PlascoEnergy GROUP

What's in Ottawa's Garbage?

Every year 1,017,000 tonnes of solid waste is collected in Ottawa—approximately 330,000 residential and 697,000 Industrial, Commercial and Institutional (IC&I.) Currently, about 33% of residential waste is diverted from landfill through recycling programs. The City is working to increase residential waste diversion to 40% in 2007. The diversion rate for IC&I waste is estimated at about 17-22%.

ITEM	% of Waste by Weight	Carbon	Hydrogen	Oxygen	Nitrogen	Sulphur	Chlorine	Ash	H2O	Energy Content Mega Joules/Tonne of Waste
Newsprint	1.6%	48.83%	6.21%	42.35%	0.15%	0.25%	0.15%	2.1%	25.00%	14,497
Magazines	3.6%	39.20%	5.52%	39.11%	0.13%	0.25%	0.15%	15.6%	16.00%	12,713
Corrugated Cardboard	4.5%	45.99%	6.35%	44.26%	0.14%	0.29%	0.15%	2.8%	20.00%	14,704
Paper	4.1%	42.09%	5.86%	38.84%	0.40%	0.25%	0.79%	11.8%	23.00%	12,748
Glass	2.1%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.0%	0.00%	0
Metals	2.8%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	100.0%	0.00%	0
PET	0.7%	57.70%	3.87%	38.43%	0.00%	0.00%	0.00%	0.0%	0.00%	22,556
PVC	0.0%	42.49%	5.35%	1.08%	0.00%	0.00%	50.91%	0.2%	0.00%	17,998
PE (LLD, LD, HD)	3.9%	85.63%	14.37%	0.00%	0.00%	0.00%	0.00%	0.0%	0.00%	47,339
Polystyrene	0.9%	91.60%	8.07%	0.00%	0.00%	0.15%	0.00%	0.0%	0.00%	46,420
Plastic Film Blend	2.3%	83.79%	13.84%	0.14%	0.12%	0.00%	2.11%	0.0%	0.00%	45,777
Mixed Plastics	3.1%	66.39%	9.16%	9.47%	1.00%	0.34%	3.53%	10.1%	15.00%	26,947
Food Waste	33.8%	44.83%	6.38%	32.13%	2.83%	0.15%	0.95%	12.8%	60.00%	7,594
Yard Waste	2.9%	42.35%	5.33%	31.89%	1.62%	0.27%	0.24%	18.3%	45.00%	9,315
Diapers	9.2%	57.18%	8.04%	29.24%	0.70%	0.16%	0.22%	4.5%	60.83%	10,245
Textiles	3.1%	49.64%	6.69%	36.15%	4.15%	0.37%	0.36%	2.6%	25.00%	15,339
Construction/Demolition	2.1%	32.48%	3.97%	27.24%	0.19%	0.06%	0.07%	36.0%	11.20%	11,288
Pet Litter, Excrement	7.7%	33.70%	4.70%	26.15%	3.05%	0.37%	0.81%	31.2%	40.50%	8,274
Carpet	2.3%	50.28%	7.67%	4.90%	4.20%	0.10%	2.90%	30.0%	0.00%	24,699
Ottawa Residential Waste	**100.0%**	**46.13%**	**6.49%**	**23.20%**	**1.37%**	**0.20%**	**0.92%**	**21.7%**	**35.83%**	**13,555**

The energy value of the MSW is raised to 16,500 MJ/T by blending into it unrecyclable plastic from the City's Blue Box program. The plastic feed is 8% of the MSW feed.

Where does Ottawa's residential waste go?

Roughly two-thirds of Ottawa's residential waste is landfilled at the City-owned and operated Trail Waste Facility.

About one-third goes to the Carp Road landfill, which is owned and operated by Waste Management Canada Inc.

A small amount is disposed of in the Springhill landfill, which is owned by the City but operated by Tomlinson Environmental Ltd.

Any hazardous elements like mercury or other heavy metals contained in things like batteries, thermometers and fluorescent light bulbs that end up in landfills—when they should be sent for controlled disposal—contaminate the air, water and land.

