

*2nd Workshop on "Short and Long-Term Solutions for MSW Management Problem in Indian Cities", New Delhi February
February 22, 2013*

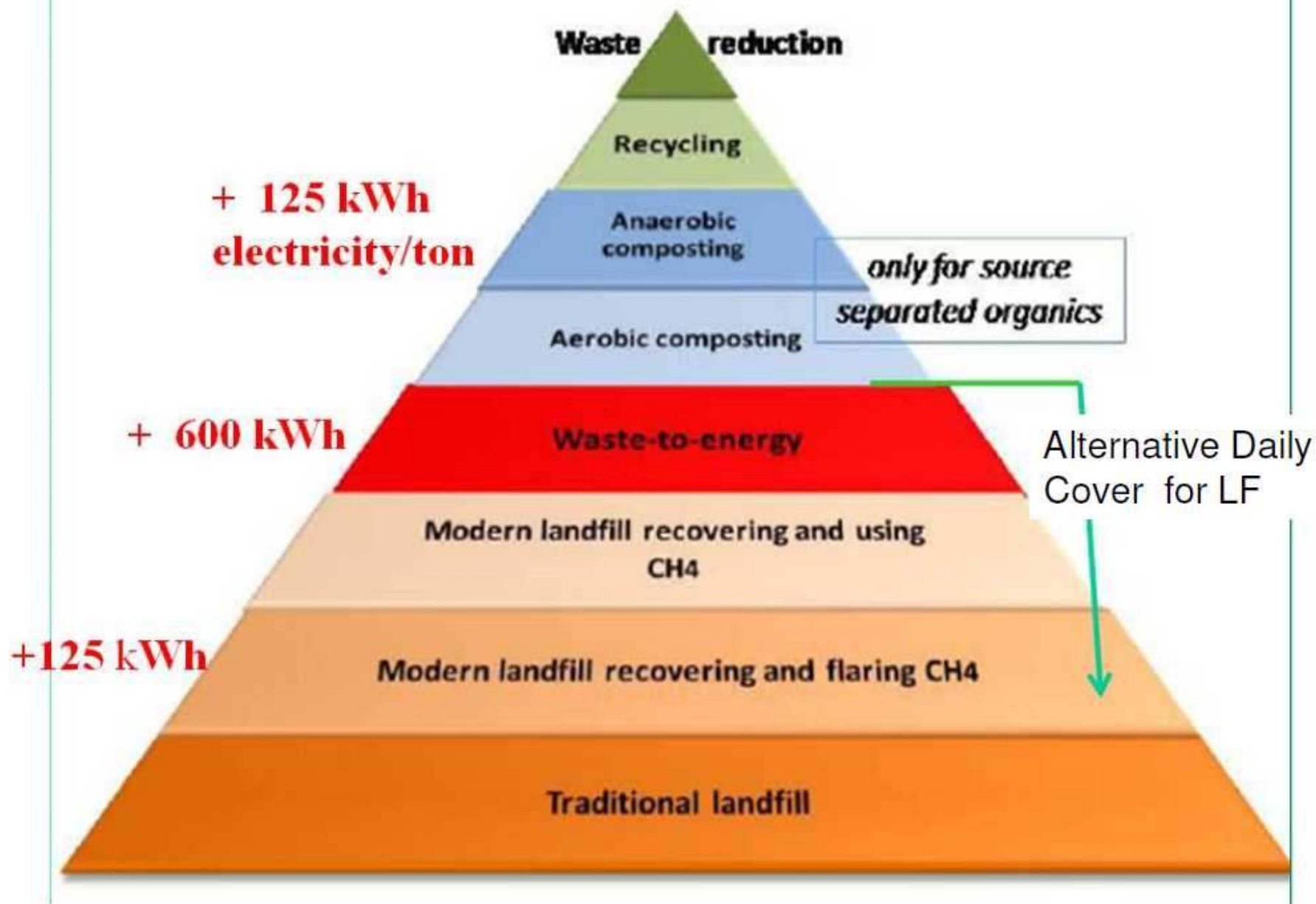
WHAT INTERNATIONAL EXPERIENCE HAS TAUGHT US ABOUT MANAGING THE URBAN SOLID WASTES

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Expanded Hierarchy of Waste Management



INCREASING RECYCLING IN DEVELOPING COUNTRIES

- Least costly way for municipal government to increase Recycling:
 - Ask citizens to separate their MSW to a) Designated recyclables, and b) trash to be landfilled or sent to WTE plants
- Encourage the informal recycling sector (scavengers) to collect the Recyclable stream
- Provide for collection of Recyclables that are not collected by scavengers and transport them to Materials Recovery Facility (MRF)

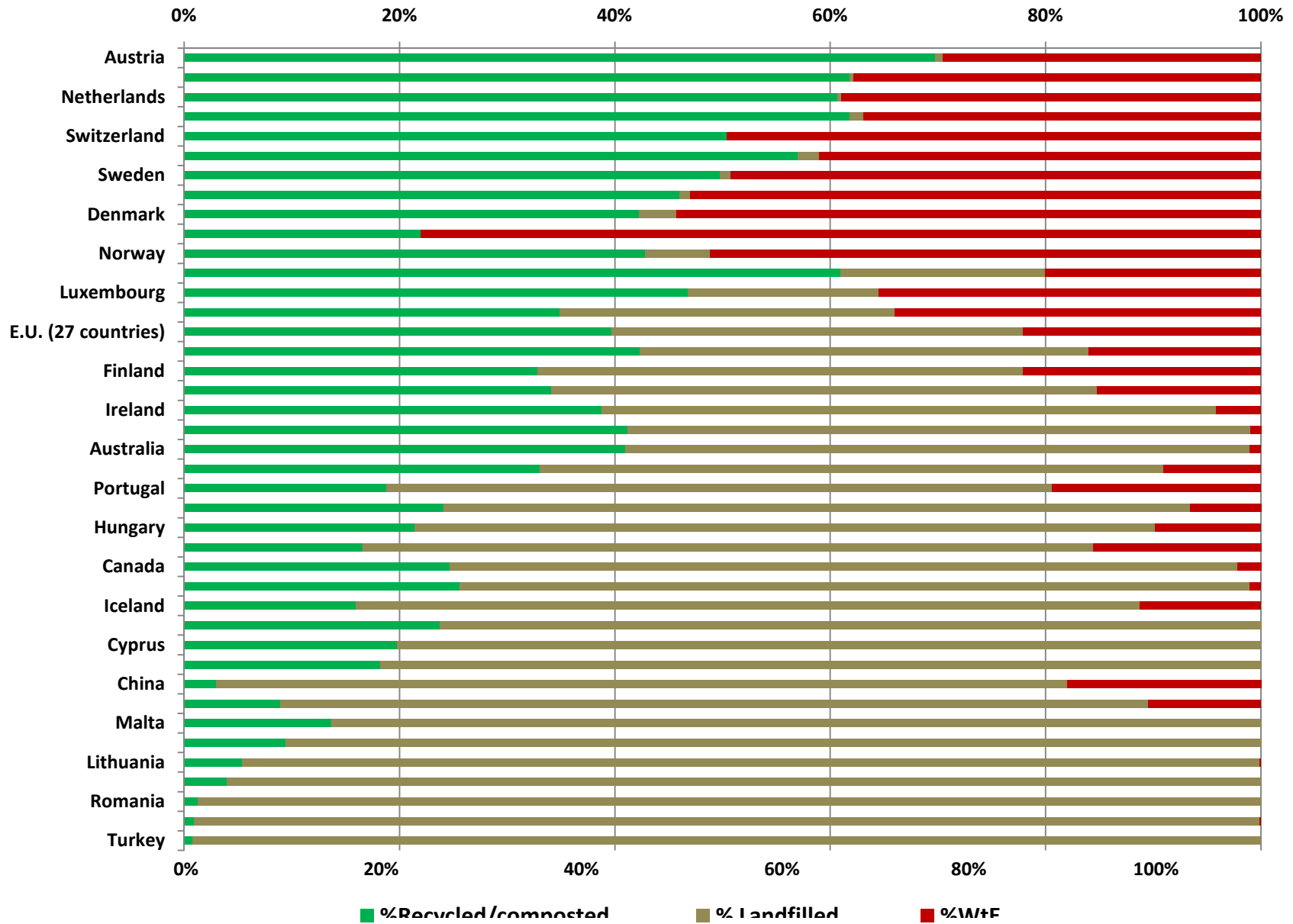
INCREASING COMPOSTING IN DEVELOPING COUNTRIES

- Least costly way for municipal government to increase Composting: Provide a windrow composting center where municipality and citizens transport their park/yard wastes and get compost product to be used as soil conditioner
- Next and more costly means: Anaerobic Digestion facility where source-separated food wastes from large generators (institutions, food processors) are treated to produce methane and a compost product.

NOW: WHAT TO DO WITH POST-RECYCLING WASTES?

- There are only two proven alternatives to waste dumping for India: Sanitary landfilling protects ground and surface waters and cuts down GHG emissions by about one half (0.5 ton GHG/ton MSW). It costs \$100-200 per annual ton of capacity and uses one square meter of land for every 10 tons of MSW landfilled
- Gasification/combustion with energy recovery (Waste to Energy or WTE). The dominant process (combustion on a moving grate) costs \$300-600 per ton of annual capacity but has an electricity revenue of \$60/ton (at \$100/MWh)

The EEC "Ladder" of Sustainable Waste Management

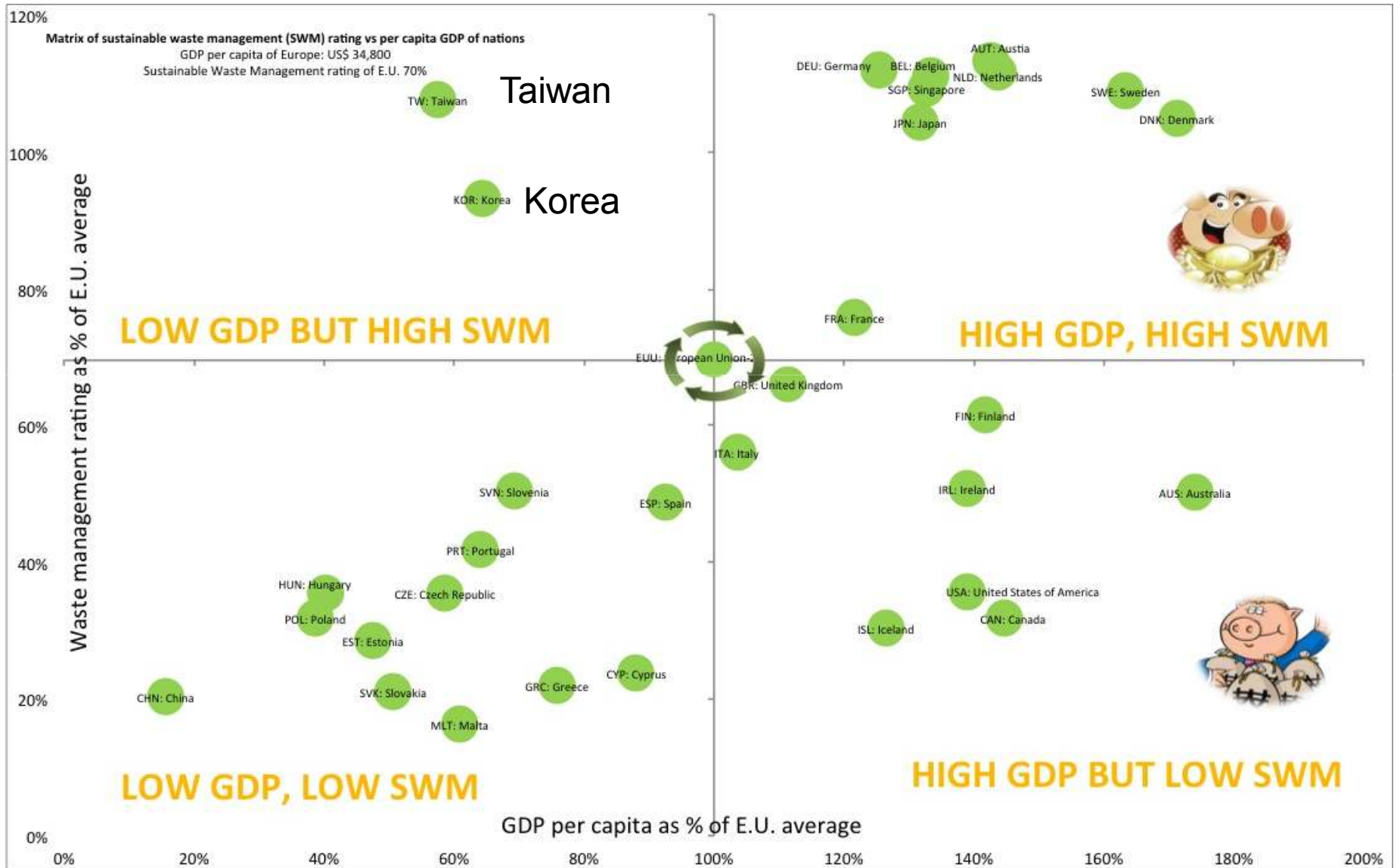


WTERT CONTACTS, 2002-2012 (by GDP/PPP per capita) (one or more WTEs)

COUNTRY	GDP/cap	COUNTRY	GDP/cap	COUNTRY	GDP/cap	COUNTRY	GDP/cap
Qatar	\$104,300	Germany	\$38,400	Greece	\$26,600	Panama	\$14,300
Bermuda	\$69,900	Taiwan	\$38,200	Portugal	\$23,700	Bulgaria	\$13,800
Singapore	\$60,500	Belgium	\$38,200	Barbados	\$23,700	Costa Rica	\$12,100
Norway	\$54,200	Denmark	\$37,600	Hungary	\$19,800	Brazil	\$11,900
Hong Kong	\$49,800	Finland	\$36,700	Argentina	\$17,700	Serbia	\$10,800
Ireland	\$49,100	U.K.	\$36,600	Chile	\$17,400	Azerbaijan	\$10,300
United States	\$49,000	France	\$35,600	Russia	\$17,000	Thailand	\$9,500
U.A.E.	\$48,800	Japan	\$35,200	P. Rico	\$16,800	Jamaica	\$9,100
Switzerland	\$43,900	S. Korea	\$32,100	Botswana	\$16,200	Ecuador	\$8,600
Cayman Isl.	\$43,800	Israel	\$31,400	Malaysia	\$15,800	China	\$8,500
Austria	\$42,400	Bahamas	\$31,400	Lebanon	\$15,700	Egypt	\$6,600
Canada	\$41,100	Italy	\$30,900	Mauritius	\$15,100	India	\$3,700
Sweden	\$40,900	Cyprus	\$29,400	Mexico	\$14,800	Nigeria	\$2,600
Australia	\$40,800	Czech Rep.	\$27,400	Turkey	\$14,700	Sierra L.	\$900

The EEC Matrix of Sustainable Waste Management and GDP

(on PPP basis), Bourtsalas and Themelis, *Waste Management World*; in press



The Global Landfilling Picture

(N.J. Themelis and P. Ulloa, "Methane generation in landfills", *Renewable Energy* 32 (2007) 1243-1257)

