

CLEVELAND MUNICIPAL SOLID WASTE TO ENERGY

Comprehensive Overview

Cleveland's Energy Future



August 23, 2010



Department of Public Service

**Division of Waste Collection
and Disposal**

Cleveland **PP** PublicPower
Count on it

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1. All About MSWE

- Since the Spring of 2007, CPP has encouraged the reuse of MSW as a valuable resource that may be processed, recycled and sold
- This resource will take careful planning and investment to extract but the end result is new jobs, tax revenues, an environmentally friendly alternative energy source, and increased control of

Cleveland's energy future

All About MSWE

MSWE in Cleveland brings a transformation of the process of waste collection, waste recycling and waste reuse.

Cleveland's greatest take away from the MSWE Project is beyond renewable energy and recycling. Our greatest benefit from the MSWE project is sustained economic development and job creation.



All About MSWE

A new way to think about MSW

- Waste to Energy in Cleveland would not start at the landfill, the transfer station, or even at the curbside for waste pickup
- The process would start in the home as the resident is required to take steps to sort MSW as recyclable and non-recyclable materials

City-wide Recycling

- Societal change/ community-wide behavioral change
- New rules that would define and identify targeted recyclables
- Provide two carts, one for comingled recycled waste

All About MSWE

The outcome of the Kinsei gasification process is syngas. Syngas is combustible and can be used as a fuel much like natural gas.

Three primary types of thermal gasification:

- Conventional gasification
- Plasma gasification
- Pyrolysis gasification

All About MSWE

- Cleveland's MSW to Energy Facility will use thermal gasification rather than incineration.
- **Incineration vs. Thermal Gasification**
 - Incineration of MSW is through combustion of organic materials in an oxygen rich environment that produces complex hazardous oxides in the process
 - Thermal gasification of MSW is through high temperature chemical conversion of organic materials into synthetic gas (composed primarily of H₂ and CO) in a controlled oxygen and heat environment.
 - Thermal gasification breaks down hazardous organic substances such as dioxins and furans

St. Lucie County Plasma Gasification

Plain Dealer – August 2, 2007

Harnessing the power of trash

A plasma torch gasification device will be built in St. Lucie County in Florida. When fully operational, it will turn 3,000 tons of trash into electricity every day. It is expected to open in 2010, and initially will process 1,000 tons of waste a day. The plant should be fully operational by 2013.

1 Trash

Trash is fed into the gasification chamber.

2 Gasification chamber

Trash is mixed with oxygen, then vaporized by a 10,000-degree plasma arc flame. Gaseous exhaust and inert solid waste result.

Plasma torch

The arcs produce an electric plasma flame that is hotter than the surface of the sun.

SOURCE: GeoPlasma of Atlanta

Heat exchangers

Particle filter

3 Exhaust gasses

Exhaust gasses are cleaned and combined to create a combustible gas used to power steam turbines to generate electricity.

Oxygen duct

40 megawatts

4 Waste

Inert pellets used for road paving.

5 Steam-powered turbines

The steam-powered turbines will produce 160 megawatts of electricity a day, of which 120 megawatts will be sold for the electrical power grid. The 120 megawatts can power 75,000 homes each day. The other 40 megawatts are used to run the plant.

Steam-powered turbine generators

Electric grid

120 megawatts

The plant site

The first plasma torch gasification plant in the United States is scheduled to begin operation in 2010 in Florida.



JAMES OWENS | THE PLAIN DEALER

Waste to Energy **Anaerobic Digestion**

See the best pictures of the week from the Plain Dealer photography staff at cleveland.com/pdmultimedia

METRO

SUNDAY, NOVEMBER 23, 2008 | SECTION B

THE PLAIN DEALER

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Akron turns waste into watts

Methane-fueled sewage plant is a first

ELLEN JAN KLEINERMAN
Plain Dealer Reporter

It's basic biology. Tiny bacteria at the sewage plant eat organic waste and emit methane gas. The gas is captured and converted to electricity. The electric-

ity is used to power the sewage plant.

Akron put a system like this online last December to process one-third of the sludge going through its wastewater treatment plant and is finding success: The city is saving about 15

percent on its electricity bill.

Akron's methane-powered sewage plant is the only system of its kind in the United States. But other cities, including Solon and Canton, now are looking to follow Akron's lead.

Use of this biological process

to create energy from waste should gain momentum within the next five to 10 years, predicted Jim Currie of Ohio State University. That's because conventional ways of disposing of waste are becoming too expensive and our appetite for new fuel sources is increasing, said Currie, program director of Bio-Hio at OSU's Agricultural Re-

search and Development Center in Wooster. "The hurdle is showing people how well the system works," Currie said.

Ohio's abundance of farms, ethanol companies, and food and beverage processing plants like Anheuser-Busch make it a prime spot in which to root this technology, Currie said.

SEE METHANE | B7

Waste to Energy Anaerobic Digestion

Turning waste into energy

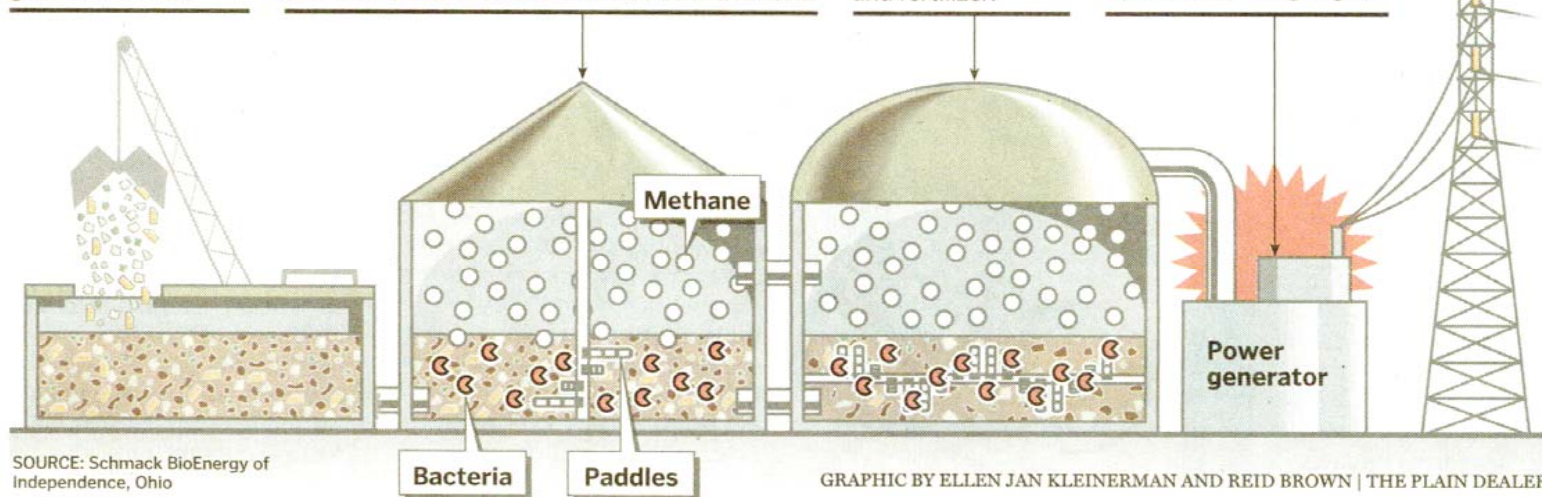
Producing energy, like electricity, auto fuel or natural gas, from organic waste is an old concept gaining new attention. The process called anaerobic digestion involves bacteria that do not need oxygen to survive. The closed processing tanks mean no smell on the outside. The bacteria eat the waste and give off methane, which is converted to usable energy. Akron opened its \$7 million biogas plant last year and is planning expansions. Schmack BioEnergy, which built the Akron plant, soon will break ground on plants in Columbus and Zanesville.

