Training Workshop of Waste to Energy for North Africa

December 5th to 6th, 2022 (Online)

Reda M. Kabbaj
Co-Chair WtERT Canada
Vice-President International Relations, GWC
Research Associate, EEC, Columbia University
December, 2022

What is WtERT?

Recognized as one of the world's foremost research centers on thermal conversion of waste (experimental and analytical)

The Waste-to-Energy Research and Technology Council (WtERT) was founded in 2002 by the Earth Engineering Center of Columbia University in New York.

The Earth Engineering Center is the engineering unit of Columbia University's Earth Institute. It's mission is to develop technologies that can help in the sustainable development of the Earth's resources: Minerals, energy, water, and the environment.

Over the years, universities and organizations in several other countries created WtERT organizations resulting in the formation, in 2011, of the Global WtERT Council, Inc. (GWC). GWC is now a non-profit corporation registered under the laws of New York State and the U.S. and brings together engineers, scientists and managers from universities and industry in several countries to develop solutions to major environmental problems.

Our Mission

More than 20 years of continuous research and dissemination of knowledge

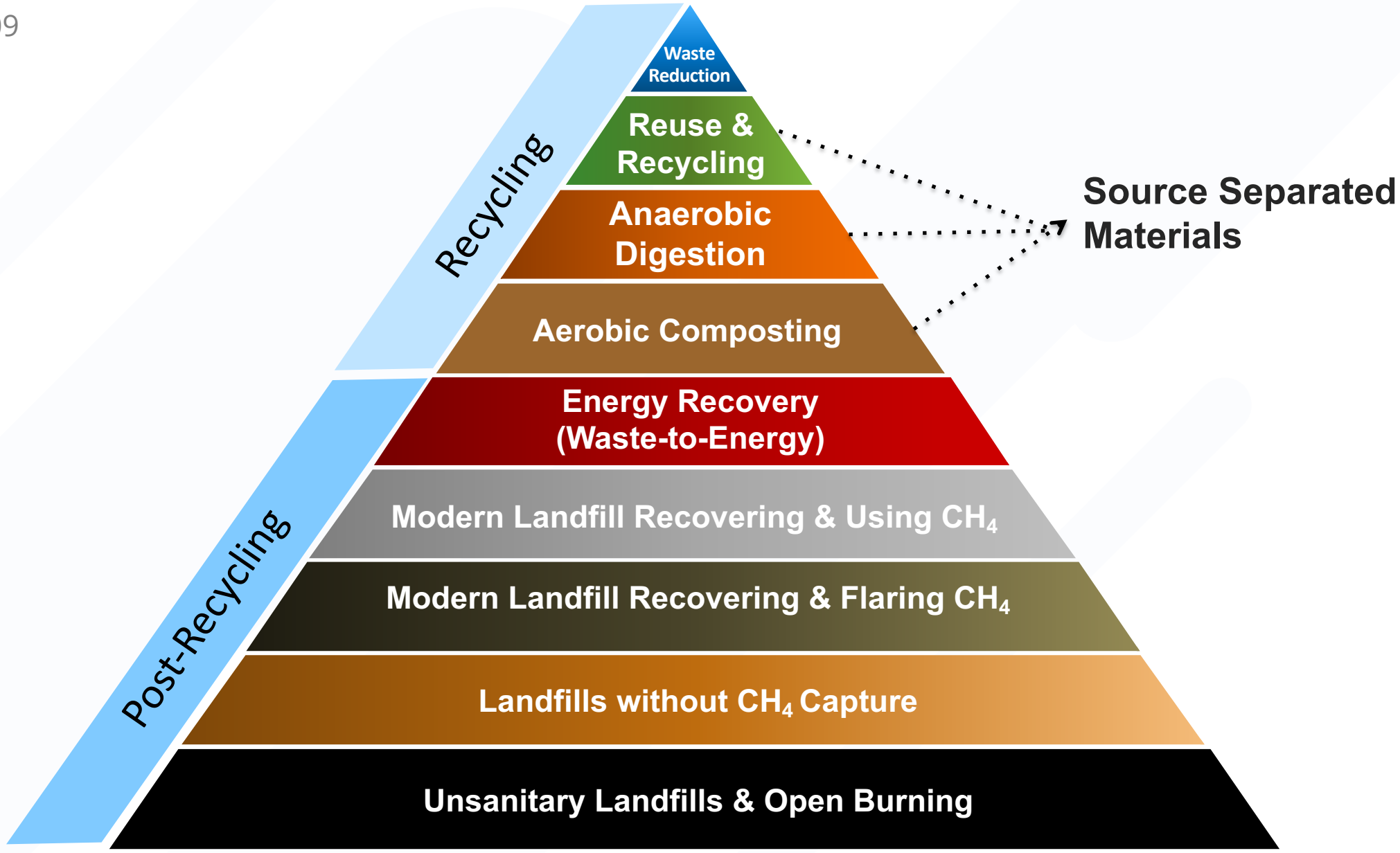
The mission of GWC is to:

- identify the best available technologies for the recovery of materials and energy from urban and other residues of human activity
- conduct research and development as required, and
- disseminate this information by means of its publications, the web, and periodic Meetings.

In particular, the objectives of the GWC member organizations are to increase resource recovery from used products and minimize the environmental impacts of waste disposal, worldwide. The guiding principle of GWC is that the sustainable management of wastes must be based on science and best available technology and not what seems to be inexpensive now but can be very costly in the near future.

