibility	CWT has proven its technical and financial capabilities through its development of one commercial-scale facility at more than twice the throughput proposed for the County. It has received significant (non-monetary) support from the U.S. EPA, U.S. DOE, and members of Congress. The commercial plant was financed with equity capital.	50	

EBARA CORPORATION

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Ebara has a 4950 tons/day demonstration facility processing MSW.	50	
Need to Scale Conversion Unit to 100 TPD Size	The unit that Ebara operates has 15 tons/day capacity a scale up of 6X is required to process 100 tons/day.	33	
Engineering the Complete System	Ebara is operating a demonstration complete system.	75	
Marketability of Conversion Products	Ebara proposed facility will produce electricity.	100	
Existing Operational Experience	For the system that Ebara suggest they have limited operational experience.	50	
Economics	Net costs are supported and is not reasonable ($289/ton).	50	
Landfill Diversion	Ebara Corporation described their diversion rate at > 95% or more.	100	
Supplier Credibility	Ebara is a large corporation with annual business of $1.8 billion. They have extensive environmental and engineering capability.	100	

GEM AMERICA, INC.

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	GEM has a pilot plant and a commercial operating plant (shut down for now, but awaiting re-start) treating MSW.	100	
Need to Scale Conversion Unit to 100 TPD Size	GEM's commercial-size modules are rated at about 40-50 TPD. The 100 TPD throughput could be accomplished with 2-3 modules, or scale-up of two is required.	66	
Engineering the Complete System	GEM has developed a small demonstration facility and a 14,000 TPY commercial-scale facility. It has also signed a contract to develop a commercial facility in Spain, using auto shredder residue. GEM has partnered with ICC, Inc., a large engineering firm in the U.S. for a complete EPC package. The submittal contained complete data, including a mass and energy balance for the proposed facility and environmental data on the syngas and by-product char.	75	
Marketability of Conversion Products	GEM's proposed facility would produce electricity.	100	
Existing Operational Experience	GEM's pilot plant has been in operation for 8 years. The commercial plant in South Wales was in operation for >1 year, until the owner/operator shut it down for commercial (not technical) reasons. It is awaiting a waste contract so that it can re-start.	25	
Economics	Net costs are supported and is not reasonable range ($105/ton). Details provided on Attachment 2. Additional revenues may be possible from sale of char and ash, if testing shows them to be marketable.	50	
Landfill Diversion	Based on testing to date, the char/ash mixture has not been found to be hazardous. Therefore, it can likely be used for cement making, providing a diversion rate of ~100%.	100	
Supplier Credibility	GEM America is owned by Mr. Weltz and GEM International, Ltd. GEM International is staffed by personnel including the GEM process inventor and senior managing director. GEM is partnering with ICC, Inc., an engineering firm, for offering an EPC package. GEM offers to warrant its system at 75% of rated capacity, and would put money in escrow to insure performance. Together, the team offers credible, but somewhat limited technical and financial resources compared to others.	50	

GEOPLASMA LLC

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	One of Geoplasma's partners, Hitachi Metals, has had direct experience with this technology using MSW.	100	
Need to Scale Conversion Unit to 100 TPD Size	The existing facilities in Japan are rated at 100 TPD per module, so no scale-up is required.	100	
Engineering the Complete System	Geoplasma's partner, Hitachi Metals, has designed and built three facilities using its plasma gasification technology. The submittal contained extensive information on the commercial systems, the technology, pre-processing and power generation subsystems, facility integration concepts, and the roles of the partners for the proposed facility. Lead firm has no development experience but the partner does.	25	
Marketability of Conversion Products	Geoplasma's proposed facility would produce electricity.	100	
Existing Operational Experience	The proposed technology has been used at pilot scale for 6 years, at commercial scale at 24 TPD for 2 years, and at commercial scale at 200 TPD for almost 3 years. One operating demonstration facility.	25	
Economics	The proposed system is very capital intensive and has a very high cost in $/TPY. The larger commercial systems have a much lower than $172/T cost, which would be expected. Net costs are on the high side, but not the highest of all suppliers. Geoplasma provided some details on Attachment 2 but not complete. Values for products and by-products look reasonable.	0	
Landfill Diversion	Since the system operates at very high temperatures, the inorganics are recovered as a vitreous, non-hazardous slag which is marketable. Diversion rate is ~100%.	100	
Supplier Credibility	Geoplasma itself has few resources, but it has put together a very strong technical and development team, including JDI, Inc. (owns shopping malls and re-develops environmentally impaired sites into industrial parks and malls), Hitachi Metals Corp. (process design, process equipment design and supply, facility design and construction oversight), Westinghouse Plasma Corp. (plasma torches), Energy Systems Group LLC (subsidiary of Vectren, to operate facility and provide operating guarantees), SPF Group and UBS (financial), MACTEC (engineering, siting, and permitting) and Georgia Institute of Technology (technological oversight and permitting assistance). This team provides extensive technical and financial resources and credibility. JDI has over 25 years of experience in providing financial guarantees and security arrangements, such as letters of credit and performance bonds.	50	

INTERNATIONAL ENVIRONMENTAL SOLUTIONS

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	IES has conducted numerous tests of its 50 TPD unit with MSW and many other feedstocks, but has no commercial experience.	50	
Need to Scale Conversion Unit to 100 TPD Size	Existing system is operating at 50 TPD. 2X scale-up is required.	66	
Engineering the Complete System	IES has already designed and developed a demonstration facility rated at 50 TPD for testing different feed stock (undergoing its air permitting tests), and has designed and will be constructing a 147 TPD sized unit. It has supplemented its technical resources by partnering with engineering and equipment supply companies. Although they have developed the pre-processing and conversion subsystems, IES itself has not developed a complete facility with power generation. The original submittal lacked some important details, but they were provided in response to a Request for Additional Information. IES provided energy and mass balances, facility layouts, and considerable information on its partners and their services/equipment.	25	
Marketability of Conversion Products	IES's proposed facility would produce electricity.	100	
Existing Operational Experience	IES's demonstration unit has been in operation for a short time testing various feedstock and is undergoing air emission compliance testing.	25	
Economics	Costs are based on development of a 50 TPD pilot unit that has tested only small amounts of MSW and is within acceptable range.	50	
Landfill Diversion	Recovery of metals and glass; carbon char may be able to be used as landfill cover, but would not need to be disposed of in a landfill at a cost. Diversion rate is ~99%.	100	
Supplier Credibility	IES itself is a small, privately held company, but has partnered with other companies such as H. West Equipment (design of conveyors and MRFs), Northern Power Systems (provided feasibility study and designs power plants), DeVere Construction Company (develops and engineers power plant designs), Advanced Energy Strategies (energy project development and regulatory issues), and Manit Systems (automated controls). IES has developed its existing facilities solely with equity capital, although it is still a small company. Once commercial operation of the 50 TPD facility begins in Spring 2005, treating industrial wastes and other feedstocks for its customers, it expects to have an income stream. The EPC contractor will provide overall insurance and performance bonds.	50	

INTERSTATE WASTE TECHNOLOGIES, INC.

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	IWT's Thermoselect technology has significant experience on MSW, with throughputs up to 250,000 TPY.	100	
Need to Scale Conversion Unit to 100 TPD Size	Thermoselect technology modules have a throughput of over 250 TPD, so no scale-up is required.	100	
Engineering the Complete System	The Thermoselect technology has been developed at several full-scale facilities, integrating the conversion technology with power generation (both steam turbine generators and reciprocating engines). IWT's submittal was complete, with extensive information on existing facilities, energy and mass balances for the proposed facility, samples of by-products, and information on their project partners.	100	
Marketability of Conversion Products	IWT 's proposed facility would produce electricity.	100	
Existing Operational Experience	The Thermoselect technology has been in operation in Karlsruhe, Germany for 5 years (recently shut down for economic reasons), in Chiba, Japan for 5 years, and at Mutsu, Japan for 2 years. There are five facilities planned to go into operation in Japan in the 2005-2006 period.	100	
Economics	IWT provided significant detail for the cost information in Attachment 2. Attachment 3 also provided detail on all of the expected by-products and market rates. The units costs are substantiated. The Thermoselect technology is very capital intensive, and netl costs in $/T ($186 ton)are higher than all other pyrolysis and conventional gasification systems. With high capital recovery, interest, and O&M to run the proposed plant, net costs are the highest of all suppliers.	50	
Landfill Diversion	The Thermoselect technology incorporates extensive syngas cleanup and recovery of by-products from the emission control systems and gasifier. Essentially all by-products are marketable or can be marketable. Diversion is ~99%.	100	
Supplier Credibility	IWT has partnered with large, financially sound companies which have implemented large projects worldwide. HDR/Zachry have experience in providing financial guarantees, letters of credit and performance bonds in their work. They would provide a 100 % payment and performance bond for the design and construction of the facility. Montenay Power would provide appropriate guarantees for the O&M of the facility. The team provides significant technical and financial resources.	100	

NTECH ENVIRONMENTAL

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	There are 46 ENTECH systems worldwide, with 10 treating MSW.	100	
Need to Scale Conversion Unit to 100 TPD Size	There are ENTECH systems operating at 67 TPD on MSW. With two modules, the 100 TPD throughput would be satisfied or 2X scale up is required.	66	
Engineering the Complete System	NTech has designed facilities with the ENTECH Renewable Energy System, which incorporates combustion of the syngas in a thermal reactor, followed by recovery of the heat in a boiler and steam production for external use. They have not yet designed a plant which incorporates pre-processing of MSW or power generation. NTech's submittal was complete, with extensive information on the technology and the process, a mass flow diagram, and project descriptions.	50	
Marketability of Conversion Products	NTech's proposed facility would produce electricity.	100	
Existing Operational Experience	There are 46 commercial-scale ENTECH systems in operation. The largest throughput is 67 TPD of MSW. The oldest has been in operation for over 15 years.	100	
Economics	Costs are supported by dozens of existing systems in operation. The capital cost of the system, in $/TPY, is close to the average of all of the pyrolysis and conventional gasification suppliers' costs. Some details were provided in Attachment 2, but information presented in Attachment 3 showed a lack of experience with pre-processing and post-processing for recovery of recyclables.	50	
Landfill Diversion	Recovery of metals and glass from bottom ash creates marketable by-products. Diversion is ~99%.	100	
Supplier Credibility	NTech is represented in the U.S. by Whitten Group International (Whitten), a project management and development company. Whitten holds proprietary intellectual properties and equipment patents. Its clients and partners are international construction developers, gas & oil companies, and local and federal governments. ENTECH as the technology provider would make available a number of bonds and guarantees. Whitten, as the project developer, would incorporate these bonds in the facility construction, through Allianz, its financial partner. Allianz underwrites projects up to $100 million. Together, the team provides extensive technical and financial resources.	100	

PRIMENERGY, LLC/RENEWABLE RESOURCES ALLIANCE, LLC

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Primenergy has extensive experience on gasification of a wide range of biomass feedstocks. In their partnership with RRA, they have tested RRA's refuse-derived fuel, called PRMB, at pilot scale.	50	
Need to Scale Conversion Unit to 100 TPD Size	Primenergy has designed and built facilities using their technology with modules treating 200 TPD. RRA has facilities that handle MSW at several thousand TPD. No scale-up is required.	100	
Engineering the Complete System	Both Primenergy and RRA have extensive resources in their specific areas of expertise. RRA has developed and built large pre-processing facilities. Primenergy has built facilities that incorporate biomass gasification with steam generation and power production. However, they have not yet integrated the three subsystems. The Primenergy/RRA proposal was complete, with mass and energy balances and process flow diagrams.	75	
Marketability of Conversion Products	RRA's proposed facility would produce electricity.	100	
Existing Operational Experience	RRA and its affiliates have been in operation for over 20 years, and make up one of the largest recovery and recycling companies in California. They operate the largest composting facility in the state, rated at 3,600 TPD. They are constructing a PRMB facility rated at 3,600 TPD. Primenergy has 18 gasifiers in operation, with the oldest in operation for over 15 years.	100	
Economics	Primenergy and RRA have proposed a system that has a capital cost, in $/TPY, very close to the average of all of the pyrolysis and gasification technologies. They provided fairly detailed information on Attachments 2 and 3. Capital and O&M costs are based on many operating systems (both Primenergy and RRA). Net costs are in the acceptable range, and are lower than most of the other suppliers.	100	
Landfill Diversion	Extensive pre-processing to produce the PRMB feedstock, plus isolation of bottom ash from fly ash and emission control system by-products to make bottom ash marketable provides for 99% diversion.	100	
Supplier Credibility	RRA and its affiliates hold more than 30 MSW franchises, forming one of the largest waste/recycling companies in California. They have the largest composting facility in California. RRA is capable of obtaining financing for the project. Its affiliate, CR&R has 1,000 employees, and provides much of the design for its facilities in-house. It has developed the PRMB system. Primenergy is a large equipment manufacturer, with 18 gasifiers in operation worldwide. It has in-house technical expertise for design of gasification facilities, including associated material handling, emission control, and power generation equipment. The partnership has extensive technical and financial capabilities. CR&R has raised >$25,000,000 in bond financing from the California Pollution Control Finance Authority and has an available credit line of $105,000,000, which is guaranteed by the underlying municipal waste franchises.	100	

GREEN ENERGY CORPORATION

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Green Energy has experience on gasification of a wide range of carbonaceous material. They tested MSW.	50	
Need to Scale Conversion Unit to 100 TPD Size	Green Energy has designed and built units to process one ton per day and 5 tons per day. They are in the process of building a 15 tons/day unit for a customer to process wood waste	0	
Engineering the Complete System	Green Energy did not put together a complete MSW treatment facility.	0	
Marketability of Conversion Products	Green Energy proposed facility would produce electricity.	100	
Existing Operational Experience	The proposed technology has been used at pilot scale. One and 5 TPD units operated for a year	25	
Economics	Green Energy does not have current commercial facility. Their cost is based on the pilot and test units.	50	
Landfill Diversion	Green Energy Technology described their diversion rate at 90% or more.	100	
Supplier Credibility	Green Energy was incorporated October 14, 2003. A financial statement dated June 30, 2004 is included in their response.	25	

ARROW ECOLOGY AND ENGINEERING OVERSEAS LTD

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Processing MSW	100	
Need to Scale Conversion Unit to 100 TPD Size	Operating since Dec 2002 at 90 tpd	66	
Engineering the Complete System	Are operating a complete facility	100	
Marketability of Conversion Products	Electricity is very marketable; the marketability of compost is questionable	33	
Existing Operational Experience	Commercial unit operating for 2 years	75	
Economics	Cost elements are provided, and backed up in a general sense	50	
Landfill Diversion	79%	33	
Supplier Credibility	Extensive financial and technical resources	100	

BIOENGINEERING RESOURCES, INC (BRI)

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Pilot scale experience with RDF	50	
Need to Scale Conversion Unit to 100 TPD Size	Presently operating at 1.5 tpd, so scaling factor is 67	0	
Engineering the Complete System	Submitted a complete concept, but has not been developed in any detail	0	
Marketability of Conversion Products	Ethanol and electricity are marketable products	66	
Existing Operational Experience	The facility in Fayetteville, AR, can only be described as a pilot plant	0	
Economics	Cost elements are provided and is not reasonable ($0.00/ton), but there isn't any backup to speak of	0	
Landfill Diversion	15% is sent to the landfill	66	
Supplier Credibility	Income statement provided is from 2000.	25	

CANADA COMPOSTING INC.

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Commercial experience with source-separated organics	25	
Need to Scale Conversion Unit to 100 TPD Size	Operating at larger scales	100	
Engineering the Complete System	Are operating complete facilities	100	
Marketability of Conversion Products	Electricity is marketable; the marketability of compost is questionable	33	
Existing Operational Experience	Commercial units operating for 20 years	100	
Economics	Cost elements are provided and not reasonable ($172/ton), and backed up in a general sense	0	
Landfill Diversion	56%	0	
Supplier Credibility	Adequate financial and technical resources	100	

ORGANIC WASTE SYSTEMS (OWS)

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Are processing MRF residuals at commercial scale	100	
Need to Scale Conversion Unit to 100 TPD Size	No scale-up needed	100	
Engineering the Complete System	Have built complete systems that are in commercial operation	100	
Marketability of Conversion Products	Electricity is marketable; the marketability of compost is questionable	33	
Existing Operational Experience	Many commercial facilities, operating for up to 12 years	100	
Economics	Costs supported, not reasonable range ($197/ton) for 100 tons/day. For larger system the cost will be less.	50	
Landfill Diversion	About 60%	33	
Supplier Credibility	Extensive technical resources, adequate financial resources.	75	

WASTE RECOVERY SYSTEMS, INC./VALORGA

Ranking Criterion	Assigned Performance Levels and Justification	Rating	Weight
Waste Suitability	Processing MSW at commercial scale	100	
Need to Scale Conversion Unit to 100 TPD Size	Operating at larger scales	100	
Engineering the Complete System	Are operating complete facilities	100	
Marketability of Conversion Products	Electricity is marketable; the marketability of compost is questionable	33	
Existing Operational Experience	Commercial units operating for 20 years	100	
Economics	Cost elements are provided in the reasonable range, and backed up in a general sense	50	
Landfill Diversion	76%	33	
Supplier Credibility	Extensive financial and technical resources	100	

TABLE A-7
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF) AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

TABLE A-7
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF) AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
South Coast Recycling & Transfer Station	4430 Calle Real Santa Barbara, CA 93110	County of Santa Barbara Transfer Station 123 East Anapamu Street Santa Barbara, CA 93101	NA/ Construction/ demolition Agricultural Mixed municipal Tires	130 East Victoria Street Santa Barbara, CA 93101	Yes	Yes. Do not have space.
Santa Ynez Valley Recycling & Transfer Station	4004 N. Foxen Canyon Road at Landfill Los Olivos, CA 93441	County of Santa Barbara Public Works Solid Waste and Utilities Division 109 East Victoria Street Santa Barbara, CA 93101	NA/ Construction/ demolition Green Material Inert Mixed municipal Tires Wood Waste	130 East Victoria Street Santa Barbara, CA 93101	Yes	Yes. Do not have space.
MarBorg C and D Recycling/Transfer St.	119 North Quarantina Street Santa Barbara, CA 93101	MarBorg Industries Mario A. Morgatello 136 North Quarantina Street Santa Barbara, CA 93103	NA/ Construction/ demolition Agricultural, Ash, Green Materials, Inert, Metals Mixed municipal	136 North Quarantina Street Santa Barbara, CA 93103	Yes	Not Interested.

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Tehachapi Recycling, Inc	416 North Dennison Road Tehachapi, CA 93561	Tehachapi Recycling, Inc. P.O. Box 1750 Tehachapi, CA 93581	MRF/ Construction/ demolition Green Material Industrial Inert Mixed municipal	416 North Dennison Rd Tehachapi, CA 93561	Yes	Not Interested.
Mt. Vernon Metropolitan Recycling Center	2601 South Mt. Vernon Avenue Bakersfield, CA 93307	Kern Refuse Inc. C/O 1501 Truxtun Avenue Bakersfield, CA 93301	MRF/ Construction/ demolition Mixed municipal	City of Bakersfield Solid Waste Department 4101 Truxtun Ave Bakersfield, CA 93309	Yes	Yes. They have space. Too Small.
Gold Coast Recycling Facility	5275 Colt Street Ventura, CA 93003	Gold Coast Recycling Inc. 5275 Colt Street, Suite 2 Ventura, CA 93003	MRF/ Mixed municipal	5275 Colt Street Ventura, CA 93003	Yes	Yes. Do not have a lot of room. Are willing to do what they can.
Del Norte Regional Recycling & Transfer	111 South Del Norte Blvd. Oxnard, CA 93030	BLT Enterprises of Oxnard, Inc. 511 Spectrum Circle Oxnard, CA 93030	MRF/ Agricultural Construction/ demolition Industrial Mixed municipal	111 South Del Norte Blvd. Oxnard, CA 93030	Yes	Yes. Eugene Tseng is the consultant. Space available and very interested.

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Santa Clarita MRF and Transfer Station	Proposed Site 26000 Springbrook Ave Santa Clarita, CA 91350	Burrtec Waste Industries, Inc. Eric Herbert 9890 Cherry Avenue Fontana, CA 92335	MRF/ Mixed municipal	City of Santa Clarita 23920 Valencia Boulevard Suite 300 Santa Clarita, CA 91355	Yes	Yes
Rail Cycle Commerce Materials Recovery Facility	6300 E. 26th Street Commerce, CA 99999	Waste Management Incorporated 18500 Van Karmen Ave., Suite 900 Irvine, CA 92175	MRF/ Construction/ demolition Industrial Mixed municipal	16122 Construction Circle East Irvine, CA 92606		No Response
Coastal Material Recovery Facility	357 W. Compton Blvd. Gardena, CA 90248	Si-Nor Inc. 357 W. Compton Blvd. Gardena, CA 90248	NA/ Construction/ demolition Inert Mixed municipal Tires Wood waste	357 W. Compton Blvd. Gardena, CA 90248		No Response
Angelus Western Paper Fibers, Inc.	2474 Porter Street Los Angeles, CA 90021	Angelus Wester Paper Fibers, Inc. 2474 Porter Street Los Angeles, CA 90021	NA/ Mixed Municipal	2474 Porter Street Los Angeles, CA 90021	Yes	Only Yes on the 1st question. No further information.

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
East Los Angeles Recycling and Transfer	1512 N. Bonnie Beach Place, City Terrace, CA 90063	Permodo/Blt Ent. L.L.C. C/O Cons.Sv., Inc 12949 Telegraph Road Santa Fe Springs, CA 90670	MRF/ Construction/ demolition Mixed municipal	12949 Telegraph Road Santa Fe Springs, CA 90670		No Response
Waste Management South Gate Transfer	4489 Ardine Street South Gate, CA 90280	H.B.J.J. Inc. Subsidiary of USA Waste 4489 Ardine St. South Gate, CA 90280	MRF/ Construction/ demolition Green material Industrial Inert Mixed municipal	321 Francisco St. Carson, CA 90745		No Response
		Si-Nor Inc. DBA: Coastal MRF & TS 357 W. Compton Blvd. Gardena, CA 90247				
Athens Services	14048 E. Valley Blvd. Industry, CA 91746	Athens Services Ron Arakelian Jr. P.O. Box 60009 Industry, CA 91716-0009	MRF/ Industrial Mixed municipal	P.O. Box 60009 Industry, CA 91716-0009		No Response
City Terrace Recycling Transfer Station	1525 Fishburn Avenue Los Angeles, CA 90063	PJB Disposal Company 1525 Fishburn Avenue Los Angeles, CA 90063	MRF/ Industrial Mixed municipal	1525 Fishburn Ave Los Angeles, CA 90063		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Puente Hills Materials Recovery	2800 Workman Mill Road, Whittier, CA 99999	County of Los Angeles Sanitation Dist 1955 Workman Mill Road Whittier, CA 90601	MRF/ Construction/ demolition Industrial Mixed municipal	1955 Workman Mill Rd. Whittier, CA 90601		No Response
Innovated Waste Control	4133 Bandini Blvd Vernon, CA 90023	Innovated Waste Control Inc. 1300 Bristol Street North Suite 100 Newport Beach, CA 92660	MRF/ Mixed municipal	4133 Bandini Blvd Vernon, CA 90023		No Response
Carson Transfer Station & MRF	321 West Francisco Street Carson, CA 90745	U.S.A. Waste Of Ca, Inc. 321 West Francisco Street Carson, CA 90745	NA/ Construction/ demolition Industrial Mixed municipal	321 Francisco St. Carson, CA 90745		No Response
American Waste Transfer	1449 W. Rosecrans Ave. Gardena, CA 90249	Republic Industries 1449 W. Rosecrans Ave Gardena, Ca 90249	NA/ Construction/ demolition Industrial Green Material Inert, Manure Mixed municipal	1449 W. Rosecrans Ave Gardena, CA 90249		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
South Gate Transfer	9530 Garfield Ave. South Gate, CA 90280	Los Angeles County Sanitation District	NA/ Construction/ demolition Green Material Inert Mixed municipal	1955 Workman Mill Rd. Whittier, CA 90601		No Response
Browing-Ferris Ind.	2509 W. Rosecrans Ave. Compton, CA 90220	BFI 2509 W. Rosecrans Ave. Los Angeles, CA 90059	NA/ Construction/ demolition Green Material Industrial Mixed municipal	2509 W. Rosecrans Ave Gardena, CA 90249		No Response
Culver City Transfer & Recycling Station	9255 W. Jefferson Blvd. Culver City, CA 90230	City of Culver City Sanitation Div. Of P.W.D 9770 Culver Blvd. Culver City, CA 90232	NA/ Construction/ demolition Green Material Inert, Tires Mixed municipal	PO Box 507 Culver City, CA 90232		No Response
Downy Area Recycling and Transfer	9770 Washburn Road Downy, CA 90201	Los Angeles County Sanitation Dis. And Downy Area Recycling Transfer Inc. P.O. Box 4998 Whittier, CA 90601	NA/ Construction/ demolition Green Material Industrial Mixed municipal	1955 Workman Mill Rd Whittier, CA 90601		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Paramount Resources	7230 Patterson Lane Paramount, CA 90723	Paramount Recycle Resource 7230 Patterson Lane Paramount, CA 90723	NA/ Construction/ demolition Industrial Mixed municipal	7230 Patterson Lane Paramount, CA 90723		No Response
Southern Cal. Disposal	1908 Frank Street Santa Monica, CA 90404	Southern Cal. Disposal Co. P.O. Box 25666 West Los Angeles, 90025	NA/ Construction/ demolition Green Material Mixed municipal	P.O. Box 25666 West Los Angeles, 90025		No Response
Grand Central Recycling/Transfer	999 Hatcher Ave. Industry, CA 91744	Grand Central Inc. 999 Hatcher Ave Industry, CA 91744	NA/ Construction/ demolition Green Material Inert Mixed municipal	999 Hatcher Ave Industry, CA 91744		No Response
Bel-Art Waste	2501 East 68th Street Long Beach, CA 90805	Republic Industries 1449 Rosecrans Ave Gardena, Ca 90249	NA/ Construction/ demolition Green Material Inert Mixed municipal	1449 W. Rosecrans Ave Gardena, CA 90249		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Community Recycling/Resource Recovery, Inc.	9147 De Garmo Ave. Sun Valley (In Los Angeles), CA 91352	Community Recycling and Resource Recover 9189 De Garmo Ave. Sun Valley, CA 91352	NA/ Construction/ demolition Industrial Mixed municipal	9189 De Garmo Ave. Sunvalley, CA 91352	Yes	Yes. They are very interested.
Central Los Angeles Recycling Center and Transfer Station	2201 Washington Blvd. Los Angeles (City), CA 90034	BLT Waste Systems of North America 2201 East Washington Blvd. Los Angeles, CA 90021	NA/ Construction/ demolition Industrial Mixed municipal	2201 East Washington Blvd. Los Angeles, CA 90021	Yes	Yes. Have 9 acres on Washington Blvd Between Alameda and Santa Fe. M3 Heavy Industrial Full Utilities, Rail Access
Mission Road Recycling and Transfer Station	840 South Mission Road Los Angeles (City), CA 90023	Waste Management Incorporated-Bradley LF & Miss 9081 Tujunga Ave. Sun Valley, CA 91352	NA/ Construction/ demolition Mixed municipal	9081 Tujunga Ave. Sun Valley, CA 91352		No Response
West Valley Materials Recovery Facility	13373 Napa Street Fontana, CA 92335	West Valley Recycling and Transfer 9890 Cherry Avenue Fontana, CA 92335	MRF/ Green Materials Mixed Municipal Wood Waste	9890 Cherry Avenue Fontana, CA 92335	Yes	Yes

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Victor Valley MRF & Transfer Station	NW Corner of Abby Lane & 'b' Street Victorville, CA 92307	Burrtec Waste Industries, Inc. 9890 Cherry Avenue Fontana, CA 92335	MRF/ Mixed Municipal	9890 Cherry Avenue Fontana, CA 92335	Yes	Yes
Advance Disposal Transfer/Processing Facility	17105 Mesa Street Hesperia, CA 92345	Advance Disposal Company P.O. Box 400997 Hesperia, CA 92340	MRF/ Mixed municipal	P.O. Box 400997 Hesperia, CA 92340		No Response
Inland Regional MRF & Transfer Station	2059 East Steel Road Colton, CA 92324	Taormina Industries, LLC 1131 N. Blue Gum Street P.O. Box 309 Anaheim, CA 92806	MRF/ Construction/ demolition Green materials Industrial Mixed municipal Wood waste	1131 N. Blue Gum Street P.O. Box 309 Anaheim, CA 92806		No Response
Twentynine Palm Transfer Station	7501 Pinto Mountain Road Twentynine Palms, CA 92277	County of San Bernardino Solid Waste Mgt Div. Art Rivera Solid Waste Div. 222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415-0017	NA/ Construction/ demolition Industrial Mixed municipal Tires	222 West Hospitality Lane 2nd Floor San Bernardino, CA 92415-0017		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Big Bear Transfer Station	Holcomb Valley Road 1.5 Miles N of HWY 18 Big Bear City, CA 92314	County of San Bernardino Solid Waste Mgt Div. Art Rivera Solid Waste Div. 222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415	NA/ Construction/ demolition Dead Animals Green Material Mixed municipal	222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415-0017		No Response
Heap Peak Transfer Station	N Side of HWY 18; 3 Miles West of Running Springs Lake Arrowhead, CA 92407	County of San Bernardino Solid Waste Mgt Div. Art Rivera Solid Waste Div. 222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415	NA/ Mixed municipal	222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415-0017		No Response
Sheep Creek Transfer Station	10130 Buckwheat Road Phelan, CA 92371	County of San Bernardino Solid Waste Mgt Div. Art Rivera Solid Waste Div. 222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415	NA/ Mixed municipal	222 West Hospitality Lane, 2nd Floor San Bernardino, CA 92415-0017		No Response
Stanton Transfer and Recycling Center # 8	11232 Knott Ave. Stanton, CA 90680	CR Transfer Inc. 11292 Western Avenue Stanton, CA 90680	MRF/ Mixed municipal	11292 Western Avenue Stanton, CA 90680		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Rainbow Recycling/Transfer Station	17121 Nichols Ave. Huntington Beach, CA 92647	Rainbow Transfer/Recycling Inc. 17121 Nichols Ave. Huntington Beach, CA 92647	NA/ Construction/ demolition Industrial Mixed municipal Wood Waste	PO Box 1026 Huntington Beach, CA 92647		No Response
Consolidated Volume Transporters	1131 N. Blue Gum Street Anaheim, CA 92806	Taormina Industries, LLC 1131 N. Blue Gum Street P.O. Box 309 Anaheim, CA 92806	NA/ Industrial Mixed municipal Tires	1131 N. Blue Gum Street P.O. Box 309 Anaheim, CA 92806		No Response
Sunset Envir Inc. Transfer Station/Resource Recovery Facility	16122 Construction Circle East Irvine, CA 92606	Sunset Environmental 16122 Construction Circle East Irvine, CA 92606	NA/ Construction/ demolition Industrial Mixed municipal	16122 Construction Circle East Irvine, CA 92606		No Response
Waste Management of Orange/Transfer Station	2050 N. Glassell Street Orange, CA 92865	USA Waste of California, Inc. 2050 N. Glassell Street Orange, CA 92865	NA/ Construction/ demolition Mixed municipal	1800 S. Grand Santa Ana, CA 92705		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Moreno Valley Solid Waste Recycle & Transfer Facility	17700 Indian Street Moreno Valley, CA 92551	Waste Management of the Desert 41575 Eclectic Street Palm Desert, CA 92260	NA/ Construction/ demolition Green Material Metals Inert Mixed municipal	41575 Eclectic Street Palm Desert, CA 92260		No Response
Idyllwild Collection Station	28100 Saunders Meadow Road Idyllwild, CA 92549	County of Riverside Waste Management Department 14310 Frederick Street Moreno Valley, CA 92553	NA/ Ash Green Material Mixed municipal	14310 Frederick Street Moreno Valley, CA 92553		No Response
Robert A Nelson (RANT) Transfer Station & MRF	1830 Agua Mansa Rd Rubidoux, CA 92509	Agua Mansa MRF, LLC 9890 Cherry Avenue Fontana, CA 92335	MRF/ Mixed municipal	9890 Cherry Avenue Fontana, CA 92335	Yes	Yes. They have 5 acres of land beside the facility.
Perris Transfer Station and MRF	1706 Goetz Road Perris, CA 92570	CR&R Incorporated 11292 Western Avenue Stanton, CA 90680	MRF/ Mixed municipal	1706 Goetz Road Perris, CA 92570	Yes	Yes. They have 27 acres adjacent to their property.
Escondido Resource Recovery	1044 W. Washington Avenue Escondido, CA 92033	Jemco Equipment Corporation P.O. Box 1187 Ramona, CA 92065	MRF/ Construction/ demolition Green materials Mixed municipal	1044 W. Washington Avenue Escondido, CA 92033		No Response

TABLE A-7 (CONTINUED)
LONG LIST OF MATERIAL RECOVERY FACILITIES (MRF)
AND LARGE TRANSFER STATIONS (TS) OF SOUTHERN CALIFORNIA

Name	Address	Operator/Business Owner	Operational/Waste Type	Mailing Address	Recycling Market Development Zone	Interest in Conversion Technology
Ramona MRF And Transfer Station	324 Maple Street Ramona, CA 92065	Ramona Disposal Service P.O. Box 1187, 324 Maple Street Ramona, CA 92065	MRF/ Construction/ demolition Green materials Mixed municipal	P.O. Box 1187 Ramona, CA 92065		No Response
Fallbrook Recycling Facility	550 W. Aviation Road Fallbrook, CA 92028	Fallbrook Refuse Service 550 W. Aviation Road, Fallbrook, CA 92028	MRF/ Construction/ demolition Mixed municipal	550 W. Aviation Road, Fallbrook, CA 92028		No Response
Edco Station	8152 Commercial Street La Mesa, CA 91942	Edco Disposal Corporation 6670 Federal Blvd Lemon Grove, CA 91945	MRF/ Construction/ Demolition Green materials Industrial Mixed municipal	6750 Federal Blvd. Lemon Grove, CA 91945	Yes	Yes
Valley Environmental Services Recycling	702 East Heil Avenue El Centro, CA 92243	Valley Environmental Services 3354 Dogwood Road Imperial, CA 92251	MRF/ Mixed municipal from the curb recycling with high percentage of residue	3354 Dogwood Rd Imperial, CA 92251	Yes	Yes. Possibly space availability depending on the need.

LOS ANGELES COUNTY INTRODUCTORY LETTER TO THE MRFs/TSs

LOS ANGELES COUNTY
SOLID WASTE MANAGEMENT COMMITTEE/
INTEGRATED WASTE MANAGEMENT TASK FORCE
900 SOUTH FREMONT AVENUE, ALHAMBRA, CALIFORNIA 91803-1331
P.O. BOX 1460, ALHAMBRA, CALIFORNIA 91802-1460
www.lacountyiswmtf.org

DONALD L. WOLFE
CHAIRMAN

REQUEST FOR INTEREST
SOLID WASTE MANAGEMENT ALTERNATIVE TECHNOLOGY PROJECTS
SOUTHERN CALIFORNIA REGION

The Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force (Task Force) in concert with the County of Los Angeles is currently researching and promoting the development of conversion technologies as alternatives to traditional solid waste disposal methods. As a part of these efforts, we have an opportunity to partner with solid waste management facilities in order to develop and test these state-of-the-art solid waste management technologies. We are excited about the potential of these technologies to significantly increase the amount of solid waste diverted from disposal and create marketable and valuable products and fuels.

Our aim is to develop a demonstration facility in Southern California that utilizes new technology(ies) to manage solid waste, testing the feasibility of such facilities and gaining real data on their operation in California. This may well be the first facility of its kind in Southern California and the operation of the facility will be widely publicized well beyond California and the Nation.

The Task Force, and more specifically its Alternative Technology Advisory Subcommittee (Subcommittee), represents a diverse array of public and private entities committed to exploring conversion technologies as a potentially viable solid waste management alternative. Members of the Subcommittee include representatives from the Task Force, the County of Los Angeles, the City of Los Angeles, the County Sanitation Districts of Los Angeles County, private consultants, and members of the public. Each member has interest, knowledge, and experience in the field of conversion technologies and all have committed their resources to help make this endeavor a success.

We are contacting operators of solid waste management facilities, especially Materials Recovery Facilities, as to their interest to partner with the Task Force in development of a demonstration conversion technology facility. **It is requested that you fill out and return the enclosed postage-paid postcard in order to convey your interest to us**. The postcards are being compiled by URS Corporation under contract with the County of Los Angeles Department of Public Works, and a representative from URS will be in touch with you soon to follow up on this letter. Please note that we will assume you are not interested in participating if we do not hear back from you by September 30, 2004.

We want to emphasize that facility operators interested in a partnership can look forward to the support of the County of Los Angeles, the Sanitation Districts of Los Angeles County, the Task Force, and other representative members. This includes technical and material support as well as assurances of confidentiality. The Subcommittee's representative members are determined to pursue the development of a facility in the next few years. We look forward to your positive response and working together in achieving this endeavor.

Should you have any questions regarding this matter, please contact Mr. Shapoor Hamid of URS Corporation at (213) 996-2200, who is coordinating our data collection and research efforts under contract with the County, or you may contact Ms. Shari Afshari of the County of Los Angeles Department of Public Works at (626) 458-3500, if you would like information regarding the County's efforts to promote Conversion Technology.

Very truly yours,

Michael Miller, Vice-Chair
Los Angeles County Solid Waste Management Committee/
Integrated Waste Management Task Force and
Mayor, City of West Covina

CS:my
Letter2MRFs

Enc.

cc: Each Member of the Los Angeles County Board of Supervisors
Each Member of the County Sanitation Districts Board of Directors
Chief Engineer & General Manager of the County Sanitation Districts
Each Member of the County of Los Angeles Regional Planning Commission
Interim Director of the County of Los Angeles Department of Public Works
Each Member of the Los Angeles County Integrated Waste Management Task Force
Each Member of the Alternative Technology Advisory Subcommittee

SAMPLE OF URS' LETTERS SENT TO THE MRFs/TSs

November 2, 2004

MRF Address

Re: MRF/TS

Dear Sir/Mam:
The County of Los Angeles Department of Public Works (CLADPW) Integrated Waste Management Task Force has engaged URS Corporation to perform a conversion technology study and to facilitate the development of a conversion facility in Southern California. This study will exclusively prioritize residue from a Material Recovery Facility (MRF) and Transfer Station (TS) as the feedstock for a potential conversion facility. A Los Angeles County letter introducing URS as the contractor for this job and County's purpose for this project was sent to the Southern California MRF/TS on September 30, 2004.

The County letter also included a postcard with questions regarding willingness to partner with a conversion technology supplier and space availability. Your initial positive response prompted URS to pursue this issue further and to start evaluation of your facility for this purpose. To this end, URS will need your assistance in providing some basic data regarding your facility and the residues that are currently disposed of in a landfill. The following information will help to expedite MRFs/TSs evaluation process:

- The daily tonnage of the MSW delivered to the facility
- Types of waste (single family residential, apartment buildings, commercial or industrial)
- Is MSW going through any type of separation before coming to the facility?
- Daily tonnage of the MRF/TS residue disposed of in a landfill
- Composition (existing data) of the MRF/TS residue going to the landfill
- Space available adjacent to the facility, zoning and transportation access
- Pretreatment capability and availability of utilities (electricity, water sewage).

Also, URS representatives would like to visit your facility. The above-mentioned information can be given to URS during our visit. Please provide us the name and phone number of a contact person with dates and times that are convenient for this visit.

We appreciate your assistance and if you have any questions, please do not hesitate to call me.

Best Regards,

Shapoor Hamid, PhD, REA
Senior Scientist/Project Manager
Email: shapoor_hamid@urscorp.com

Conversion Technologies Evaluation Services Project
Questionnaire for Conversion Technology Suppliers
January 2005

INTRODUCTION

Municipal Solid Waste (MSW) collected from residences and businesses in the County of Los Angeles (the County) is presently going to Material Recovery Facilities (MRFs) or Transfer Stations (TSs). After separation of some recyclable items, the residues left behind are disposed of in a landfill or incinerator. The goal of the County of Los Angeles Department of Public Works, Integrated Waste Management Task Force, is to divert some of the MRFs/TSs residues from traditional disposal.

The County has contracted with URS Corporation (URS) to evaluate a range of thermal, biological and chemical "conversion technologies" to treat the MRF/TS residues, create useful byproducts, and reduce the amount of MRF/TS residues going to the landfills. Also, URS is evaluating MRFs/TSs in Southern California for their willingness and ability to partner with a conversion technology supplier and to determine if they have adequate space and appropriate feedstock to develop a successful MSW conversion facility.

The County's goal is to select a supplier to develop a demonstration facility to treat the MRF/TS residues and produce usable products and by-products such as fuel, electricity, chemicals, and/or compost. This demonstration facility will be located adjacent to a MRF/TS in Southern California and will serve as a showcase for using MSW conversion technologies in the United States.

The purpose of this questionnaire is to obtain information about currently available technologies and to address specific technical and financial issues regarding these technologies and suppliers. Once responses from the questionnaire are evaluated, the County may select one or more suppliers with which to negotiate a contract for conversion technology facility development, or it may issue a Request for Qualification to a limited audience for development of the facility.

TECHNOLOGY/SUPPLIER REQUIREMENTS

The following requirements were established for evaluating suppliers and their technologies. The supplier and its technology must comply with all of these requirements to be considered further in this process.

1. **Waste Diversion Rate.** The supplier's technology must be able to reduce the amount of MRF/TS residuals going to the landfill by at least 50%.

2. **Demonstrated Processing Experience.** The supplier must have developed at least a pilot scale facility, designed to process MSW or similar feedstock at a rate of approximately 5 short tons/day, and that has operated for at least one year. During any one-year period, it must have processed at least 1,000 short tons of MSW (composition of the MSW close to that of post recycled MRF residual) or similar feedstock. Note: sewage sludge, black liquor solids, chemicals, plastics or tires are not considered a "similar feedstock".

3. **Conversion to Useful Products and By-products.** The supplier's technology must show capability to produce marketable products and by-products.

4. **Environmental Compliance.** The supplier's technology must comply with all regulatory requirements in the state of California (i.e., air emissions).

5. **Responsiveness.** Supplier must reply to URS requests for data within a timely manner (i.e. within the timeframe noted in this questionnaire).

6. **Ability to Partner with a MRF/TS**. Supplier must be willing and able to create a partnership with a MRF/TS in Southern California.

7. **Facility Size.** Supplier must exhibit the capability to develop a demonstration facility that will process approximately 100 short tons/day of MRF residuals.

RESPONSE PREPARATION

Respondents are solely responsible for the costs of responding to this questionnaire. All responses and the contents therein, will become the property of the County of Los Angeles Department of Public Works Integrated Waste Management Task Force and may be released to the public.

COMMITMENT

Response to this questionnaire does not commit the County of Los Angeles Department of Public Works, its Integrated Solid Waste Management Task Force or URS Corporation as their consultant to issue any subsequent Request for Qualification (RFQ) or Request for Proposal (RFP).

SUBMITTAL

All responses received by the county should include complete responses to each question contained in this questionnaire, regardless of previous responses or submittals to the County or to URS on other projects. Five hard copies of the response, and a CD or emailed copy, should be sent to the address provided in the contact section of this questionnaire.

SCHEDULE

The time frame for response to this questionnaire begins on January 13, 2005 with distribution of the questionnaire. The response must be received by 5:00 PM (Pacific Standard Time), February 14, 2005.

CONTACT

All inquiries regarding this questionnaire and submittal of the response should be directed to:

Mr. Shapoor Hamid, PhD, REA
URS Corporation
915 Wilshire Blvd., Suite 700
Los Angeles, CA 90017
shapoor_hamid@urscorp.com
Phone: (213) 996-2200
Fax: (213) 996-2290

Please provide complete answers to the following:

Question #1:

Name of Firm
Name of Technology
Principal Contact Person
Address
Telephone/Fax
E-mail

Question #2:

Please provide information about your firm and your technology. This can be available information in brochure format. Include firm history, location(s), accomplishments, personnel resources and ownership structure. Also, in order to show financial credibility to implement the project from development to operation, please provide an Annual Report for the most recent fiscal year (include parent corporation, if applicable).

Question #3:

Please provide the following information for up to three existing reference facilities.

- Name and location
- Owner/Operator
- Technology
- Feedstock
- Start-up date
- Capital cost
- Annual operation and maintenance cost
- Throughput (short tons/day and short tons/year)
- Area of facility, acres
- Types/quantities of products and by-products (for electricity, list gross and net kW)

- Amount of residuals sent to landfill
- Photos of the facility
- Air and water emissions
- Status of the facility, i.e. in operation, shut down

Question #4

For the facility the supplier is proposing for the County, describe the technology, including pre-processing systems, conversion unit, and product processing (e.g. electricity generation) appropriate for the type MRF residuals described in Attachment 1. List the number of processing lines and/or modules and the capacity of each in tons/day and tons/year. Describe the evolution of your technology with regard to timing and throughput capacity, including current commercial status.

Question #5:

For the facility the supplier is proposing for the County, discuss characteristics and composition of the anticipated products and byproducts. If available, provide analytical data for the end products and by-products. Also, provide assumptions used in estimates of selling prices of products and by-products, and describe your marketing experience with these products and by-products, particularly in California.

Question #6:

Briefly discuss the environmental impacts from your existing facilities, or issues that require permits. Include, as appropriate, air emissions, water emissions, solid waste residues, visual impacts, nuisances, and odor impacts. Also, where applicable, include a description of the syngas/biogas cleaning and air emission control systems, such as wet and dry scrubbers, cyclones, baghouses, activated carbon injection, etc., as well as other products and by-products processing proposed.

Question #7:

For the facility the supplier is proposing for the County, please provide a description of the feedstock requirements (i.e. size, moisture content, etc.) of your conversion unit, and indicate how your system would deal with the variability of MRF/TS residuals.

Question #8

For the facility the supplier is proposing for the County, please provide a site layout drawing showing area requirements and an equipment/building general arrangement.

Question #9

For the facility the supplier is proposing for the County, please provide information on the utility requirements (e.g. natural gas, fuel oil, water, electricity, and sewer), and staffing requirements.

Question #10:

For the facility the supplier is proposing for the County, please describe the composition, quality, and quantity of the hazardous and non-hazardous wastes generated by your system and whether they would have to be disposed of in a hazardous or regular landfill.

Question #11:

For the facility the supplier is proposing for the County, summarize the facility characteristics in a mass balance diagram that shows material delivered, recycled, disposed, and products generated/processed, on both a daily and annual basis. For electricity generation, list gross and net kW.

Question #12:

For the facility the supplier is proposing for the County, please provide information on the capital cost, operation and maintenance costs, and revenues generated. This information should be included in Attachments 2 and 3. Use the following assumptions:

- Exclude land cost
- Buildings and site improvements are amortized at an annual interest rate of 6% over 20 years
- All equipment is amortized at 6% over 7 years
- Hauling and disposal cost of the final solid residue is $50 per ton
- Power will be provided to the facility at $60 per Megawatt-hour
- Operating and maintenance costs should be escalated at 3% per year

Question #13:

Describe your ability/experience in providing financial guarantees and security arrangements, such as letters of credit or performance bonds.

Question #14:

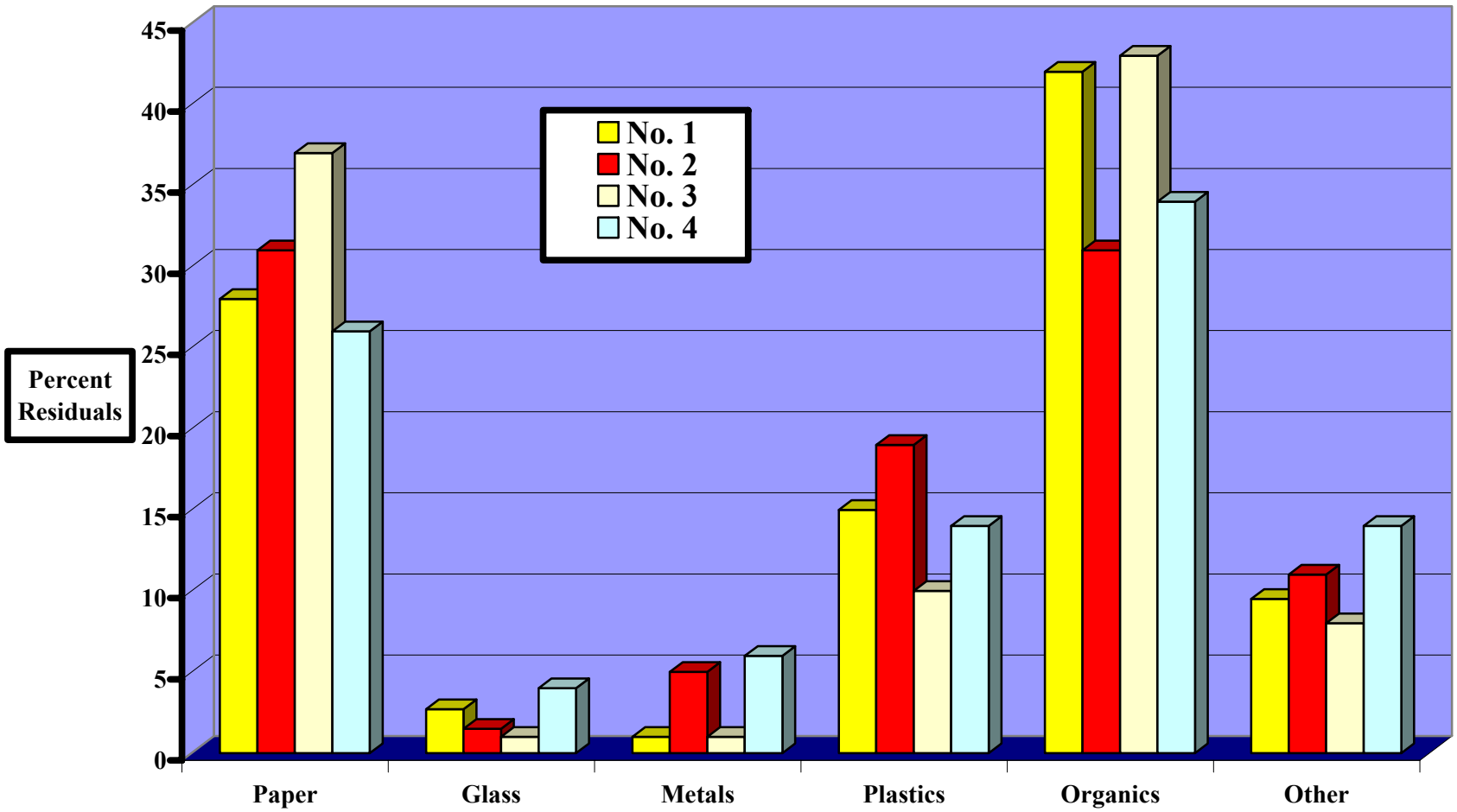
For the facility the supplier is proposing for the County, please provide a summary of the key advantages offered by your technology processing MRF/TS residues for the Southern California area. Compare those advantages with the key challenges you will encounter.

Responses must utilize the following customary U.S. units:

Parameter	Required Unit	Metric Equivalent
Area of Facility	Acres	1 acre = 0.4047 hectare
Length, size	Inches or feet	1 inch = 2.54 cm; 1 foot = 0.304 meter
Temperature	°F	Temperature in °F = (1.8 x (temp. in °C) + 32
Pressure	psi	1 psi = 6.895 kPa
MSW Heating Value	Btu/lb, LHV basis (LHV = lower heating value)	1 Btu = 1055 J = 252 cal; 1 lb = 1 pound = 0.454 kg; 1 kJ/kg x 0.43 = 1 Btu/lb
Syngas or biogas Heating Value	Btu/scf, LHV basis (LHV = lower heating value)	scf = standard cubic foot = 28.32 liter = 0.02832 m^3 (STP); 1 kJ/m^3 x 0.0268 = 1 Btu/scf
Syngas or biogas flow	scfh	scfm = scf per hour
Density	lb/ft^3	1 ft^3 = 28.32 liter
Weight	Pounds or short tons (2000 lbs. = 1 short ton)	1 short ton = 907 kg
Volume, liquids	U.S. gallons	1 US gallon = 3.7854 liter
Volume, gases	ft^3	1 ft^3 = 28.32 liter = 0.02832 m^3
Electric power	MW or kW	
Costs	$ U.S.	
Particle size	inches	1 inch = 2.54 cm

<u>Attachments:</u>
Attachment 1 – Examples of MRF Residue Composition
Attachment 2 – Cost Form
Attachment 3 – Revenue Form

Attachment 1. Examples of MRFs Residual Composition



ATTACHMENT 2

COST FORM (US$)

I. Capital Cost

- Building and site improvements $_____
- Equipment $_____
- Office equipment $_____
- Other (Specify) $_____

Total Capital Cost $_____

Total Annualized Capital Cost $_____

II. Annual Operation & Maintenance Costs:

- Operational labor and fringes $_____
- Other direct operational expenses $_____
  - Hauling and disposal of final solid residue
  - Hauling and disposal of other material
  - Equipment fuel
  - Property & liability insurance
  - Operating supplies and chemicals
  - Utilities (water, electricity, natural gas, fuel oil, etc.)
  - Other
- Direct Maintenance $_____
  - Parts and equipment
  - Shop supplies
  - Other
- General and Administrative and fringes $_____
- Miscellaneous General & Administrative $_____
  - Building Maintenance
  - Communications
  - Printing
  - Supplies
  - Legal
  - Travel
  - Public relations
  - Other

***Total Annual Operation & Maintenance Costs* $_____**

***Total Annual Costs (Capital + O&M)* $_____**

ATTACHMENT 3

Revenue Form

Material Type	**Quantity Recovered (solids: tons/year; liquids: gallons/year; Electricity: MWh/year)**	**X Unit Value* (US$/ton for solids and US$/gallon for liquids)**	**Total Annual Revenue (US$)**
Ferrous Metals			
Non-Ferrous Metals			
Carbon Char			
Bottom ash or Slag			
Activated Carbon			
Electricity		$0.045/kWhr	
Syngas			
Biogas			
Ethanol			
Biodiesel			
Compost			
Fertilizer			
Methanol			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
Others Specify			
TOTAL REVENUE			

***** freight-on-board at MSW conversion facility

Los Angeles County Solid Waste Management Committee / Integrated Waste Management Task Force

ALTERNATIVE TECHNOLOGY ADVISORY SUBCOMMITTEE

Conversion Technologies Evaluation Services Project
Amendments to Questionnaire for Conversion Technology Suppliers
January 2005

The Los Angeles County Solid Waste Management Committee/Integrated Waste Management Task Force/Alternative Technology Advisory Subcommittee at its January 21, 2005 meeting decided to amend the questionnaire that was sent to the conversion technology suppliers on January 13, 2005, in order to encourage more potential technology vendors to respond to the questionnaire. The amendments are related to **Technology Suppliers Requirement** section and **Schedule** and are as follows:

Amendment No. 1

Item No.2 "Demonstrated Processing Experience" should read: The Los Angeles County prefers a technology supplier that developed at least a pilot scale facility, designed to process MSW or similar feedstock at a rate of approximately 5 short tons / day, and that has operated for about one year. During this period, it should have processed an MSW feedstock (composition of the MSW close to that of post recycled MRF residual) or similar feedstock. Note: sewage sludge, black liquor solids, chemicals, plastics or tires are not considered a "similar feedstock".

Amendment No. 2

Item No.4 " Environmental Compliance" should read: The supplier must demonstrate that the technology is capable of complying with all applicable regulatory requirements for an existing unit (e.g., air emissions).

Amendment No. 3

Schedule: The response must be received by 5:00 PM (Pacific Standard Time), February 28, 2005.