		Lead	Cadmium	Mercury
Heavy Metals	Total Heavy Metal per Tonne of MSW in grams/Tonne	12.17	7.44	3.29

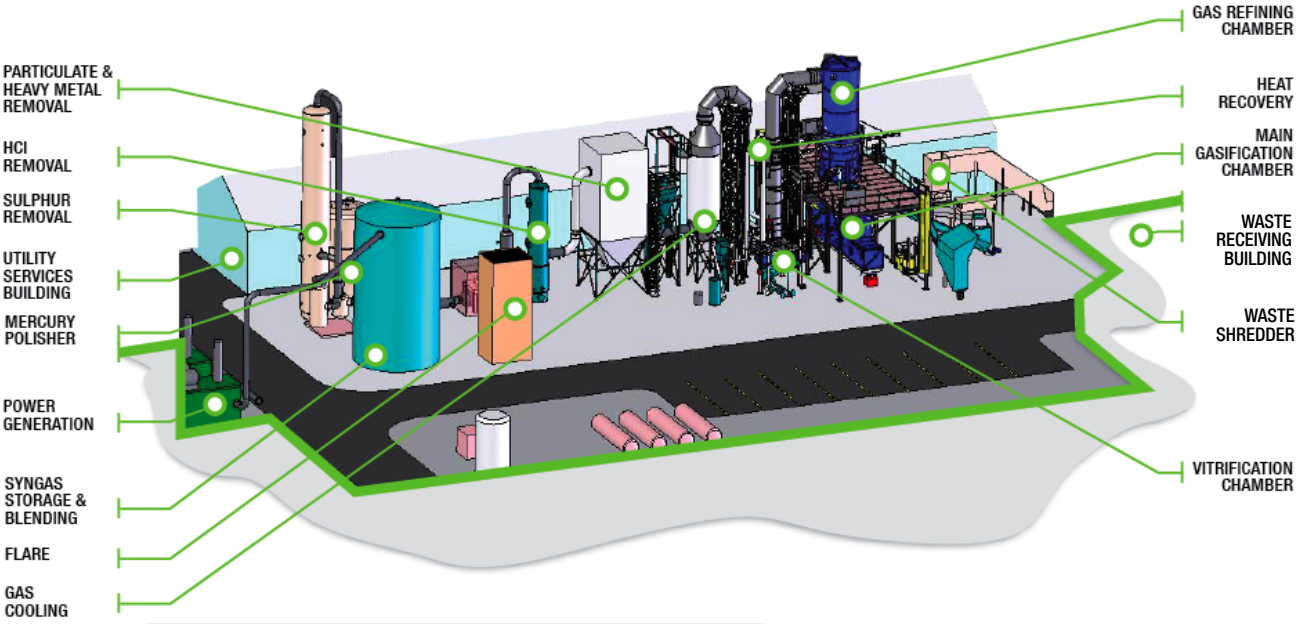
We are separating out magnetic metals.

A magnet is installed in the MSW feed system. All ferrous metals will be removed and sent for recycling, rather than be processed by the system and turned into an inert residual solid material (slag).

The PlascoEnergy Trail Road Site

PlascoEnergy GROUP

The PlascoEnergy Trail Road Site



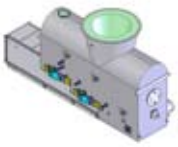
Gas Refining Chamber

Refine raw syngas to product-quality syngas

Use plasma for intense heat and ionization effect

Crack tars and large molecules into H2 and CO rich syngas

Main Gasification Chamber



Gasification of waste

Use heat recovered from syngas

Low temperature gasification (<900'C)

Convert volatile solids into raw syngas

Push solid residue to vitrification chamber

Vitrification Chamber

Isolate high temperatures from Main Chamber

Produce additional syngas for power generation

Produce vitrified slag for sale as an aggregate



Environmental Impact

Air Emissions

Technology exists today to remove contaminants from energy feed stocks like waste. Refining the raw synthetic gas (syngas) by the plasma process and cleaning the refined gas with the best available technology delivers the following results.

It is important to note that hazardous substances in the waste delivered to PlascoEnergy are removed and sent for controlled disposal—where they should have been sent to begin with—instead of being sent to landfill.