1 In addition to sewage, food waste, farm waste and distillers' grains left over from the brewing of beer can go into the mix.

2 The slurry is moved to a digester tank, where bacteria are introduced into the process. The bacteria eat the waste and produce biogas, which primarily consists of methane. Mechanical mixing paddles and heat exchangers ensure the correct distribution of food and a stable environment.

3 Fermentation is finished in a second tank. Leftover solids are dehydrated and can be used as compost and fertilizer.

4 The biogas can be used to fuel a power generator or boiler or can be upgraded to meet natural gas quality standards and then injected into the gas grid.



SOURCE: Schmack BioEnergy of Independence, Ohio

GRAPHIC BY ELLEN JAN KLEINERMAN AND REID BROWN | THE PLAIN DEALER

Waste to Energy Incineration

THE WALL STREET JOURNAL.

Saturday/Sunday, December 6 - 7, 2008

U. S. NEWS

Cities Give Waste-to-Energy Plants a Second Look

Higher U.S. Landfill Costs and Uncertain Oil Prices Drive an Expansion of Existing Trash Incinerators, Plans for New Ones

BY ILAN BRAT

Turning refuse into energy, first seen as a kind of environmental alchemy, fell out of favor in the 1990s as protests mounted against trash-burning plants.

But spurred by growing landfill costs and demand for energy, local governments have been spending hundreds of millions of dollars expanding existing waste-to-energy plants, and proposing new ones.

Of the 87 U.S. incinerators that currently convert trash into electricity, one in Florida completed a \$120 million project to expand by 50% last year. Another expansion in the Sunshine State and two others in Pennsylvania and Minnesota are in the works.

Most incinerators feed garbage into a chamber, where natural gas is used to set it afire. The heat creates steam that turns a turbine to produce electricity. The burned trash shrinks to a tenth in volume, leaving ash.



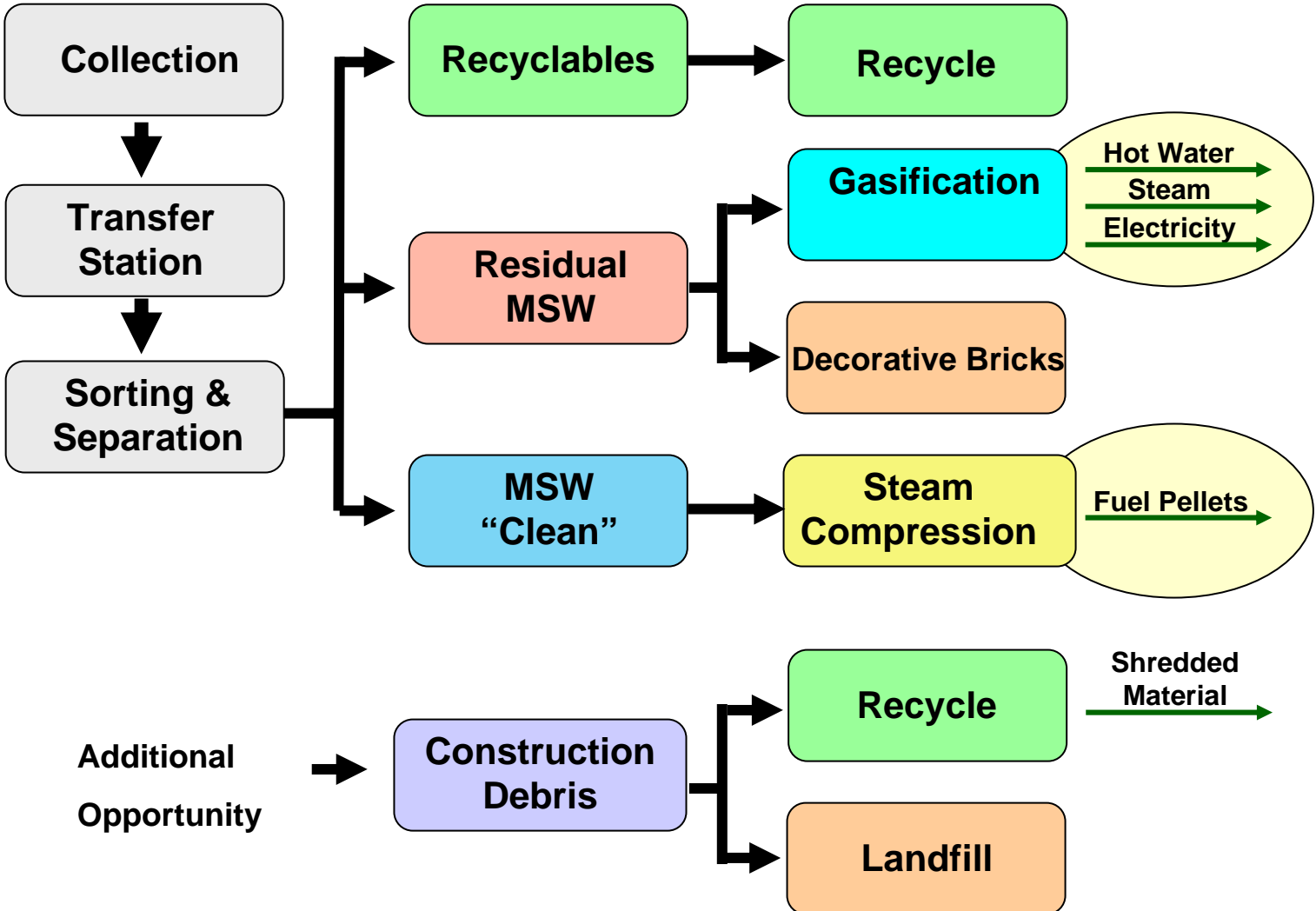
Andrew Testa/Press for The Wall Street Journal

Garbage is fed into furnaces after being dropped at a loading bay at a Covanta plant in Westbury, N.Y. New incinerators are being considered in Maryland, California and Florida.

