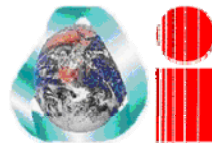


WTERT 2008 Bi-annual Meeting

THE GOVERNMENT ROLE FOR SUSTAINABLE WASTE MANAGEMENT IN NORTH AMERICA

Prof. Nickolas J. Themelis
Director, Earth Engineering Center, Columbia University,

WTERT



**Waste-To-Energy Research
and Technology Council**

U.S. MSW generation, recycling and post-recycling, 2004

Columbia/ BioCycle survey (BioCycle, April 2006)

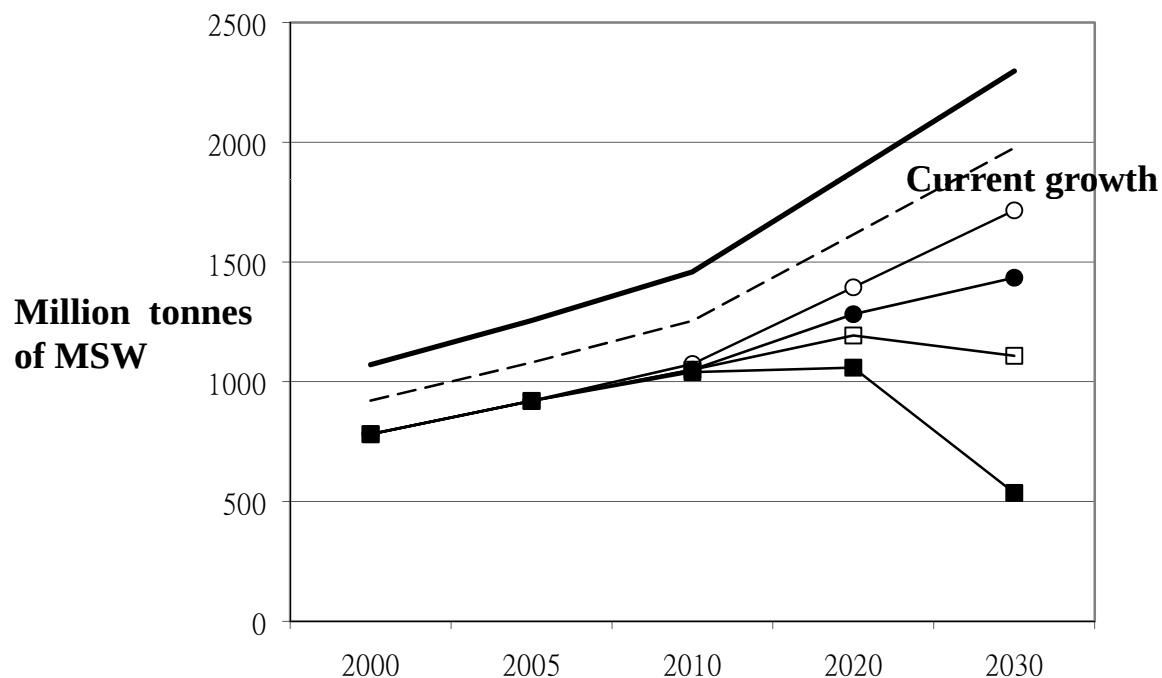
	MSW Generated	Recycled / composted	Waste-to- Energy	Landfilled
2004, mil. U.S. tons	388*	110	29	249*
2004, percent	100%	28.5%	7.4%	64.1%
2004, New York	100%	43.0%	19.5%	37.5%
2004, California	100%	39.6%	1.5%	58.9%

***Note:** The EPA 2008 GHG Report uses the Columbia/BioCycle (LF: 249 Mt) and not the Franklin data

Estimated Global Disposition of Post-Recycling Municipal Solid Wastes (in million metric tonnes)

- **Combustion with energy recovery: 170 Mt**
- **Landfilled, partial methane recovery: 200 Mt**
- **Landfilled without methane recovery: 800 Mt**

Tonnes of MSW generated and landfilled at current rate of WTE growth and at 2.5%, 5%, and 10% growth



Global Potential of WTE and LFG Capture to Mitigate Methane Emissions From Landfills, 2000-2030, E. Matthews, NASA Goddard Institute for Space Studies, and N.J. Themelis (Sardinia Landfill Symposium, October 2007)

Conclusion of Columbia study:

- **At current rate of growth of WTE industry, WTE cannot catch up with global generation of MSW**
- **To reduce GHG emissions of waste management, it is necessary to increase rate of WTE growth and also of global capture of landfill gas (LFG).**

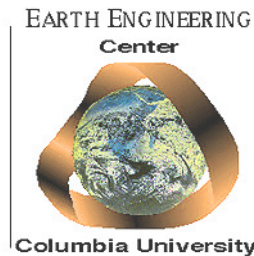
Energy and GHG reduction potential of Controlled Combustion with energy recovery (Waste-to-Energy or WTE)

- **Potential for GHG reduction: 924 million tonnes CO₂**
- **Potential for generation of electricity: 480 billion kWh/y**

Plus land conservation (vs modern landfilling), estimated at about 40 square kilometers per year, globally

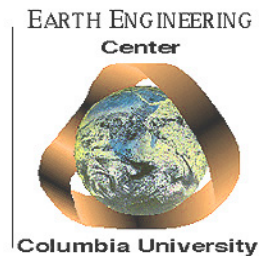
Ongoing study of
Center for Sustainable Use of Resources (SUR):

- **The U.S. is the world's largest landfiller, with 24% of the total MSW landfilled.**
- **The U.S. is the world leader in capturing landfill methane, with about 60% of the LFG captured globally.**



Ongoing study of
Center for Sustainable Use of Resources (SUR):

- **The EPA hierarchy of waste management should be expanded so as to differentiate between better and worse types of landfills.**





Present hierarchy of waste management

Over most of the globe:



Modern “sanitary” landfills are much better than the old ones. They control liquid emissions and 50-60% of gas emissions –they will still be used in the near future



Los Puentes Landfill, LA, CA



Need to expand hierarchy of waste management

What is the role of governments in reducing GHG emissions of waste management? The future has already happened:

- **Japan has made landfilling very costly, even for WTE ash that must be vitirfied**
- **EU's Landfill Directive: Phase out landfilling**
- **Singapore, no landfilling, no export of MSW**
- **China.....CHINA???**

CHINA: An Emerging WTE Giant

- **China is the world's second largest landfiller (after the U.S.).**
- **Only 20% of China's MSW goes to sanitary landfills at this time**
- **The rest is deposited at rudimentary landfills without liner, gas collection, or leachate treatment system.**
- **China is the world's largest emitter of landfill methane**
- **However, China has already over 70 WTEs of various types (President Tang, CQUST, WTERT 2008)**

A driving force in China: PRC provides a \$0.03/kWh credit for WTE electricity

WTE is a major source of Renewable Energy in U.S.

Energy source	Billion kWh generated	% of total renewable energy
Geothermal	13.52	28.0%
WTE (from only <u>7.4%</u> of the MSW)	13.50	28.0%
Landfill gas (from <u>64.1%</u> of the MSW)	6.65	13.8%
Wood/other biomass	8.37	17.4%
Solar thermal	0.87	1.8%
Solar photovoltaic	0.01	0.0%
Wind	5.3	11.0%
Total	48.22	100.0%

1 U.S. ton of MSW=550 kWh==1 barrel of oil

**What the U.S. government should do: SWPD-
ASME White Paper to U.S. Congress
(www.wtert.org)**

- **EPA to promote WTE (as well as it has done for Landfill Gas capture and use)**
- **EPA to take an active part when new WTE projects are proposed by community leaders**
- **Federal government to provide a renewable energy credit for at least the biomass fraction of MSW (65%)**

Taiwan WTE Observation Deck on Stack





Taiwan WTE:
Not your usual
stack