ITEM	Current Ontario Limit	Limits Agreed to by PlascoEnergy for Demonstration Project	Maximum Design Limits for Demonstration Site	Expected Performance at Demonstration and Commercial Facilities	Units
HCl	18	13	2	1	ppmv
Nitrogen oxides	110	110	110	20	ppmv
SO2	21	14	12	4	ppmv
Organic matter	100	75	25	25	ppmv
Particulate matter	17	12	3.3	2.5	mg/Rm3
Mercury	20	20	1	0.5	ug/Rm3
Cadmium	14	14	1.2	1	ug/Rm3
Lead	142	142	12	12	ug/Rm3
Dioxins and furans	80	40	0	0	pg/Rm3

PlascoEnergy will be installing equipment to reduce NOx emission levels. It is not yet known the level of reductions that will be achieved, however, it will be substantially lower than the maximum limit.

*parts per million (volume based)
**1 mg/Rm3 = 0.001 gram per cubic meter of exhaust
*** 1 ug/Rm3 = 0.000001 gram per cubic meter of exhaust
**** 1 pg/Rm3 = 0.000000000001 gram per cubic meter of exhaust

Land

The amount of garbage being sent to landfill (where it can eventually leach into the ground) will be dramatically reduced--for every 1000 Kg of waste processed by the PlascoEnergy system 1 Kg of waste needs to be sent to landfill.

The PlascoEnergy demonstration facility uses less than three acres. A 200 tonne-per-day commercial facility would require four acres with every additional 100 tonnes-per-day module requiring an additional 1 acre. In order to site a plant, minor modifications are made to the surface: grading the land, installing large concrete pads and paving. Storm water drainage and collection is managed according to Ontario requirements. The site modifications are similar to what is required for a retail store and parking lot.

Regardless of where the facility is situated, the land which it utilizes will not be contaminated.

Environmental Impact

Water Consumption and Use

Water is used in the system to cool the syngas, cool the slag, to remove HCl from the syngas and to wash the waste receiving floor. The required water comes from the MSW itself and from an on-site well.

Total Water Usage	L/hr	usgpm*
Raw Water (well water)	7606	33.5
Water in wet MSW	809	3.6
Total Water In	**8415**	**37.0**
Total Water Discharge	**L/hr**	**usgpm***
Evaporation		
Non-contact cooling water evaporation	5742	25.3
City Water Treatment Plant		
Non-Contact Cooling water discharge	1700	7.5
Contact Cooling Water discharge	700	3.1
Other, MSW wash water discharge	273	1.2
Total Water Out	**8415**	**37.0**

* usgpm = US gallons per minute

Cooling Water

Almost 90% of the water required by the process is used to cool the syngas. None of this water contacts the syngas or is contaminated by the process in anyway. However, water usage will be a significant concern in some communities. Therefore, PlascoEnergy will provide optional "dry cooling" technology to commercial sites. The dry cooling will add modestly to the cost of a plant and require about 5% more power to operate, so there is slightly less power available to the grid, but it will eliminate the need for cooling water.

On-Site Treatment of Contact Water

PlascoEnergy expects that all of the contact water will comply with the City of Ottawa's Sewer use by-law. Therefore, the water will initially be trucked to the City's water treatment centre. However, Plasco is pursuing water treatment technology, so the contact water can be re-used in the plant or cleaned to potable water standards. Once a technology has been chosen, it will be installed at the demonstration facility.

Water treatment combined with dry cooling will result in a PlascoEnergy plant being a net producer of clean, potable water.

Performance Monitoring and Reporting

Monitoring

The Ontario Ministry of the Environment (MOE) evaluated all possible air emission sources from the demonstration facility. The MOE determined that two sources are significant and require monitoring. Emissions from the other sources are predicted with MOE approved computer models. The MOE also prescribed what contaminants must be monitored.

Source ID	Source Description Title	Expected Contaminants	Significance
1	Converter	Plasco Reg List	N
2	Flare Stack (for start-up and emergency use only)	Plasco Reg List	Y
3	Gas Engine Exhausts	Plasco Reg LIst	Y
4	Material Handling	Particulate	N
5	Storage Tanks	VOC	N
6	Converyor and Shredder	Particulate	N
7	Unloading of raw material and loading of baghouse waste	Particulate	N
8	Vehicular Traffic - garbage trucks	Particulate	N
9	Loading bucket equipped machines	Particulate	N
10	Building heaters	NO2	N

The emissions monitoring plan, which includes monitoring location selection, monitoring equipment selection and installation, certificate testing, monitoring methods/standards, data acquisition system, quality assurance plan, was created by a third-party environmental engineering firm. Emissions monitoring will be done using continuous emissions monitoring systems (CEMS), or for contaminants that cannot be measured continuously, periodic testing will be performed by a third-party qualified environmental engineering firm.