Ridge Road Transfer Station

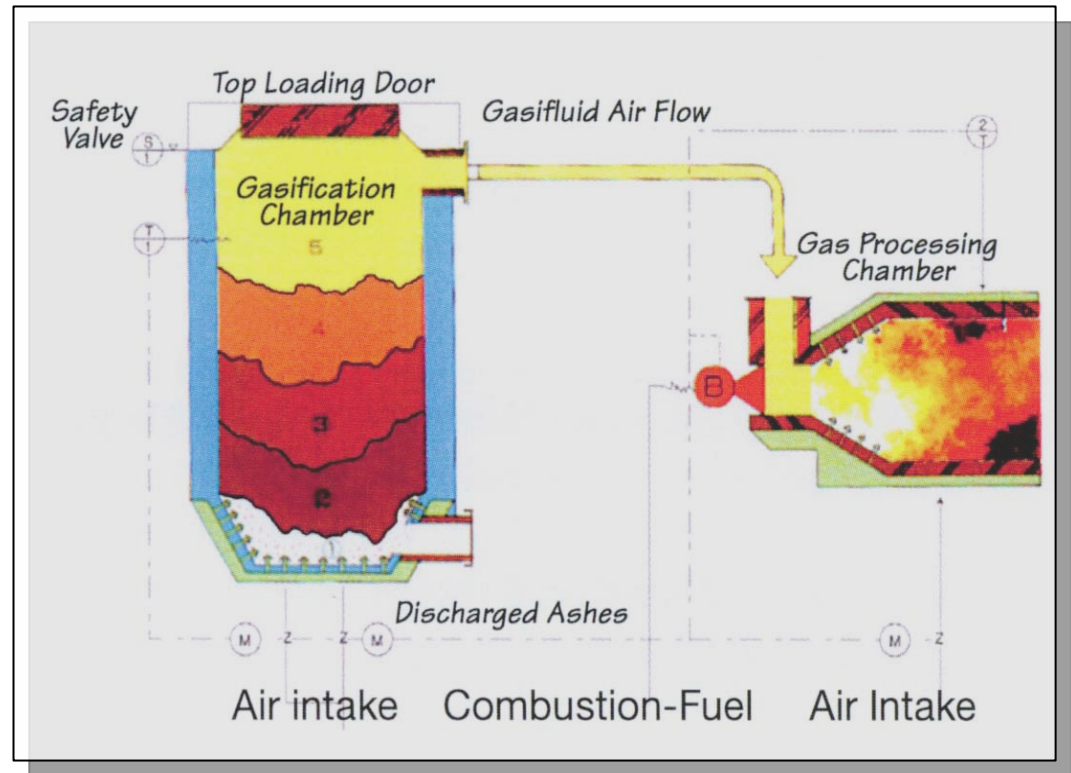
- **Suitability of the Ridge Road Transfer Station for MSWE:**
 - Roadway pavement near the Ridge Road Transfer Station is generally in good condition and not in need of rehabilitation;
 - Based on preliminary information, there will be minimal visual impacts by the Facility to the surrounding communities;
 - There are no sensitive receptors (schools, churches, hospitals) in the areas immediately adjacent (within ½ mile) to proposed Facility;
 - Existing traffic flow within the Ridge Road Transfer Station works well;
 - All existing turning radii within the Ridge Road Transfer Station are sufficient;

Cleveland's Approach and Facility Design



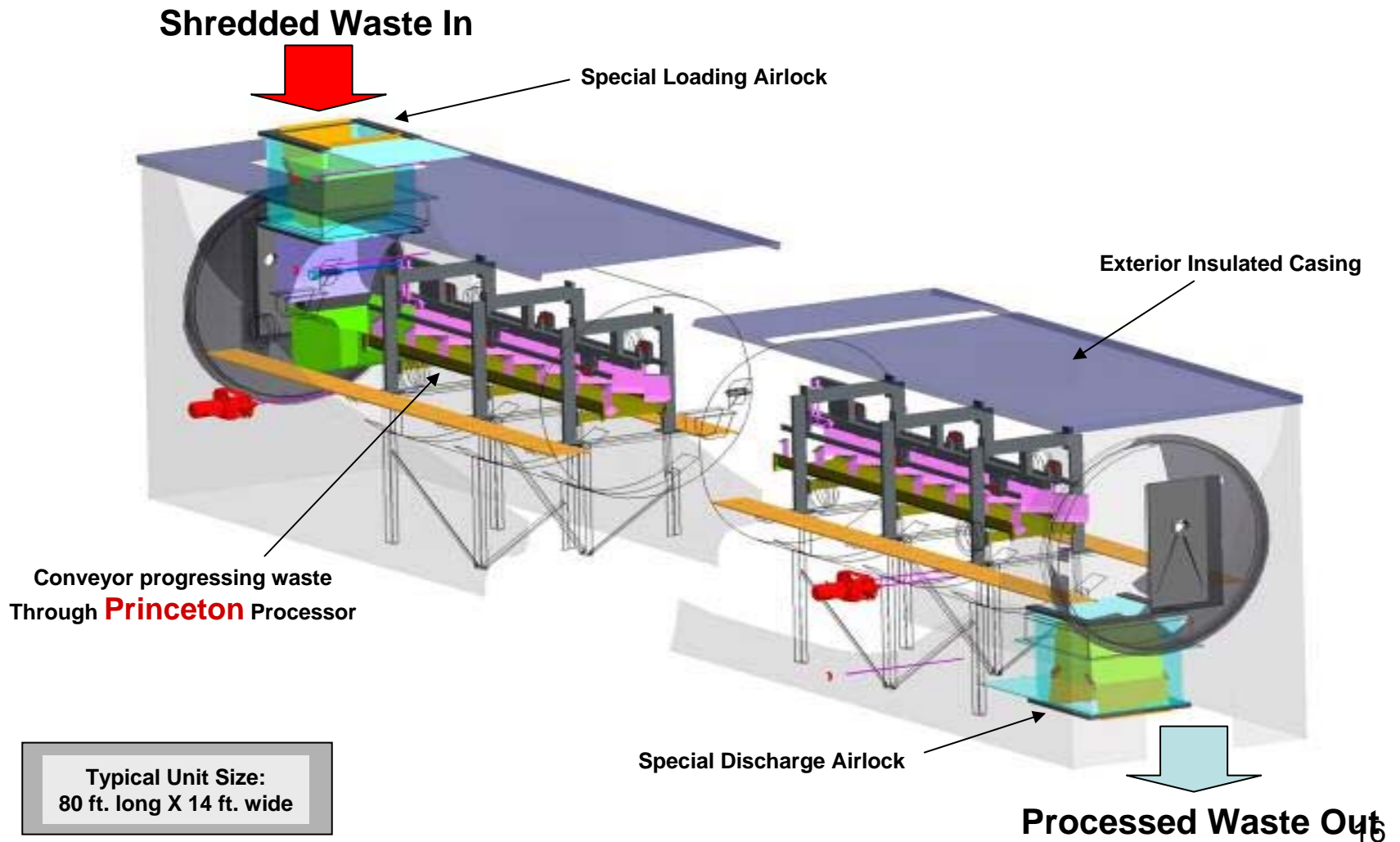
Gasification Process

- Kinsei's Gasification Process:
System will be ignited at 80°C and rapidly increased to 800°C. Through precision temperature and air flow control, system restrains formation of toxins. 6-8 hr process.
- After gasification, ash remains are reduced to 5% of initial input volume. Enhanced furnace can reduce ash to 1-2%. Ash discharges are 99% non-organic and non-toxic. This "silicon" can be sold.



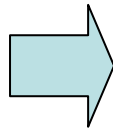
1. **Gasification Processing Chamber**
2. **Heating Chamber**
3. **Fluidization Chamber**
4. **Heat Transfer Chamber**
5. **Gasification Chamber**

Steam Compression Technology



Operation Overview (Fuel Cells)

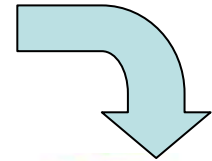
MSW



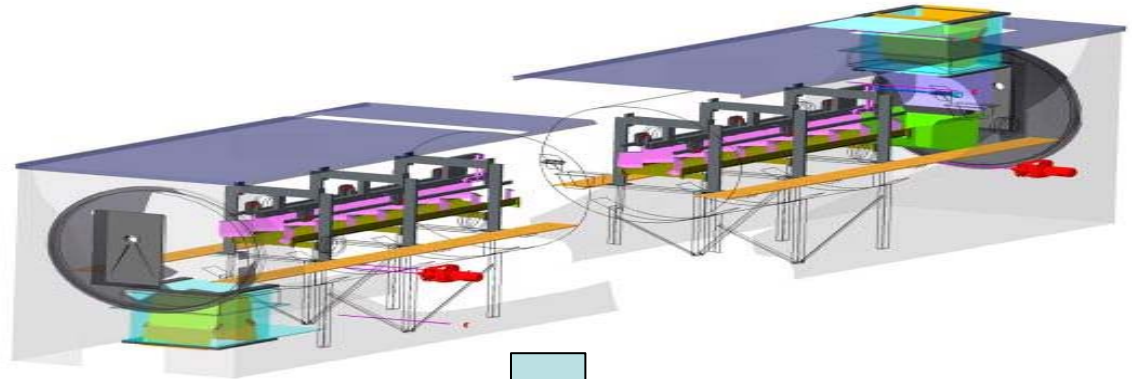
Shred to Uniform Size



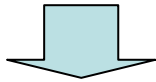
Shredded Waste In



Princeton
Steam Compression
System



Fuel Cells (Pellets) Out



Fuel for Power Plant



Remote Steam Plant

Overview Fuel Pellets



- fiber exits the system at approx 40% moisture content with a gross calorific value of 11 MJ/kg (2629 Kcal/kg or about 11,000 BTU/Lb)



- dried fiber has a gross heat value of <10000 BTU/lb
- this biomass contains minimal sulfur and is much cleaner, when burnt, than fossil fuel
- total sulfur content 0.12% (dry)
- this is approx 10% of the sulfur content of coal

MSWE Non-fired Brick Making Process

- Gasification ash remnants and construction debris may be utilized to make bricks and/or road paving materials.
- Cleveland's approach will be based on a technique called cold injection molding.
- The bricks are not fired in a kiln and are air dried.





2. Benefits to the General Fund

#1 Reduced Tipping Fees

CLE Average Estimated Tipping Fees	\$35.00/ton
Tipping Fees for participating communities	- <u>\$25.00/ton</u>
Estimated Saving to Gen Fund	\$10.00/ton

#2 Improved Operational Efficiency and lower cost

Benefits to the General Fund

- **Improved Operational Efficiency**

DPS Waste Collection & Disposal 2008

– Collection Services and Miscellaneous Budget	\$3.3M	
– 234 Employees	<u>\$11.2M</u>	
– Residential Collection and Recycling	\$14.5M	\$14.5M
– Waste Disposal and Community Processing		\$12.1M
– Ancillary Services		<u>\$1.5M</u>
Total budget for the General Fund		\$28.1M

New MSWE Division

– MSWE Residential Collection and Recycling*	\$10.15M	
– MSWE Waste Disposal and Processing*	\$12.10M	
– Ancillary Services		<u>\$1.50M</u>
Total budget for the General Fund		\$19.45M

Possible Annual Savings to the General Fund \$8.65M

* 30% efficiency $(8.65/28.1 * 100) \%$

Benefits to the General Fund

□ Increased City Tax Revenues

- City will receive an estimated **\$40,000** in taxes per year from the construction people employed to build this facility (Estimated salary of \$40,000 avg. for 50 personnel @ 2% tax rate)
- City will receive an estimated **\$300,000** in taxes per year once PEG and other partners establish offices in the City (Estimated avg. salary of \$50,000 for 300 personnel @ 2% tax rate)

3. City-wide Recycling Program

City-wide Recycling Program Cost

	Per Unit	Total Cost
54 Automated Trucks	\$215,000	\$11,600,000
340,000 Carts	\$50	\$17,100,000
30 Cart Tippers	\$3,000	\$100,000

		\$28.8 Million

4. Cleveland Public Power

- CPP purchases 99.9% of its power
- CPP owns very little generation and that generation is expensive natural gas fired turbines used for peaking purposes only
- *This is a risky position and exposes the City to volatile power market forces when power prices are rising*
- It also means Cleveland pays for generation jobs and generation assets elsewhere

CPP Avoided Cost

- Local generation of 10-20 MW would reduce MISO transmission dependence
- Reduce transmission cost \$3.00/MWh

This yields monthly savings of \$20k - \$40k

Annual Transmission

savings \$250k - \$500k

- Annual Generation savings
\$10 MM - \$20 MM



5. Design Requirements

- MSW Recycling to meet Sustainability goals
- Electric Power generation to minimize market dependence
- Generation cost must be comparable to other green power project cost
- Environmentally friendly generation fuel source
- Technology to meet and/or exceed EPA emission requirements for SOX, NOX, and CO2 emissions

MSWE Design Requirements

- True Sustainable System
- MSW Recycling to meet recycling goals
- Minimize waste sent to landfill
- Electric Power generation to minimize market dependence
- Electric Generation that helps meet AEPS goals
- Environmentally friendly generation fuel source
- Maximize all system outputs
 - Bricks from ash
 - Fuel pellets from “yard waste”

6. Division of MSWE

Benefits of the Division of MSWE

- MSWE is expected to require **152 employees**, 70 of those will be absorbed from Division of Waste Collection (DWC) reducing its demands upon the COC's General Fund by \$4.35M;
- MSWE will create an additional **82 jobs** *without requiring any funds from the COC's General Fund* as it is expected to be self-sustaining;
- MSWE will take its collected MSW to the Ridge Road Transfer Station for processing rather than area landfills. MSWE will charge CLE a lower tipping fee resulting in a savings of around **\$2.5 MM** per year

Division of MSWE

Benefits of the Division of MSWE

- MSWE's own operations are likely to be completely self-supporting: all of its operational expenses (including payroll, equipment, repair and maintenance) are expected to be paid for through the Division's revenue streams;
- Annual savings to the CLE General Fund would appear to be in excess of \$8.65M through reductions in waste collection services and costs.

Division of MSWE

- All services and functions of the proposed MSW to Energy Facility would occur in the Division of MSWE:
 - Recycling
 - Gasification
 - Steam Compression (fuel pellet production)
 - Electric Generation
 - Decorative Bricks and more

What's in a name? Marketability

Division of MSWE

- In addition, MSWE would manage the front end of the process and oversee waste collection services.
- The General Fund would *in-source* the waste collection function to MSWE
- General Fund would still pay for collection services but would pay less

Division of MSWE

- **Residential Collections/ Recycling**

Weekly collection of MSW and recyclable commodities

- **Waste Disposal/ Commodity Processing**

Deliver collected MSW to landfills and market recyclables. Operate Transfer Station.

- **Ancillary Services**

Clean up activities downtown streets and muni buildings.
Repair, replace and service outdoor waste receptacles.
Provide collection of dead animals and other services.

Division of MSWE

Residential Collection and Recycling Collection

Activities: Weekly collection of solid waste, bulk items, and recyclables

- Salaries and wages (full and part-time)
- Benefits and Training
- Maintenance, Inter-departmental transfers and more

Waste Disposal and Commodity Processing

Activities: Deliver MSW to landfills, market recyclables, and operate transfer station

- Waste Disposal, Waste Disposal Ohio EPA
- Salaries, wages, benefits
- Maintenance, Inter-departmental transfers and more

Division of MSWE

MSWE's successful operational improvements in solid waste collection services will be achieved by two primary factors:

- (a) Upgrading Collection Resources
- (b) Reallocation of Human Resources

(a) Upgrading of Collection Resources

Fully Implement a City-wide Waste Collection Recycling Program

- Convert the current manual collection operation to a *Fully-automated system* for solid waste and a *Semi-automated system* for recycling utilizing special carts and tippers.
- The investment in the new trucks and tippers for waste collection services will be *essential* to MSWE's operating success



(b) Reallocation of Human Resources

Automated System for Solid Waste Collection

- One (1) man crew (*2 less than a manual system*)
- Average 46 Routes Per Day (*8 less routes than a manual system*)
- Average Route Consist of 1,000+ Stops (*500+ more than a manual system*)
- Average 25-35 tons collected per truck daily (*30% more than a manual system*)



Division of MSWE

- Reduced worker's comp and injury claims by at least 10% annually. (15 less injuries ~\$86,000/yr)
- Workers relocated from the DPS Division of Waste Collection solid waste collection process would be offered employment and/or be re-assigned to other sections in MSWE's MSW to Energy facility

DPS Waste Collection Cost

Division of Waste Collection 2008 Budget

	Cost	Staff	
		FT	PT
Resid. Collection/ Recyc.	\$14.5M	202	32
Disposal /Comm. Process	\$12.1M	22	
Ancillary Services	\$1.5M	21	
	-----	-----	-----
Total G. F. '08 Cost	\$28.1M	245	32

Residential Collection and Recycling Collection

DPS Waste Collection 2008 Budget*

Collection Services and Misc.	\$3.3M	
234 Employees	<u>+\$11.2M</u>	
	\$14.5M	\$14.5M

MSWE Waste Collection Services

- Automated and Semi-auto Collection City-wide
- Employee Reallocation within MSWE
- *30% Savings from Opr. Efficiency Improvements*

Collection Services Charge to G. F. \$10.15M	<u>-\$10.15M</u>
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Avoided Cost & Savings to General Fund	\$4.35M
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* Cost allocations are estimated

Collection Service and Disposal Cost

DPS Div. of Waste Collection '08 Budget

Residential Collection and Recycling	\$14.5M
Waste Disposal and Comm. Processing	\$12.1M
Ancillary Services	<u>\$ 1.5M</u>
	\$28.1M

Division of MSWE Services

MSWE Residential Collection and Recycling	\$10.15M
MSWE Waste Disposal and Processing	\$7.8M
<i>DPS Waste Collection</i> Ancillary Services	<u>\$1.5M</u>
	\$19.45M

Possible Annual Savings to General Fund \$8.65M

Waste Disposal and Commodity Processing

DPS Waste Collection 2008 Budget*		
MSW Tipping Cost	\$9.95M	
22 Employees and Other	<u>+\$2.11M</u>	
	\$12.1M	\$12.1M
MSWE Waste Processing Charges		
300,000 tons @ \$26/ton	\$7.8M	
Staff included at Transfer Sta.	<u>+ \$0</u>	
MSWE Charge to General Fund	\$7.8M	<u>-\$7.8M</u>
Avoided Cost and Savings to General Fund		\$4.3M

* Cost allocations are estimated

7. Economic Development

Jobs Per Component

MSW to Energy facility operation 24/7 in 3 shifts

Component full time staffing needs

#1	Collection Process:	N/A
#2	Waste Sorting:	24-36
#3a	Waste Processing:	12-18
#3b	Steam Compression:	18-24
#4	Gasification Operation:	18-24
#5	Power Plant Operation:	18-24

Total Direct Jobs: 90-126

Economic Development

Princeton Group means: Manufacturing Facilities

- Components of Cleveland's systems would be assembled, and some manufactured, locally.
 - Sorting Systems (manual and/or automatic)
 - Pyrolysis Gasification Facility
 - Steam Compression System
- This would mean more jobs and demand as Cleveland's model is duplicated nationally.



Economic Development Opportunities

– Revenues from the facility

- Estimated revenue generation potential of \$86.6* million for the MSWE facility
- Estimated annual revenue from sale of bricks \$1.84 million (20.46 million bricks @\$0.09/brick)
- Estimated annual revenue from tipping fees \$16.8 million (682,000 tons @ avg. \$24.6/ton of MSW)



Economic Development Opportunities

Revenues from the facility continued

- Estimated annual revenue generation through recycling is \$13.7 million (238,700 tons @ avg. \$57.5 per ton)
- Estimated revenue generation from sale of RDF pellets is \$2,199,450 (102,300 tons @ \$22 per ton[†])
- Estimated revenue from sale of electricity is \$9 million (163,680 mw @ \$55/MWh)



Economic Development Opportunities

Regional Benefits

- Estimated costs savings from tipping fees for other participating communities \$3.05 million (382,000 tons of MSW @ \$8/ton estimated)
- RDF pellets act as tools for emissions trading
- Cleveland's dependency on landfills are virtually eliminated
- City becomes hub for future advanced energy technology development
- Redevelopment and redeployment of City's Brownfield areas due to influx of corporations migrating to Cleveland

Economic Development Opportunities

Technology Ripple Effects

- Companies in the Cleveland area may manufacture and supply parts for the MSWE facility and other WTE facilities being built within the US and around the world
- Technology Commercialization will increase the Per Capita Income of the region by attracting and keeping highly educated people in the region
- Opportunities in the high technology sector will encourage Universities to focus on doing research in high technology areas, thus increasing R&D grants for the region

Economic Development Opportunities

Foreign Investment

- Possibility of international companies establishing operations in the Cleveland area
- Estimated potential foreign direct investment of \$47 million in steam compression and gasification equipment for the facility (PEG estimate)
- Propel Cleveland and the region as a technology, manpower and financial resource for countries looking to develop alternate energy resources

8. Environmental Impacts

- Traditional fuel types available in other parts of the State/Country are not available in a “non-attainment” area like Cleveland.
- “Non-attainment” means a geographic area in which the level of certain air pollutants is higher than national air quality standards.

Environmental Impacts

Opportunity for Increased MSW Collection

- Cleveland's Ridge Road Transfer Station has a daily MSW capacity of 3,000 tons (253 days of operation)
- Ridge Road Transfer Stations daily MSW
 - On-peak 1,500 tons daily
 - Off-peak 900 tons daily
- Ridge Road unused capacity
 - On-peak 500 tons daily
 - Off-peak 1,100 tons daily

Participating communities that enter a long term contract with Cleveland could see reduced tipping fees of 15% or more. This would mean that they could save \$500,000 to \$1 million dollars annually by participating with Cleveland.

Sight, Smell, Noise, and Truck Traffic

- This environmentally friendly generation fuel source meets and exceeds EPA emission requirements for SOX, NOX, and CO2 emissions, and is offered by an industry leading Japanese company:

Kinsei Sangyo Company

- A Full-Service Waste-to-Energy Engineering Company
- Over 300 operating facilities in Japan, China and in Asia. Currently under construction is the Clyde, Ohio Gasification Facility scheduled to go in operation in Oct/Nov '07.
- U.S.A. marketing office in N.J. established in 2005.
- 22 patents world wide, 8 in USA and 8 more pending.

Sight, Smell, Noise, and Truck Traffic

Kinsei's Technology

- **Gasification**- Processes MSW with high temperatures in separate stages and restrains the formation of toxic substances (Dioxin, CO, NO_x, Sox).
- Removes more than 97% of airborne odor
- Primarily water vapor emissions (no black/gray smoke)
- No increased or high volume noise effects
- Used abroad in residential areas
- Emissions tested and certified in compliance with Japan, China and EU standards
- Will meet US EPA requirements and Kinsei/Princeton provides performance bond to back these commitments

Sight, Smell, Noise, and Truck Traffic

- Currently approximately 240 various types of trucks go in and out of the transfer station each day. Projecting 2,000 and 3,000 tons per day capacity would provide an estimate of 370 to 550 trucks per day. At that higher level, truck traffic would increase to the facility.
- The facilities will be staffed for around the clock operation with two shifts of sorters for MSW deliveries during the day. MSW will be processed each delivery day.



Sight, Smell, Noise, and Truck Traffic

Community in Japan around a gasification facility



9. Estimate of Facility Cost

Estimated Facility Cost:

City-Wide Recycling (equipment & vehicles)	\$29 million
MSW Receiving Station	\$21 million
Recycling Station	\$12 million
Gasification Equipment	\$21 million
Power Plant (10-20 MW)	\$15 million
Steam Compression Equipment	\$45 million
Construction	\$21 million
Civil Engineering	\$ 8 million
Decorative Brick Equipment	\$ 8 million

Total Estimated Cost	\$180 million

10. Feasibility Study Findings

Independent Consultants evaluated the MSWE model and assumptions.

Consultant team

- RNR Consulting
- URS Corporation
- DLZ Ohio, Inc.
- Cloud & Associates

Feasibility Study Findings

Environmental Permits

Solid Waste Transfer Station

- The Ridge Road Transfer Station permit application, based on current rules, would not be replaced by the solid waste to energy recovery permit. Ohio EPA confirmed that it would be necessary to maintain a transfer station permit in addition to the energy recovery permit, at a minimum, to allow for the offsite disposal of ash.
- Manufactured fuel pellets, depending on the final determination of their classification (i.e., solid waste or recyclables) may also have an impact on the permitting of the facility.

Feasibility Study Findings

Performance Bonds – used to reimburse the City for damages sustained due to breach in performance by PEG/KSL.

For this Project, the performance bond amount recommended of PEG/KSL is as follows*:

Gasification:	\$18.0M
Steam Compression:	\$24.0M
Engineering and Design Services:	\$5.0M
20% “penalty” amount:	+ <u>\$9.4M</u>
TOTAL:	\$56.4M

Feasibility Study Findings

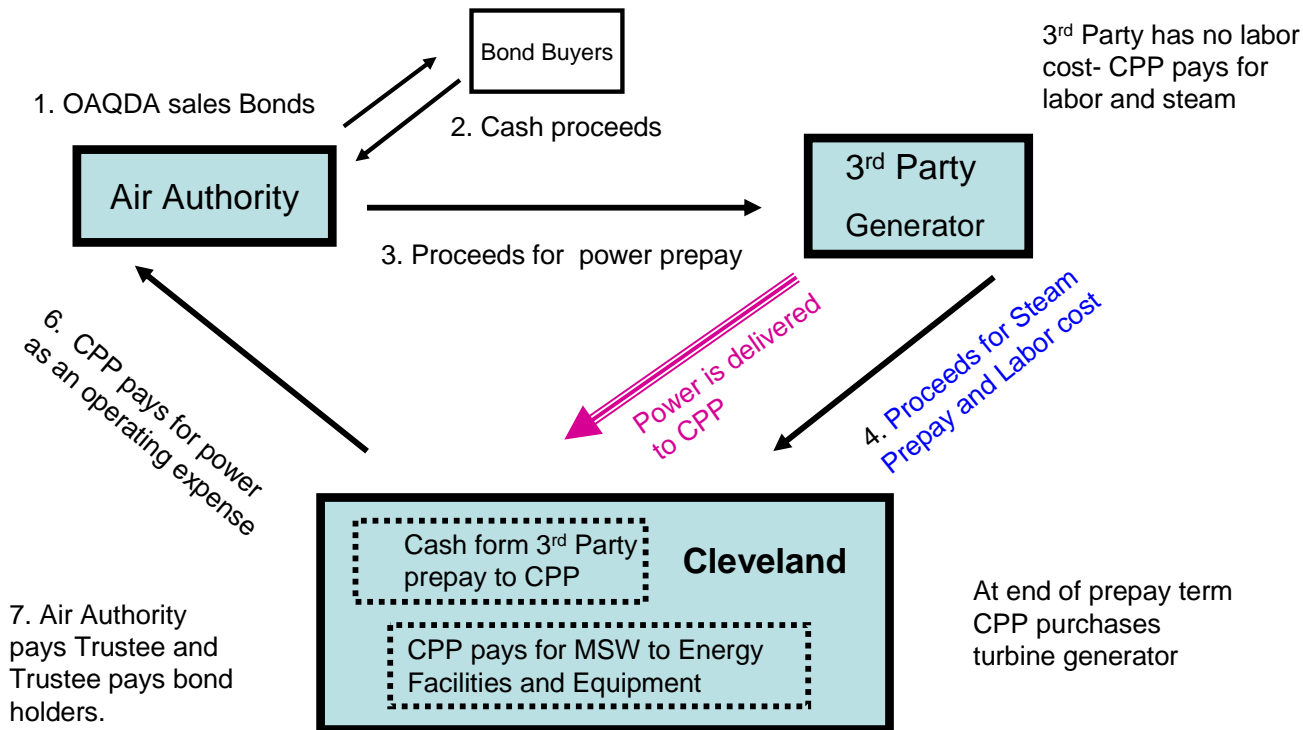
- **Project Risks:**

- PEG/KSL ceases operations during Facility's (20) year horizon
- Project's General Contractor ceases business before Project is complete
- Project cost projections are inaccurate
- Project unexpectedly delayed
- EPA/OEPA does not issue permits or creates delays in doing so
- No market or insufficient demand for the Project's bonds
- Facility has unanticipated environmental impacts

11. Financing - Prepay

Project Financing: Prepay Model

MSW to Energy Prepay Cash Flows



Financing - Prepay

The Prepay approach should be the *second* option.

Prepay Model Pros and Cons:

Pros –

- Recently used successfully for other project funding;
- Does not require new debt;
- COC's bond rating is not considered.

Cons –

- Private third party investors needed;
- Uncertainty of fixed electricity pricing over 20 year term;
- CPP will be obligated to purchase power from TPG at set rate even if market rates drop;

Financing - Prepay

- **Project Financing:**

- The Prepay Model may be utilized to fund the MSWE Project;
 - No debt for CPP or City of Cleveland
- Alternative methods to fund the Project exist;
 - Debt obligations to be met by the owners/operators of the facility
- A variety of alternative sources of funding (i.e. research grants) for the MSWE Project exist
- State/Federal dollars should be sought for to support the project



12. Gasification Technology In the US

Process	Pre-Processing	Residual	Product	Readiness
Pyrolysis	High	Char/Ash/ Oil/Tar	Producer Gas	Pilot Stage in U.S.
Gasification	Med.	Ash/Slag	Syngas/Char	Pilot Stage in U.S.
Anaerobic Digestion	Med.	Treated Water, grit	Biogas, Digestate- Compost	Pilot Stage in U.S.
Hydrolysis	High	Waste water, solids	Ethanol	No / Pilot State in U.S.
Plasma Gasification	Med.	Slag / Metals	Syngas	Pilot Stage in U.S.
Autoclave	High	None	“Fluff” (pulp)	Pilot Stage in U.S.