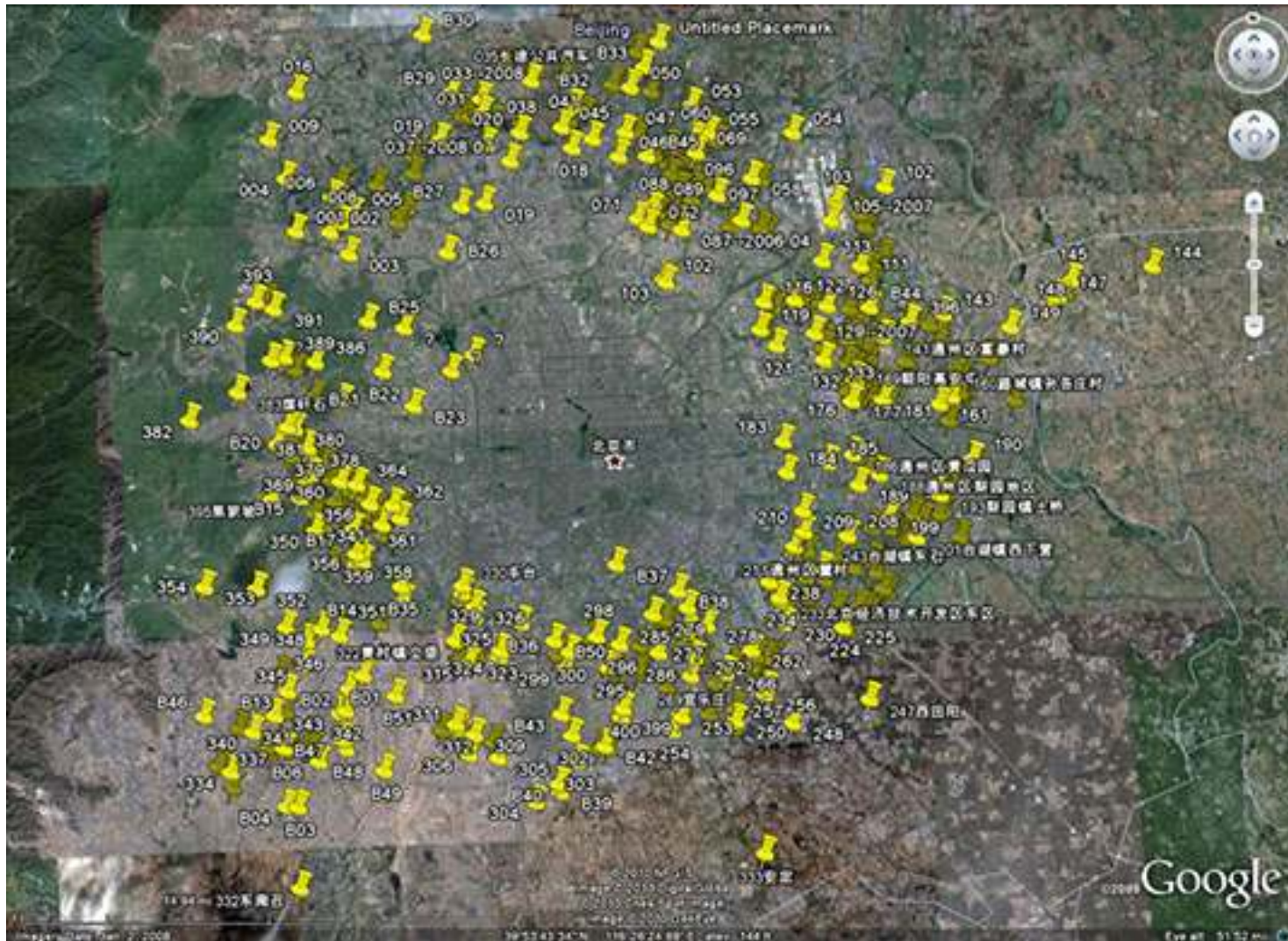
- MSW to global landfills: **1 billion tons/y**
- Landfill Gas (LFG) generation: **50 million tonnes CH₄**
- LFG collected and used or flared*: **6 million tonnes CH₄**
- LFG emitted globally: **44 million tonnes CH₄***

***Equivalent to 920 million tons of CO₂**

(over 3% of global Greenhouse Gases (GHG))

Projected to double by 2030

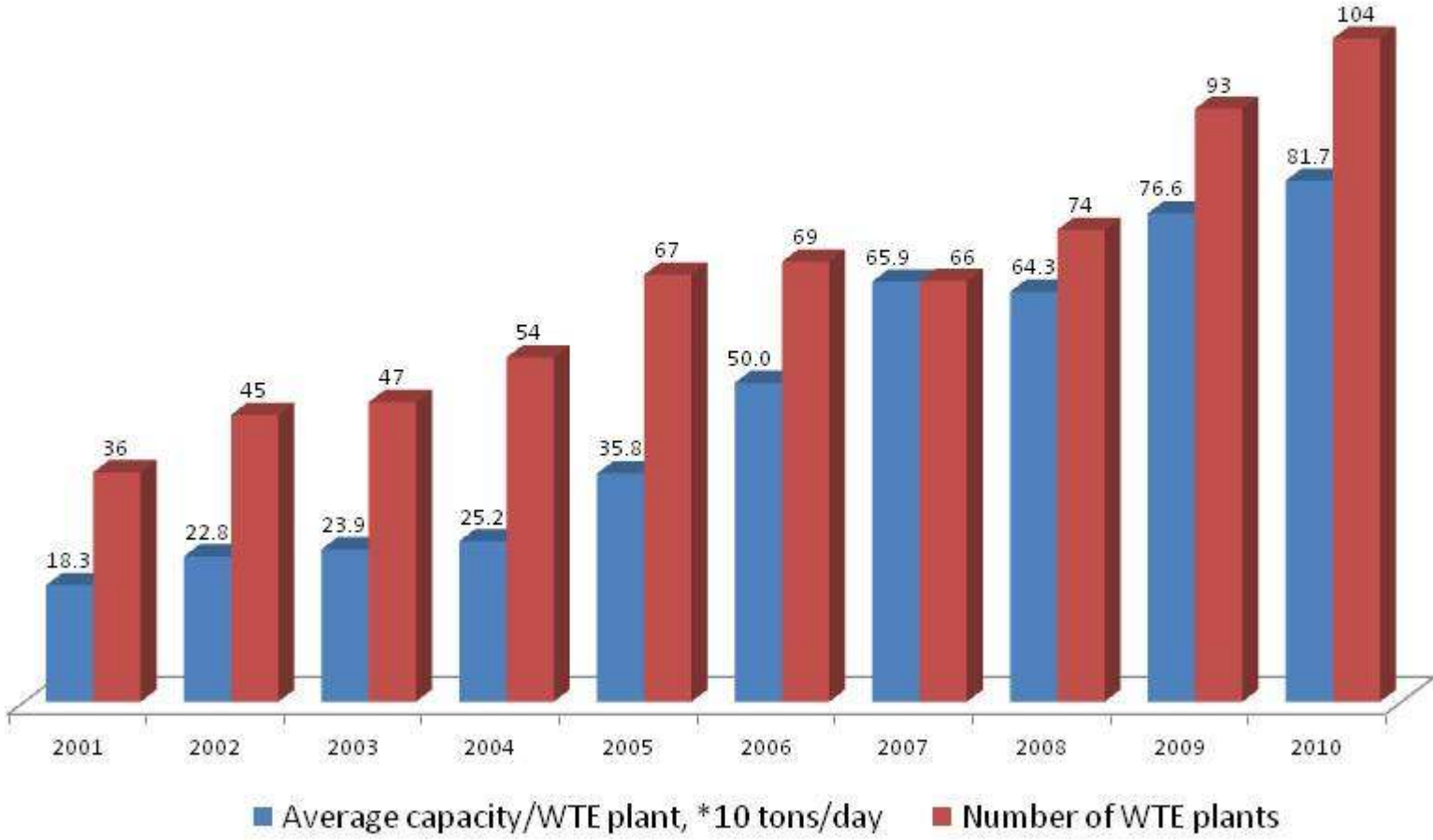
Landfilling consumes land: For example Beijing is literally surrounded by hundreds of landfills



Source: Extraordinary film by Wang Juliang, shown at CU by EEC



Growth in number and average capacity of WTE plants in China



Source: EEC/WTERT Theses of Yāni Dong (2011) and Ling Qiu (2012)

National PRC policies for encouraging WTE

Policy name	Purpose	Implementation
Announcement for Improving WTE Electricity Pricing (2012)	Price subsidy for electricity sold to the grid	\$30 per MWh over price of fossil fuel electricity
Announcement of Value-added Tax Policy for Comprehensive Utilization of Resources (2008)	Value-added Tax return for Renewable Energy	Return of the value-added tax to electricity provider
Regulations for Implementation of the Enterprise Income Tax Law of PRC (2007)	Income tax reduction for enterprises in the field of Environmental Protection	Waive 100% of income tax for first three years after project starts earning income and 50% tax waiver for Years 4-6
National 11th “Five-year Plan” for Building Harmless MSW Treatment Facilities	Encourage municipal governments to design policies that stimulate the development of WTE plants	Set a goal of 35% WTE rate for MSW treatment in east coast cities

Also: Capital investment in China: \$200/ton WTE capacity!!!!
(Ling Qiu, M.S. Thesis, EEC 2012)

In closing, some highlights of the Global WTERT Council

- Global WTERT Council was formed in December 2011 and by now consists of thirteen national organizations, including China and India
- GWC salutes the newly formed (2012) organization of WTERT-India who helped put together the New Delhi and the Mumbai Workshops. Our special thanks to Messrs. Sunil Kumar of NEERI and Ranjith Annepu of EEC.
- We hope that Indian industry and government will continue supporting WTERT-India in its efforts to advance waste management in India.

Some highlights of the Global WTERT Council

- Prof. Marco Castaldi (EEC) textbook on WTE technology; to be used in 2013 WTE courses at City College of New York and Columbia University
- WTE volume edited by Themelis in 18-volume Encyclopedia of Sustainability (Springer)
- Themelis appointed author of WTE section in IPCC 5th Assessment Report
- One-week intensive course on SWM in Athens (June 2012); the next in Baku, Azerbaijan (June 2013)

In 2013:

- Resumption of EEC Survey of Waste Generation and Disposition in the U.S.
- Main task: To determine reasons for difference in landfilling numbers by 131 million tons, between EPA and Columbia/BioCycle surveys

Read about all 2012 and 2013 GWC publications and other activities in various national WTERT web pages (e.g., www.wtert.org. www.wtert.in)

Thank you!



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