Contaminant	Measured By:	Monitoring Method/Standard
Lead	3rd Party Engineering Firm	M12
Mercury	3rd Party Engineering Firm	M101
Cadmium	3rd Party Engineering Firm	M29
Particulate Matter	3rd Party Engineering Firm	M5
NOx	CEMS	EPS 1/PG/7 (Revised)
SOx	CEMS	EPS 1/PG/7 (Revised)
Dioxins/Furans	3rd Party Engineering Firm	M0010 (MM5)
HCl	CEMS	EPS 1/PG/7 (Revised)
Organic Matter	3rd Party Engineering Firm	M0030 & M25

Reporting

The environmental performance of the demonstration plant will be reported to the following groups:

The Ontario Ministry of the Environment

An independent Public Advisory Committee, chaired by Councillor Jan Harder, set-up to monitor and report to the public and the City on the operations of the demonstration facility

The public through the zerowasteottawa.com website.

Greenhouse Gas Reductions

Garbage in landfills releases methane. Methane is a potent greenhouse gas that is 23 times more harmful to the climate than carbon dioxide CO2. In landfills equipped with current methane capture equipment about 20% of the methane continues to be released. Captured methane is flared or fed to engines to generate power. At the Trail Road Landfill, methane is captured and fed to the same type of engines that PlascoEnergy will use to produce power.

Global Warming Potential (GWP): a measurement of how much a gas has an effect on global warming. All gases are compared relative to CO2.

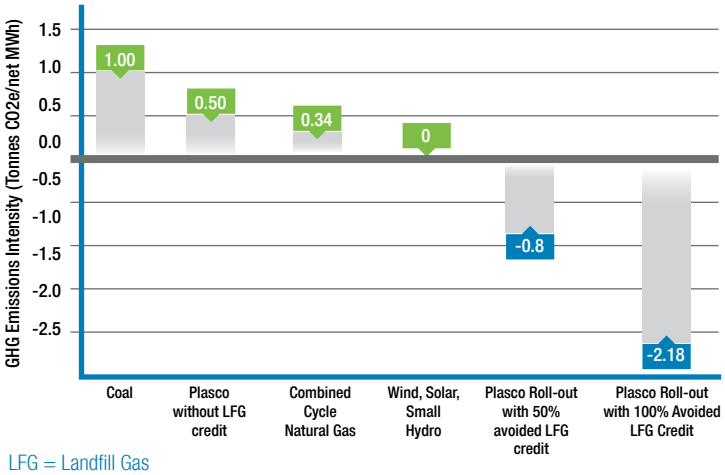
CO2 = 1; Methane = 23

* CO2e: the mass of CO2 that has an equivalent effect on global warming of any greenhouse gas. CO2e is used under the Kyoto protocol as a basis of comparison for greenhouse gas sources and sinks.

With PlascoEnergy's process no methane is released. Operating in combined cycle, less than 0.5 tonnes of CO2 per MWh is released from the engine exhaust. This is half of the CO2/MWh released from coal fed power generation and slightly more than the CO2/MWh released from natural gas fed power generation.

Since the PlascoEnergy process eliminates waste going to landfills, it also eliminates the methane release associated with landfilled waste. Therefore, the PlascoEnergy process generates 'carbon credits' because the CO2e* saved from preventing methane being released into the atmosphere is greater than the CO2 emission from the engines.

Greenhouse Gas Reductions per Net MWh of Generation



LFG = Landfill Gas




PlascoEnergy GROUP

What Becomes of the Waste?

Per Tonne	Type	Per 1000L (m^3 or 250Kg) of MSW
1150 KWh	Energy (KWh)	290 KWh
45 days	Energy (household use**)	11 days
150 Kg	Vitrified Slag	15 L
5 Kg	Sulphur	<1 L
1.3 kg	Heavy metals and particulate	<0.5 L
763 L	Water to discharge	190 L

****Household:** households include single family homes, row houses, condominiums and apartments. The energy required per household (750 KWH/month) is an average of all types of households.

Some everyday electricity uses: