

Presentation at NAWTEC 18, Orlando, FL May 12, 2010

CHLORINE SOURCES, SINKS, AND IMPACTS IN WTE POWER PLANTS

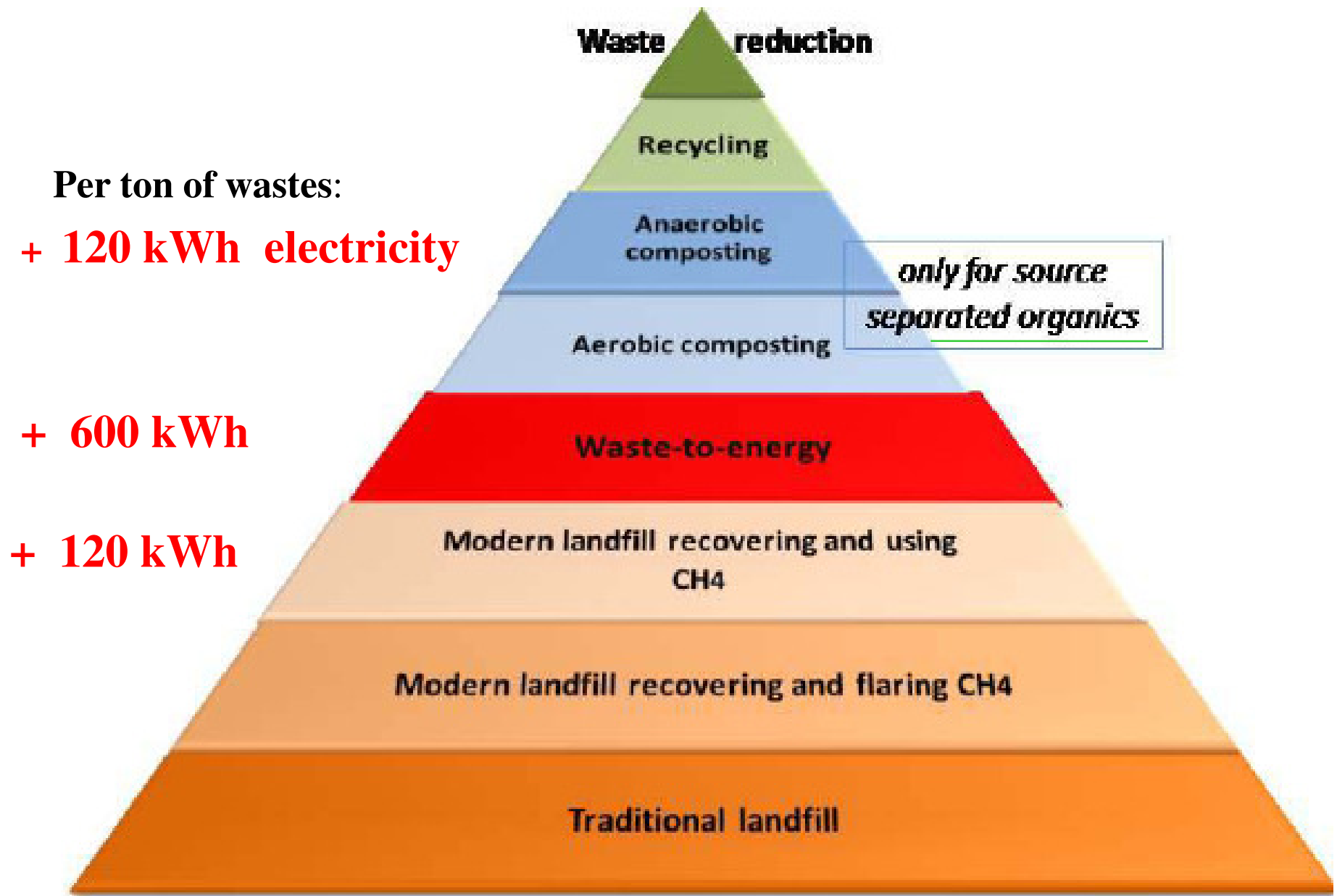
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The Hierarchy of Waste Management (EEC)

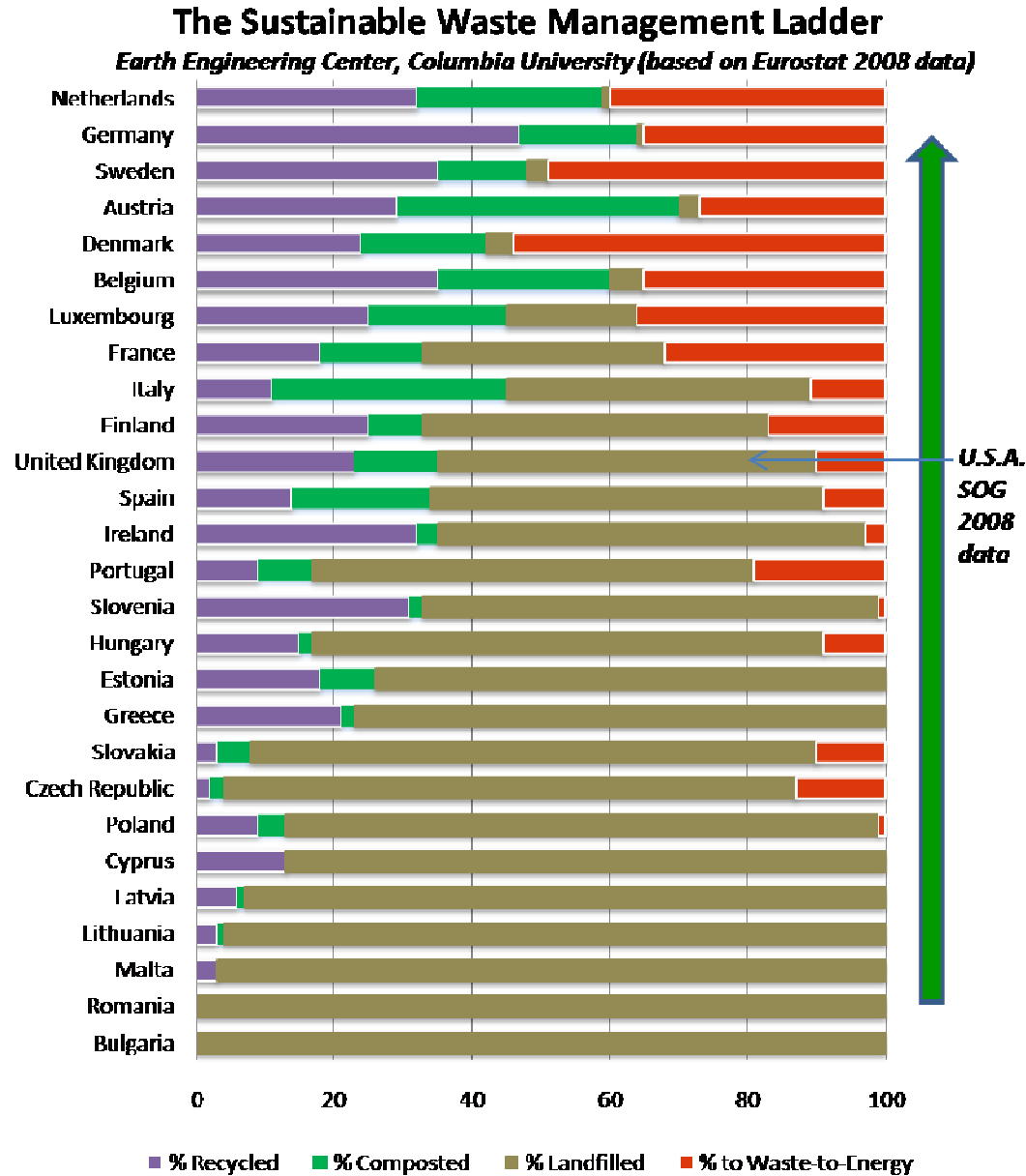


Sustainable Waste Management: The global experience

- There are only two alternatives to manage post-recycling MSW: a) by landfilling, or b) by combustion with energy and metals recovery: Waste-to-Energy (WTE; also called energy from waste or EfW).
- As shown in following slide, countries that use WTE also have strong /composting efforts.

Recycling/composting and Waste to Energy are complementary

Japan



Concentration of Chlorine in three types of MSW

	New York City MSW	U.S. typical MSW	U.K. typical MSW	U.S. coals, average
Total Cl, g/kg	4.71	7.26	4.53	0.4-1
%	0.471	0.726	0.453	0.04-0.1

Concentration of Chlorine in U.S. coal: 0.1% Cl

Five time lower than in MSW

Materials contributing to Chlorine in MSW

	% of component in MSW	Chlorine concentration in component, g/kg	Chlorine in MSW, g/kg
Paper	29.4	2	0.59
Plastics	10.4	25	2.60
Organics	34.7	3	1.04
Textiles	4.4	12.5	0.55
Wood	2.7	12.5	0.34
Miscellaneous combustibles →	5	12.5	0.63
Glass	4	0.6	0.02
Metals	4.7	0.6	0.03
Misc. non-combustible	4.7	0.6	0.03
Total	100		5.82 (0.58%)

Table 3. Contribution of MSW components to its chlorine content

Contribution of MSW components to its chlorine content

Material in MSW	Percent contribution to chlorine content
Paper	10.1%
Plastics	44.7
Organics	17.9
Textiles	9.4
Wood	5.8
Miss. Combustible	10.7
Glass	0.4
Metals	0.5
Miss. Non-combustible	0.5
Total	100.0%

Combustion gas volume from MSW: 5,000 Nm³/ton

Combustion gas volume from U.S. coal: 10,000 Nm³/ton

Therefore:

Concentration of HCl in combustion gas of MSW
power plants : $5 \times 2 =$
 $=10$ times higher than in coal-fired power plants

Who should complain of chlorinated plastics in MSW?

- **HCl is main cause of corrosion in boilers**
- **HCl corrosion is accelerated at temperatures of over 400°C**
- **WTE power plants must operate at lower superheater tube temperature than coal PP**
- **That's main reason that WTE PP have lower thermal efficiency than coal PP**

However, removing chlorinated plastics from MSW would have no effect on dioxin formation (as believed by people who demonize plastics)

- **Dioxins in combustion gas (before Air Pollution Control system):**

0.00000005 grams TEQ/ Nm³

- **Chlorine in combustion gas:**

0.500 grams HCl/Nm³

- **Dioxins in stack gas (after APC system):**

0.00000000005 grams TEQ/Nm³

- **Chlorine in stack gas, about 3% of chlorine before APC, i.e**

0.015 grams/Nm³

Distribution of chlorine in WTE bottom ash, fly ash, and combined ash

Element	Bottom ash		Fly ash		Combined ash	
	g/kg	%	g/kg	%	g/kg	%
Calcium	46.00	4.6	206.3	20.6	59.12	5.91
Sodium	4.01	0.4	18.87	1.89	5.18	0.52
Chlorine	ND	ND	165.0	16.5	22.12	2.21
Aluminum	16.53	1.65	19.43	1.94	13.40	1.34
Iron	18.17	1.82	3.45	0.35	19.75	1.98
Lead	0.8	0.08	3.55	0.36	0.83	0.08
Magnesium	5.52	0.55	5.27	0.53	6.60	0.66
Zinc	1.38	0.14	8.75	0.89	2.25	0.23

¹A.M. Szurgot, 1992 International Public Works Congress and Exposition, Boston, Aug. 29, 1992 (data from 825,000 t/y WTE)

Controlling effect of Chlorine in combustion gases?

Injection of sequestering agent above grate?

-Columbia University tests (Dr. Shang Hsiu Lee)

-FuelTech tests

-More research is needed and is warranted by magnitude of problem/

**Your last chance to nominate city practicing
Sustainable Waste Management: May 30, 2010**

Please look up Call for
Nominations in
www.wtert.org and send
nomination to
earth@columbia.edu