Gasification Technology In the US

Location	Technology / Material	Status
Plasco Energy Group / Ottawa, Canada	Plasma Arc / MSW	Operational / 98 TPD ⁽¹⁾
Green Power / Tallahassee, FL	Plasma Arc / MSW	Site selection / planning
Logite International, Binham County, ID	Gasification / MSW	Planning – Financing? / 200 TPD
Plasco Energy Group / Red Deer Cty. Alberta	Plasma Arc / MSW	Planning / 295 TPD
St. Lucie County, FL	Plasma Arc / MSW	Financing / Delayed?
L.A. County, CA	Gasification, Pyrolysis, TDP ⁽²⁾ Anaerobic Digestion / MSW	RFP for Pilot Plant “competition”
Bermuda	Plasma Arc , Incineration / MSW or wood pellets	Proposals / 200 TPD
County of Hawaii	Plasma Arc / MSW	Study
Sacramento Municipal Utility District	Plasma Arc / MSW	Cancelled

Gasification Technology In the US

Location	Technology / Material	Status
City of Orlando	Plasma Arc / MSW	Planning / Delayed?
Koochiching Economic Dev. Authority, MN	Plasma Arc / MSW	Planning Grant
Sun Energy Group, LLC New Orleans	Plasma Arc / MSW	Restart Planning / 2,400 TPD
Aitken County, MN	Plasma Arc / MSW	Planning Grant
Salinas Valley Solid Waste Authority	Gasification, Plasma Arc, Anaerobic Digestion, Pyrolysis / MSW	Proposal / 640-1, 760 TPD
Santa Barbara County, CA	Plasma, Gasification/Pyrolysis/ Anaerobic Digestion	Planning
TEPA Technologies, Ft. Riley, KS and Linn Cty. IA	Plasma Arc / MSW & flood debris	2 TPD Mobile demonstration Unit
Ottawa, Plasco Energy Group	Plasma Arc / MSW	Planning / 394 TPD
Marion, Iowa	Plasma Arc / MSW	Economic Feasibility Study
Huntington, IN, Nature's Fuel	Pyrolysis / MSW	Planning/Permitting – 100 TPD

Gasification Technology In the US

Location	Technology / Material	Status
Sevier County, TN, WastAway	Pyrolysis of MSW compost	Testing Pilot
Island of Aruba, WastAway	Autoclave / MSW	250 TPD – recently started
Salinas Valley SWA, CA – CR3	Autoclave / MSW	2 TPD pilot testing
LA County, Bluefire Ethanol	Hydrolysis / MSW	Construction / 170 TPD?
Berkeley County, SC	Anaerobic Digestion / MSW	Feasibility Study
Fort Tyndall, FL	Plasma Arc	Permitting / 10 TPD
San Jose, CA, Zero Waste	Anaerobic Digestion / MSW	Permitting / 140 TPD initial phase
Ontario, Storm Fisher	Anaerobic Digestion / MSW	Construction 350 TPD
Blue Stem Solid Waste Agency, Iowa	Anaerobic Digestion / MSW	Feasibility Study

13. Job Creation- Manufacturing

Projected Manufacturing Facility Employment Timeline and Cleveland manufacturing goals

	2010	2011	2012	2013	2014
Payroll Analysis					
Manufacturing Jobs Created - annually	4	8	8	20	15
Manufacturing Jobs Created - cumulative	4	12	20	40	55
Manufacturing Wages - annually	141,600	424,800	708,000	1,416,000	1,947,000
Total Manufacturing Wages-cumulative	\$141,600	\$566,400	\$1,274,400	\$2,690,400	\$4,637,400

Job Creation- Manufacturing

Management Jobs Created - annually	2	2	4	5	-
Management Jobs Created -cumulative	2	4	8	13	13
Management Salaries - annually	150,000	300,000	600,000	780,000	975,000
Total Management Salaries -cumulative	\$150,000	\$450,000	\$1,050,000	\$1,830,000	\$2,805,000

Total Ohio Jobs Created - annually	6	10	12	25	15
Total Ohio Jobs Created - cumulative	6	16	28	53	68
Total Ohio Wages & Salaries - annually	291,600	724,800.00	1,308,000	2,196,000	2,922,000
Total Ohio Wages & Salaries - cumulative	\$291,600	\$1,016,400	\$2,324,400	\$4,520,400	\$7,442,400

Job Creation- Manufacturing

Ohio Manufacturing	2010	2011	2012	2013	2014
System Sales (thru leasing)	2	10	20	36	48
Total System Sales - cumulative		10	30	66	114
System Cost Each (Parts only)	250,000	200,000	200,000	200,000	200,000
Total annual Equipment cost	500,000	2,000,000	6,000,000	7,200,000	9,600,000
% of Ohio Manufacturing	0%	30%	50%	80%	80%
U.S. Manufacturing and Purchasing - annually	0	600,000	3,000,000	5,760,000	7,680,000
Ohio Manufacturing and Purchasing - cumulative	0	\$600,000	\$3,600,000	\$9,360,000	\$18,960,000

14. Regional Impacts

- Advanced Energy can be one basis of the region's economic turnaround as new industries in the region develop new products and services and bring more jobs to the area.
- If the desire is to attract new technologies and businesses to the region, Cleveland's MSW to Energy facility could serve as the foundation upon which we build:
 - To nurture the growth of the advanced technology industry,
 - To facilitate the business development of local corporations
 - To propel Cleveland and the Region to the front of the international stage of advanced energy technology development

Regional Impact

- Building strong relationships with foreign companies will attract investment in the region
- Cleveland's MSW to Energy could be an anchor for regional development as:
 - the Project gains national attention and highlights the region's resources; and
 - local opportunities are marketed to associates of the Princeton Group and other foreign investors in advanced energy technologies

Regional Impact

A. Reduced Tipping Fees for Participating Municipalities

- Tipping fees continue to rise
- Transportation cost related to trucking to landfills is also on the rise
- Emissions related to shipping longer distances



Regional Impact

Targeted Marketing of Regional Assets

- Princeton's objective is to expand to develop advanced energy opportunities across the spectrum in Cleveland
 - Wind, Solar, Fuel cells, MSW and more
- Underutilized facilities and infrastructure in the region could be marketed as available for redevelopment/redeployment
- The region's industrial workforce provides skilled resources ready for new opportunities in emerging markets.
- Location: Ohio is less than 500 miles to nearly 50% of the US population
- Transportation infrastructure: roads, rail, air, barge, power grid, and pipelines all available in the region

15. Revenue Projections

Revenue from Regional MSW

- Cleveland's Ridge Road Transfer Station has a daily MSW capacity of 3,000 tons (253 days of operation)
- Ridge Road Transfer Station's actual daily tons
 - On-peak 1,500 tons daily
 - Off-peak 900 tons daily
- Ridge Road unused capacity
 - On-peak 500 tons daily
 - Off-peak 1,100 tons daily

Potential revenues from other Municipalities' MSW in the Region at \$25/tons (negotiable)

- On-peak \$12,500 daily
- Off-peak \$27,500 daily

Revenue Projections

Cost and Revenue Projections

- **Waste Collection Services**

– Collection Services and Miscellaneous	\$ 3,300,000
– 234 Employees	<u>\$11,200,000</u>
	\$14,500,000
30% Cost Savings	<u>\$10,150,000</u>
General Fund Savings	\$ 4,350,000

Feasibility Consultant's Analysis

Overall Annual Summary of Cost and Revenue Projections	
Projected Revenue	\$45,017,250
Projected Expenses	\$33,790,399
Net Profit (Loss)	\$11,226,851

Revenue Projections

Cost and Revenue Projections:

- The MSWE Project has positive NPV;
- The MSWE Project if operated successfully should be profitable over its 20 year horizon;

Model Description	NPV
Prepay Model Approach w/o brick manufacturing	\$130,846,724
Prepay Model Approach w/ brick manufacturing	\$160,859,466
Alternative Model Approach w/o brick manufacturing	\$98,206,207
Alternative Model Approach w/ brick manufacturing	\$127,218,950

16. Sustainability

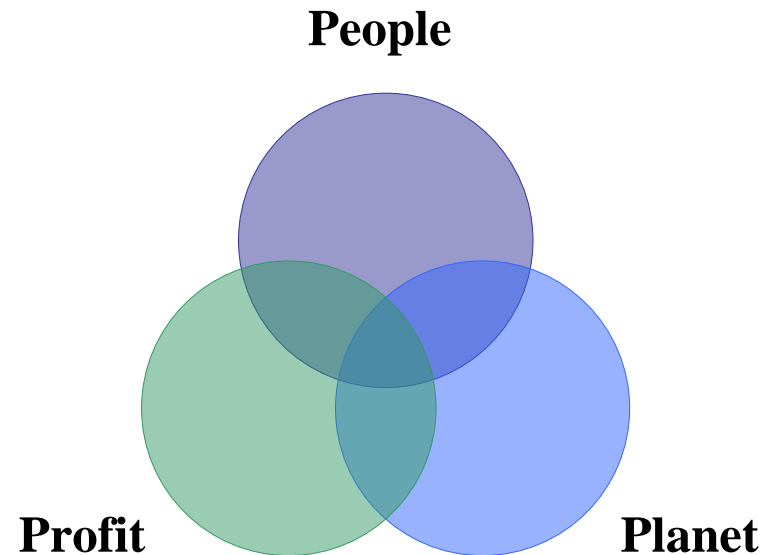


- MSW to energy facility helps to support Mayor Jackson's sustainability goals and meets our triple bottom line goals:

People – Must help the community and benefit society **i.e. jobs & economic development**

Planet – Must add value in addressing environmental issues such as climate change

Profit – Must be a profitable or cost saving approach allowing for the economic sustainability



Sustainability

Advanced Energy & Energy Efficiency

MSW facility is an advanced energy resource maximizing the efficient use of municipal solid waste.

Mayor Frank Jackson and City Council wanted an increase in advanced, renewable energy sources for Cleveland:

The City approved plans for an Advanced Energy Portfolio Standard (AEPS) for CPP.

The MSWE facility will help CPP meet these targets



Sustainability

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THE PLAIN DEALER

Jackson wants greener CPP

Seeks increase in advanced, renewable energy sources

HENRY J. GOMEZ
Plain Dealer Reporter

Cleveland Mayor Frank Jackson wants advanced and renewable energy sources — from landfill gas to the wind and sun — to represent at least 25 percent of the city-owned electric company's power supply by 2025.

Jackson said his proposal, which he plans to submit to City Council next year for approval, would promote a cleaner environment and a friendlier business climate.

A German solar outfit already is planning to make its U.S. headquarters here. And local officials are awaiting a study on the best locations



Jackson



GREEN INC. *A look at how companies are embracing "sustainability" — prospering in the*

Sustainability

Cleveland’s Advanced Energy Portfolio Standard (“AEPS”)

- Cleveland Public Power will produce and/or purchase generation from Advanced Energy Sources to meet the following goals and time lines:

<u>AEP</u>	<u>Target Year</u>
15%	2015
20%	2020
25%	2025

Sustainability

CPP's Fuel Diversity Sources

Advanced Energy Resources:

- Renewable resources (listed below)
- Cogeneration
- Distributed generation
- Fuel cells from non-sustainable resources

Renewable Energy Resources:

- Waste to energy generation
- Biomass (fuel pellets)
- Low-impact hydro
- Wind power
- Landfill gas
- Solar PV
- Solar thermal
- Fuel cells from sustainable resources



Sustainability

Health & Environment

– **Land:**

- Reduced land area used for MSW landfills
- No mining is involved in resource extraction of fuel source for energy production

– **Air:**

- Will not add to City's regulated emission problem
- Fuel pellets can be used to reduce local emission generators' air pollution
- Energy resource has a lower carbon footprint
- Reduced carbon footprint and air pollution from waste hauling to landfills. > 40 miles each way!



Sustainability



Waste Reduction & Recycling

- Increases recycling rate
 - The addition of an onsite-sorting will greatly increase material diversion rate
- Allows for faster deployment of curbside recycling
 - The curbside recycling & automated pick-up is saving the city money and significantly increasing the recycling rate

For every ton of waste diverted from the land fill, the City of Cleveland saves over \$40.00 per ton. With over 300,000 tons going to the Landfill, this represents \$\$\$\$.

17. Questions & Answers

Why Princeton Environmental Group?

- They will provide performance bonds on the EPA permits.
- They will open a Cleveland office which will be their US Headquarters
- They will bring other Japanese Companies with them and other green power technology firms
- They bring high tech jobs and a local assembly plant for the MSW to Energy facility

Questions & Answers

Why This Option for Cleveland?

- Traditional fuel types available in other parts of the State/Country are not available in “non-attainment areas” like Cleveland
 - “Non-attainment” means a geographic area in which the level of certain air pollutants is higher than national air quality standards
- Cleveland must find green/renewable/ alternative fuels if it is to generate power
- U.S. Department of Energy estimates that coal supplies 50% of America’s electricity today and will supply 57% by 2030, but new coal plants are not possible in this area
- MSW to power technology is used in other countries.

Questions & Answers

Unlike other municipalities, Cleveland is unique in that it:

- Owns the MSW*
- Has a high volume and variety of MSW*
- Manages its own Water System*
- Owns the transfer station*
- Has its own electric system with direct access to the electric grid*
- Rail is proximate to Transfer Station*

18. 10 Reasons to pursue MSWE

1. Supports Waste Collection and Recycling
2. Is a long term waste management solution
3. Substantial reduction in tipping fees
4. Environmentally friendly use of MSW
5. Places Cleveland as a leader in
 - Waste Recycling
 - Sustainability
 - Alternate Energy Production

10 Reasons to pursue MSWE

6. Reduces Cleveland's exposure and dependence on electric power markets
7. Enables Cleveland to produce electric power locally
8. Fully compliant with EPA emission standards in a non-attainment area
9. Cleveland will be the US Japanese Headquarters for Green Energy technology
10. Creates **jobs, jobs, jobs!**