The GWC hierarchy of waste management

EEC 2009



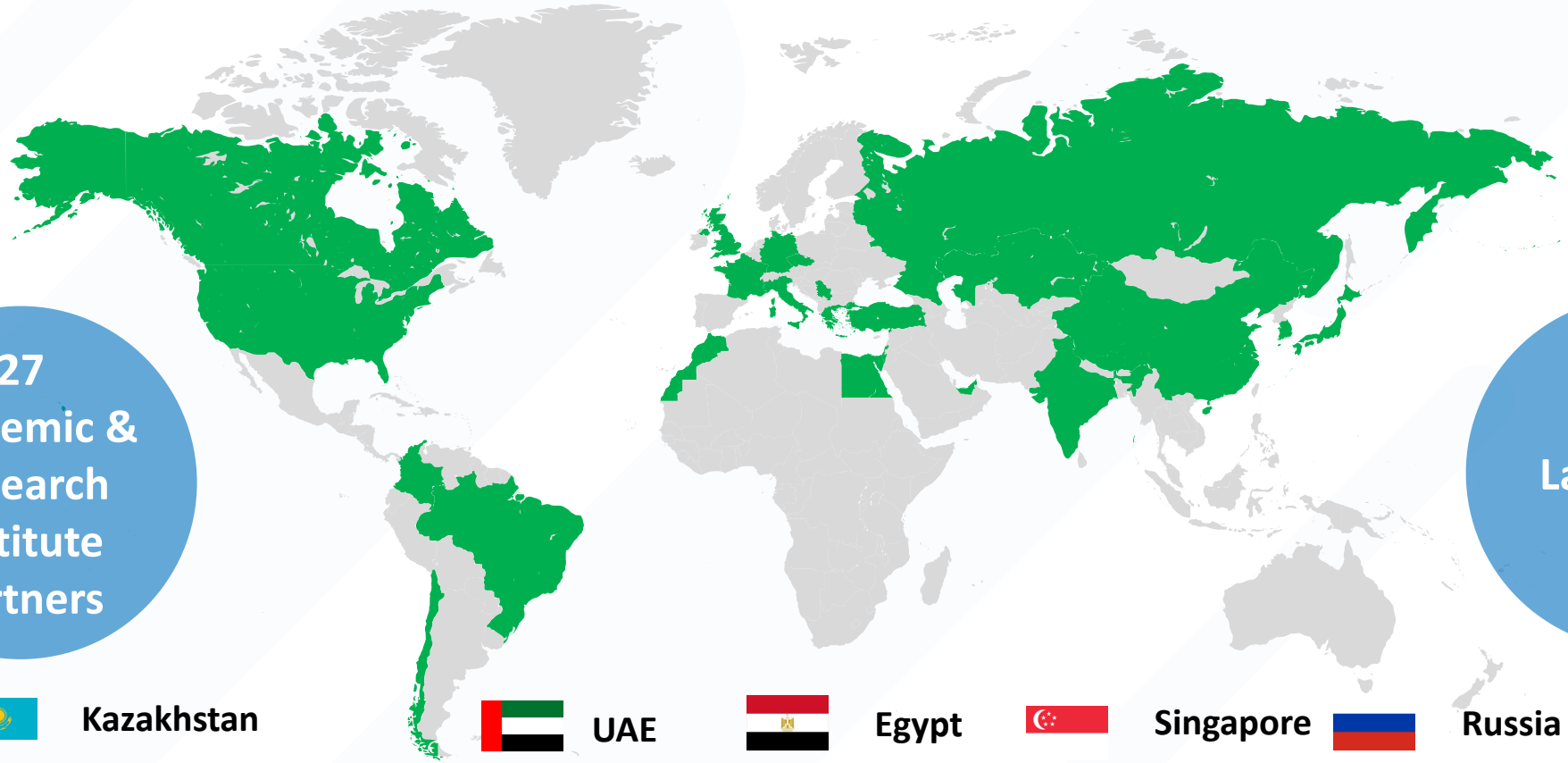
OUR Global Reach

24 Nations

5 Continents

27 Academic & Research Institute partners

19 Languages spoken



U.S.A
Kazakhstan
UAE
Egypt
Singapore
Russia
Israel
Canada
France
Germany
Greece
China
India
Chile
Italy
Turkey
South Korea
Japan
Brazil
U.K.
Colombia
Morocco
Czech Republic

Team Members

Team members of Global WtERT Council

Nickolas J. Themelis

President Global WtERT Council

Werner Bauer

Vice-President

Thanos Bourtsalas

Vice-President Global Development

Hanwei Zhang

Vice-President Engineering

Qunxing Huang

Vice President, Academic

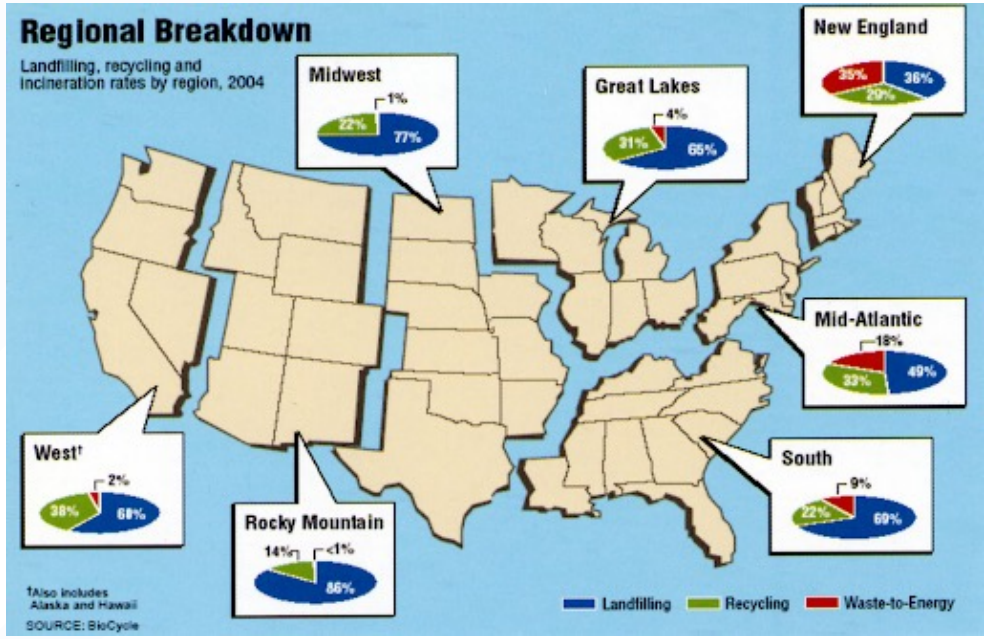
Reda M. Kabbaj

Vice-President International Relations
Co-Chair WtERT-Canada

Major achievements of GWC since its inception

Research papers: The web page www.wtert.org, under Publications-Theses, provides the results of over eighty GWC-sponsored studies on all subjects of waste management. Many of these theses and hundreds of technical papers have been published and are cited in the technical literature.

U.S. Survey of Waste Management: Since 2004, Columbia University, GWC has carried out a bi-annual survey of waste management in the fifty states of the U.S. The results of this study have been used by the Environmental Protection Agency in computing the greenhouse effects of managing municipal solid wastes in the U.S.



Major achievements of GWC since its inception

Through its research, training and global partnerships, it mobilizes science and technology to advance sustainable development

International recognition:

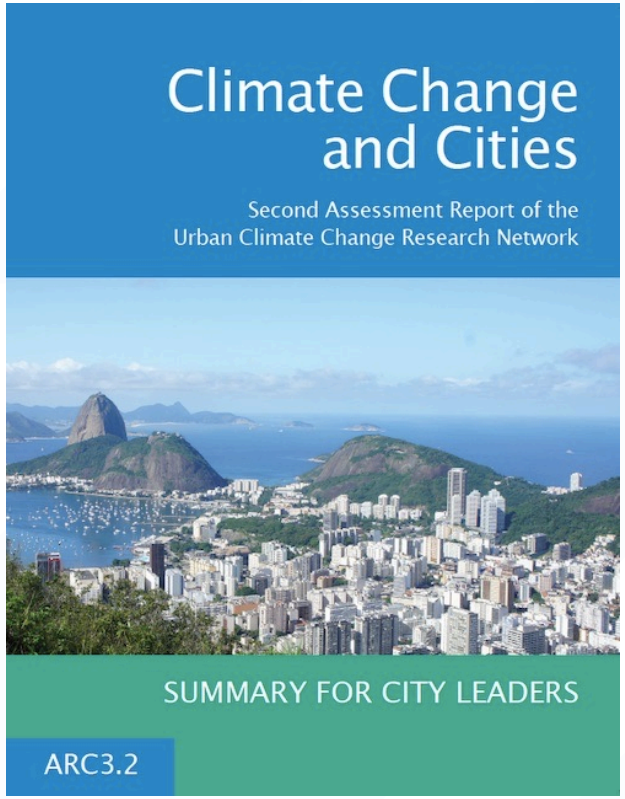
- GWC has been recognized by the most prestigious awards of the Materials and Energy Division of the American Society of Mechanical Engineers and by the Confederation of European Waste to Energy Plants (CEWEP).

- GWC co-authored the Waste Management section of the 2015 Assessment Report of the Intergovernmental Panel for Climate Change (IPCC).

- GWC was member of the the technical advisory panel of Singapore’s Environmental Protection Agency for the development of environmental guidelines for the beneficial utilization of Waste-to- Energy Bottom Ash.

Major achievements of GWC

Co-authoring UCCRN report presented at COP-21

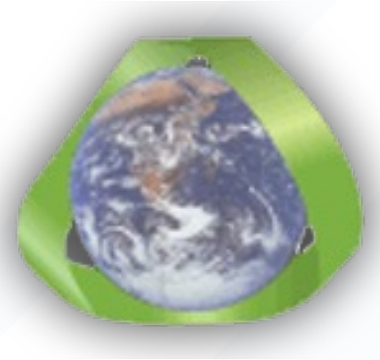


Prof. Thanos Bourtsalas is co-author of the Waste Management Chapter in the Second Assesment Report of the Urban Climate Change Research Network (UCCRN), a joint effort between the Earth Institute and the UN presented in COP21 and in UNHQ.

Including WTE in IPCC 2014 Report

Due to extensive GWC efforts WtE was for the first time acknowledged as Sustainable Waste Management (SWM) technique including the SWM ladder and SWM hierarchy and as such mentioned in IPCC 2014 report. In 2007 only recycling and composting was referred as such.

Major achievements of GWC



SOFOS Search Engine

Earth Engineering Center

Columbia University

SOFOS Search Engine is the most comprehensive on line database under the auspices of the GWC and the Earth Engineering Center of Columbia University. SOFOS contains numerous publications and dissertations regarding advancing Sustainable Waste Management.

The President's Global Innovation Fund Columbia Global Centers

The third round of grants from the President’s Global Innovation Fund

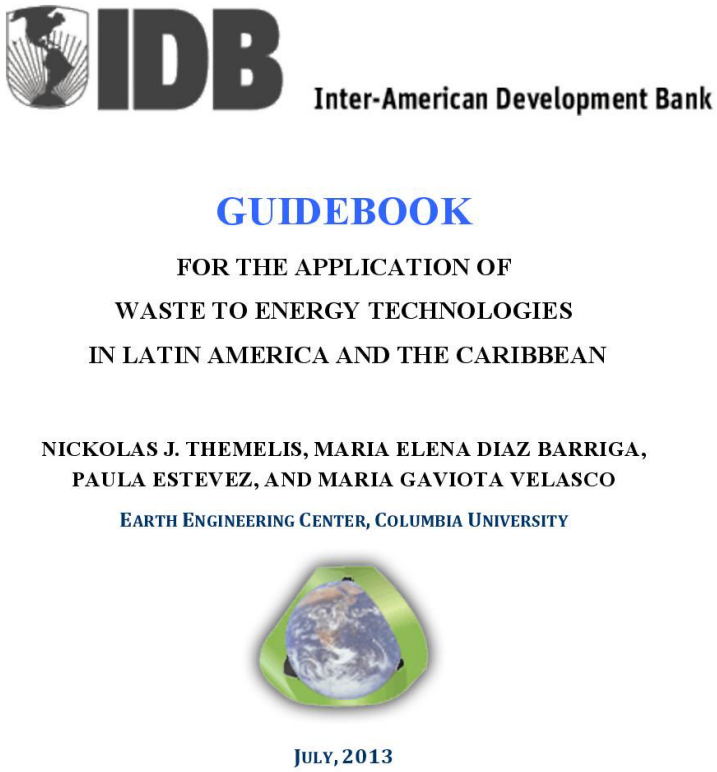
Nickolas J. Themelis is one of the faculty winners of the Columbia University 2015 President’s Global Innovation Fund grants for the project titled, “Advancing Sustainable Waste Management in Latin America and Disseminating the Results to Other Developing Regions”.

The purpose of the Fund is to support faculty who are developing projects that increase opportunities for research, teaching, and service around the world.

Guidebook on Sustainable Waste Management

In 2011, the Inter-American Development Bank (IADB) engaged the Earth Engineering Center of Columbia University to put together a Guidebook on Sustainable Waste Management that guides Latin American and Caribbean cities how to proceed with selecting the best waste management technologies and executing multi-million projects.

This Guidebook is available on Google and by now has been translated into Portuguese, Spanish, and Greek; Chinese edition is under way by the GWC regional organization WtERT-Asia.



IDB Inter-American Development Bank

GUIDEBOOK

FOR THE APPLICATION OF
WASTE TO ENERGY TECHNOLOGIES
IN LATIN AMERICA AND THE CARIBBEAN

NICKOLAS J. THEMELIS, MARIA ELENA DIAZ BARRIGA,
PAULA ESTEVEZ, AND MARIA GAVIOTA VELASCO

EARTH ENGINEERING CENTER, COLUMBIA UNIVERSITY

JULY, 2013

PLEASE NOTE: THIS GUIDEBOOK IS STILL UNDER FINAL REVIEW BY IDB, BUT IT HAS BEEN RELEASED FOR DISTRIBUTION

WTE Guidebook, EEC/IDB, July 2013 1

WtERT Pre-feasibility studies of WtE projects

GWC has accumulated an enormous amount of information and contacts that can be of value

The island of Rhodes, Greece
2008; sponsored by DEKR, updated in 2017 on behalf of the Public Power Corporation of Greece

Tripoli, Peloponnese, Greece
2009: Sponsored by Technodomiki company of Greece

Buenos Aires, Argentina
2011; sponsored by IADB

Valparaiso region, Chile

2012; sponsored by IADB

Toluca City, Mexico

2012; sponsored by IADB

Araucania, Chile

2017; sponsored by WTE-Araucania group of Chile

Montevideo, Uruguay

2013; sponsored by United Nations and Waste Management Agency of Montevideo

Lahore, Pakistan

2015; sponsored by Ecoair-U.S. and Lahore Waste Management Company

Santiago, Chile

2016; sponsored by the Columbia Global Centers

Supporting and advising Governments and Leaders around the World on best management practices

On September 26, 2018, Prof. Themelis of GWC made a presentation to UN-visiting First Lady of Turkey Emine Erdoğan and to Minister of the Environment, Prof. Birpinar, regarding the potential and benefits of WTE, for Turkey. The good news is that a one-million ton WTE plant start operation in Istanbul on March 2021.

https://www.tccb.gov.tr/en/news/542/98830/first-lady-erdogan-meets-with-professor-sachs-the-director-of-the-earth-institute-at-columbia-university

COLUMBIA GLOBAL CENTERS | MUMBAI SANTIAGO RIO DE JANEIRO

WtERT involved in The Columbia Global Centers around the World

- On April 17, 2017, The Mumbai center invited Dr. Bourtsalas of WtERT-USA to present research findings on the level of municipal solid waste (MSW) management achieved by different countries.
- On August 24, 2017, The Santiago Columbia Global Center organized a workshop to address the best available WTE technologies for the recovery of energy or fuels from municipal solid wastes and other industrial, agricultural, and forestry residues. It featured the participation of Dr. Bourtsalas as well Prof. Alex Godoy from WtERT-Chile.
- On August 29, 2017, The Rio de Janeiro Columbia Global Center hosted a workshop organized by the Earth Engineering Center of Columbia and GWC to discuss the future of waste management in Brazil and in Latin America

Recent achievements of GWC – WtERT Asia

The 2022 Waste-To-Energy Research And Technology (WtERT) Asia Meeting (May18-19, 2022), co-organized by Columbia Global Centers | Beijing and the Global Waste-to-Energy Research and Technology Council (Global WtERT Council), comprised four sessions focusing on waste-to-energy technologies and their applicability, as well as the best practices in different countries and regions.

Recent achievements of GWC – COP 27

Submitting letter to Mr. Sameh Shoukry
Minister of Foreign Affairs of Egypt and
COP27 President Designate.

COP27 represents an opportunity to follow up and promote implementation of policies and best available technologies as they are key elements to overcome landfills and promote the Global Methane Pledge made in Glasgow that aims to cut global methane pollution by at least 30 percent by 2030.

Government must provide policies and measures that aid WTE. Example of China who in last fifteen years has built WTE capacity greater than EU,+US+Japan put together

GLOBAL WtERT COUNCIL

New York, June 3rd, 2022

Esteemed Mr. Sameh Shoukry
Minister of Foreign Affairs of Egypt
COP27 President Designate
Transmitted electronically to: Prof. Dr. Mohy Mansour, Head of WtERT Egypt,
email: mansour@niles.edu.eg

Your Excellency,

The writers represent the Global Waste-to-Energy Research and Technology Council (GWC), a Non-for-Profit research group, founded in 1999 by The Earth Engineering Center of Columbia University in New York, USA, and recognized as one of the world's foremost research centers on sustainable waste management. GWC aims to bring together engineers, scientists and managers from industry and academia to identify and advance the best available technologies for the recovery of energy or fuels from solid wastes. With partner organizations in 22 countries including the United States, United Kingdom, Germany, Canada, Brazil, Greece, Italy, Egypt, China and others nations, our network is a global resource for those looking to learn more about Waste-to-Energy (WtE), its use, and its role in society.

According to current GHG inventories, landfills are the third largest source of anthropogenic methane globally and accounting for approximately 11 percent of estimated global methane emissions. Addressing methane is critically important to combating climate change. Over a 20-year period, methane is over 80 times as potent as carbon dioxide and is the 2nd largest driver of anthropogenic climate change. According to the United Nations Environmental Programme (UNEP), "cutting methane is the strongest lever we have to slow climate change over the next 25 years". In the near-term, reducing emissions of Short Lived Climate Pollutants like methane is more effective than reducing CO2. The newly released IPCC 6th Assessment Report notes that methane reduction "stands out as an option that combines near- and longterm gains on surface temperature and leads to air quality benefits by reducing surface ozone levels globally."

Following those facts, GWC could play a crucial role in addressing and developing effective responses. Building on the collective strength of academic champions members of our network compromised of 22 countries, GWC will promote cross-institutional knowledge sharing and explore collaborative initiatives that will foster a strong global commitment to divert waste from landfills. Communities and policymakers could learn more about how Methane emissions will affect them, what they can do to divert post-recycling waste from landfills to mitigate and reduce their climate footprint.

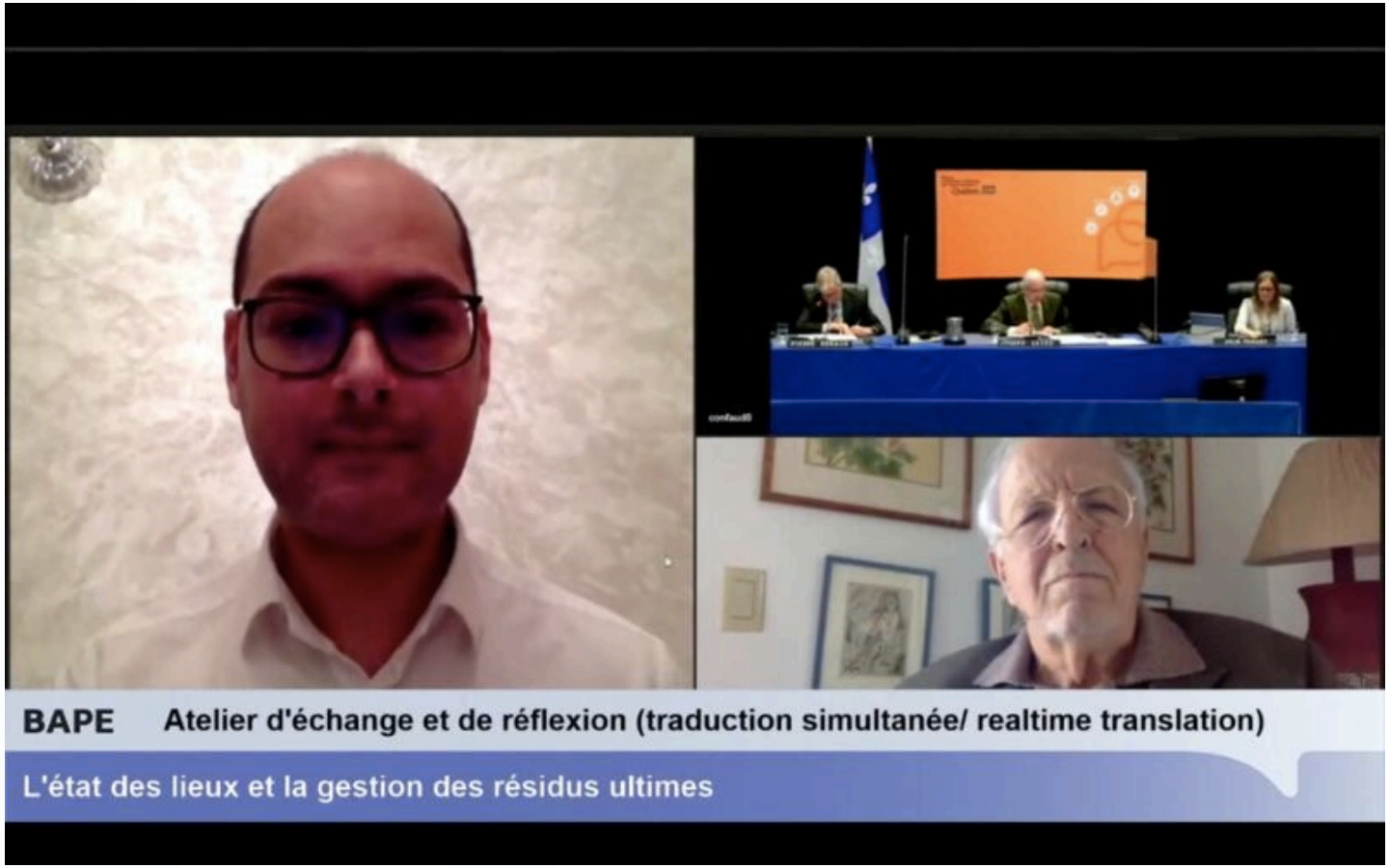
Moving forward, the next COP27 represents an opportunity to follow up and promote implementation of policies and best available technologies as they are key elements to overcome landfills, as well to follow up and promote the Global Methane Pledge made in Glasgow that aims to cut global methane pollution by at least 30 percent by 2030.

Recent achievements of GWC – WtERT Canada

Participating to Public hearing to promote WtE technology

The Office of Public Hearings on the Environment (BAPE) has published on January 25, 2022 its investigation and public hearing report on "The Current Status and Management of Residual Waste https://bapestorageaccount.blob.core.windows.net/media/1778/364_cm72_ang.pdf

Full Summary in English: https://lnkd.in/d32qYvX2



Recent achievements of GWC – WtERT Canada

Participating to Public hearing to promote WtE technology

The Commission stated about WtE technology from its report :

"Several thermal processes used in Quebec and around the world were also analyzed. For example, incineration of municipal waste is a technology that is widely selected in Europe, mainly for energy recovery and for reducing the volume of waste to be landfilled. Based on European realities and experiences with waste incinerators in urban centers, and after evaluating the contexts of their insertion and considering economic, operational, and environmental considerations, the Commission of Inquiry is of the opinion that this technology is mature and can be of interest in certain contexts."

Circular Economy project / Industrial Ecology
Steam recovery from waste to supply Hospital

Source: ville du Québec

Importance of Waste-to-Energy in Circular Economy

- Without the energy from the WtE plant, the hospital would have to use a natural gas generator, increasing its operating costs.

- At the same time, the city's garbage would have to be shipped 200 kilometres away to the nearest landfill, which would entail additional transportation and processing costs.

- This project addresses the common sustainable development objectives of both partners:
  - Improving human health;
  - Provide a quality living environment;
  - Develop circular economy projects by creating value from residual materials.

Environmental Benefits

- The only almost entirely carbon neutral hospital site in Quebec.
- Greenhouse gas (GHG) emissions reduced by 10,000 tons of CO2 per year, or about 95% less, equivalent to 2,500 cars.
- Reduced drinking water consumption by 60,000,000 liters per year, equivalent to 2,000 18-foot above-ground pools.
- Improved air quality in the area surrounding the hospital site.

The need of Waste-to-Energy facility in Casablanca

The metropolitan city of Casablanca (4.5 millions inhabitants, 1.5 million tons MSW) is looking for an alternative to small controlled landfills site of 35 hectares adjacent to the old non-regulated landfills closed, with shortage of land for sanitary landfill and public opposition to new landfills.

Therefore, a science-based review of the facts would argue that WTE is the only feasible solution for Casablanca. This offers the opportunity to increase a source of renewable energy. Also, it will reduce landfilling and the greenhouse gas (GHG) emissions of Morocco by at least one million ton per year.

35% of Morocco's MSW ended up in the landfill of Mediouna, 20 km close to Casablanca City

Instead it could be source of wealth by producing Energy and recovering metals and minerals!

Aerial photo from airplane of the Landfill of Mediouna

The advantages of Waste-to-Energy

In Waste-to-energy facility residual waste is used as a resource

Energy drives our homes, our cities and our civilizations. As our population continues to grow, so the trail of trash that we leave behind, therefore cities should be equipped with the right Waste-to-Energy infrastructure that offers those advantages :

- Destruction of pathogens and hazardous components
- Conservation of lands (volume reduction : 90%)
- GHG emission reduction
- Recovery of energy turned into electricity, heat and steam, (reduce use of fossil fuel)
- Recovery of secondary raw material (Metals and minerals) re-injected in the economy

Waste-to-Energy is complementary to recycling. It treats waste that cannot be recycled or re-used. However, cities in the developing world can skip the sanitary landfill stage and move directly from **waste dumps** to **WTE power plants.**

Rational way to manage Urban Wastes

- "**Recycling**": Source-separated wastes that can be used as materials or composted to soil conditioning "compost"

- "**Post-recycling**": Materials remaining after all possible/practical "recycling"
  - After nearly 100 years of R&D efforts, there are only two ways of dealing with "post-recycling" wastes:
    - By sanitary landfilling (LF)
    - By thermal processing to recover energy, metals, and minerals (waste to Energy or WTE)

Example of intensive recycling (Collection of 5- streams): Milano, Italy

Milano is a good example of intensive recycling that I have observed personally. Population of 1.35 million people (2015); 80% live in high rise buildings with several households.

The city collects three streams of recyclables (paper, glass, and metals with some types of plastics);

a fourth stream of compostable organics: and a fifth stream of post-recycling wastes that are combusted at the “Silla 2” WTE power plant located within the city.

Example of intensive recycling: Milano (cont.)

- Milano provides 5 collection bins to each multi-story building and each house.

- The city also provides to each household a small covered container for food wastes which are then moved by the residents to the compostable bin of their building. The compostable bags used in the food waste containers are purchased at supermarkets and other stores, at about €0.1/bag

How is the waste sorted?

TRANSPARENT BAGS
Unsorted waste
All unsorted household waste
Collection twice a week

YELLOW BAGS
Plastic and metal
Plastic bottles, plastic bags, plastic and polystyrene food packaging, cans
Collection once a week

WHITE CONTAINERS
Paper
Newspapers, magazines, books, notebooks, cardboard boxes and packaging, beverage cartons
Collection once a week

GREEN CONTAINERS
Glass only
Bottles, jars and vases
Collected once a week

BROWN CONTAINERS
Food waste
Fruit, vegetables, meat, fish, leftovers, rice, bread, cakes, pasta, cooked food
Collected twice a week

Source Amsa, A2A

Example of intensive recycling: Milano (cont.)

- Recycling regulations in Milan are strongly reinforced by periodic inspections by city government of the materials discarded by residents in the various recycling bins.

- Infractions are heavily fined, e.g., by a **$200** fine on a building, which is at the end of the year divided among the households using the building.

- By now, the Milan recycling infrastructure and the citizen participation have resulted in one of the best waste management systems in Europe.

- The results of this intensive recycling are shown in following Table.

Results of intensive recycling of Milano

Materials collected	Tons/year	%
Paper	78,000	9.6%
Plastics & metal	44,000	5.4%
Glass	65,000	8.0%
Total recycled	**187,000**	**23.1%**
Composted	141,000	**17.4%**
Total recycled and composted	**328,000**	**40.4%**
Post-recycling waste to Silla 2 WTE Power Plant	**483,000***	**59.6%**
Total MSW, tons/year	811,000	100.0%

How Morocco/ Tunisia and Egypt could benefits from China as an emerging world leader in sustainable waste management

China has demonstrated that it is possible to reduce the capital cost of WTE plants by means of :

- Dedicated Industrial and academic R&D
- Rapid growth of industry, instead of custom building one plant at the time
- Assembly line fabrication of WTE equipment
- Favorable national policy (e.g., $30/MWh credit to WTE electricity)
- Place for WTE in Belt and Road Initiative (BRI) funding

Addis Ababa, Ethiopia's 1st WtE Plant in Africa Thanks to China R&D that make dreams becomes reality

The Reppie WtE / Project Facts

- Capacity: 400 000 tonnes per annum
- Waste: Municipal Solid Waste (MSW)
- Furnace/boiler: 2 grate fired lines, vertical economizer section
- Energy production: 20 MW power
- Steam parameters: 60 bar/420˚C
- Flue gas treatment: SNCR, dry FGT system (lime milk in reaction tower), baghouse filter
- Commissioning: 2018

Landfill threat on climate change and humans lives

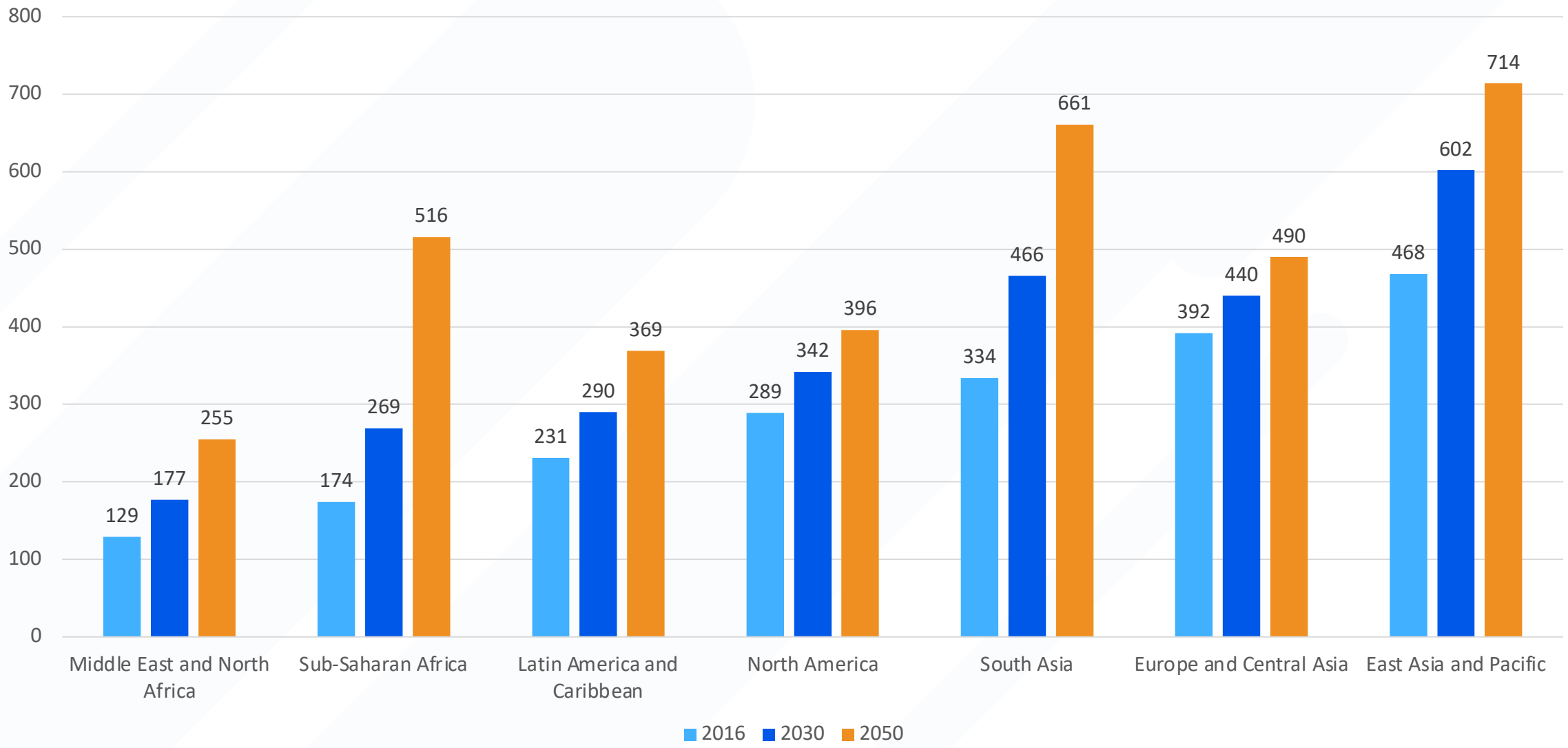
A woman mourning family members missing after a landslip at a rubbish dump in Ethiopia's capital Addis Ababa. (March 14, 2017) (TRT World and Agencies)

March 11th, 2017, The garbage landslide Koshe killed at least 115 people and left dozens of others missing

Post-recycling urban waste is a global problem

Projected waste by region

Source : World Bank report “What a waste 2.0”



Today alarming fact

Solid waste management is a major problem for cities around the world. They are using (if at all) inadequate technologies for waste treatment, leachate treatment, resource recovery and energy production.

Two-thirds of the humanity will live in cities by 2050 according to a report of United Nations. The generation of urban wastes will increase and landfilling sites will be difficult to find. Land is already scarce and transforming virgin land to landfills is not a sustainable solution. Cities are searching for alternative solid waste treatment processes to reduce the waste going into landfills and reduce the impacts of waste management on the environment and the living conditions of surrounding communities.

What the Super Nexus Age Means for Sustainable Technologies

- ✓ Dwindling resources and increased demand due to economic growth will put enormous pressure on the availability and costs for conventional resources.
- ✓ Price stress on supplies conventional resources will be driven by the projected transition of over 3 billion people into the middle class in China and India will put unprecedented pressure on both the availability and costs for conventional resources.
- ✓ Sustainable technologies must stand alone and not be dependent on other resources when possible. This thinking also applies to feedstocks that are needed for those technologies.

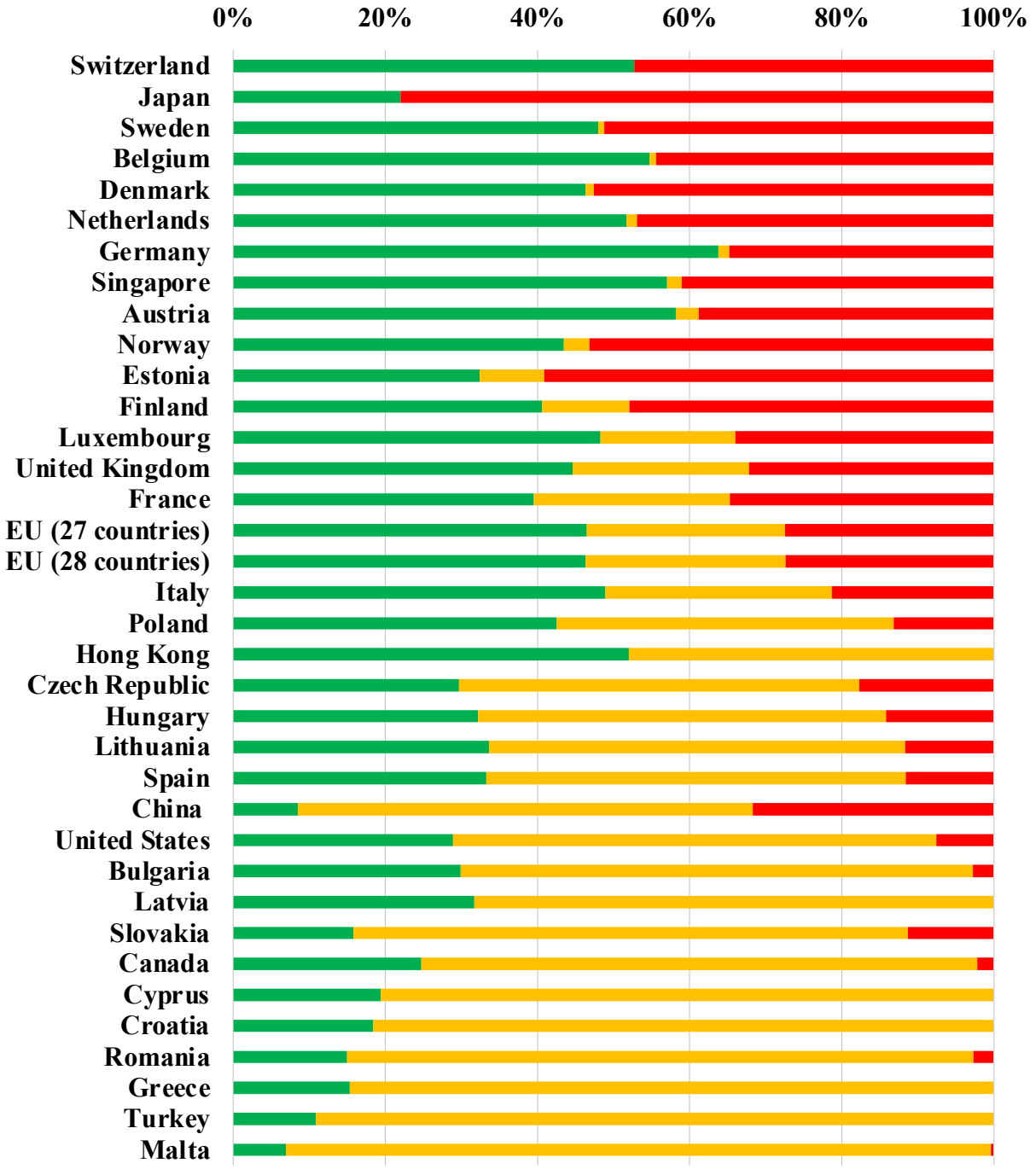
Source, Alan F. Rozich, Other Inconvenient Truths Beyond Global Warming

How urban wastes are managed in various countries?

- We call the following graph “**The ladder of sustainable waste management**”
- The nations higher up the “Ladder” are doing less or no landfilling

Ladder of sustainable waste management of nations 2016

- Recycling
- Waste dumps
- Combustion



Most deeply rooted misconceptions in the U.S.

1. Humans do not cause global warming (despite all scientific evidence and several national multi-billion dollar disasters)

2. We do not need either landfilling or waste-to-energy. All that is needed is smart 100% recycling (despite the fact that no city or country has even come halfway close to this goal (E.g. Milan 40%)

If WTE is much preferable to LF why over 80% of global urban wastes go waste dumps or sanitary landfills?

No. 1 reason:

- Waste dumping costs practically nothing
- Sanitary landfilling can be done for an overall cost of $30 to $40 per ton (depending on biogas capture
- Because of the high initial capital investment, Waste to Energy (WTE) requires a gate fee of $60 per ton when electricity price to grid is $60/MWh; and $40/ton when electricity price is $100 or higher

Notes:

a) the above costs do not include the “external” environmental costs of landfilling

If WTE is much preferable to LF why over 80% of global urban wastes go to landfilling? (cont.)

No. 2 reason:

- Continuing misinformation within the general public as to the ”external” environmental costs of landfilling:
  - Loss of land (estimated at about 200 million400,000 square meters annually fin the U.S.)
  - Greenhouse gas emissions of landfill gas (LFG) estimated by Bpurtsalas and Themelis (in press) at 342 million metric tons of $CO2_{eq}$ for the U.S
  - Dioxin and mercury emissions during unintentional landfill fires (pver one thousand landfill fires annually, in the U.S.)

Remaining obstacle to expansion of WTE, both in developing countries and, also, in the U.S.

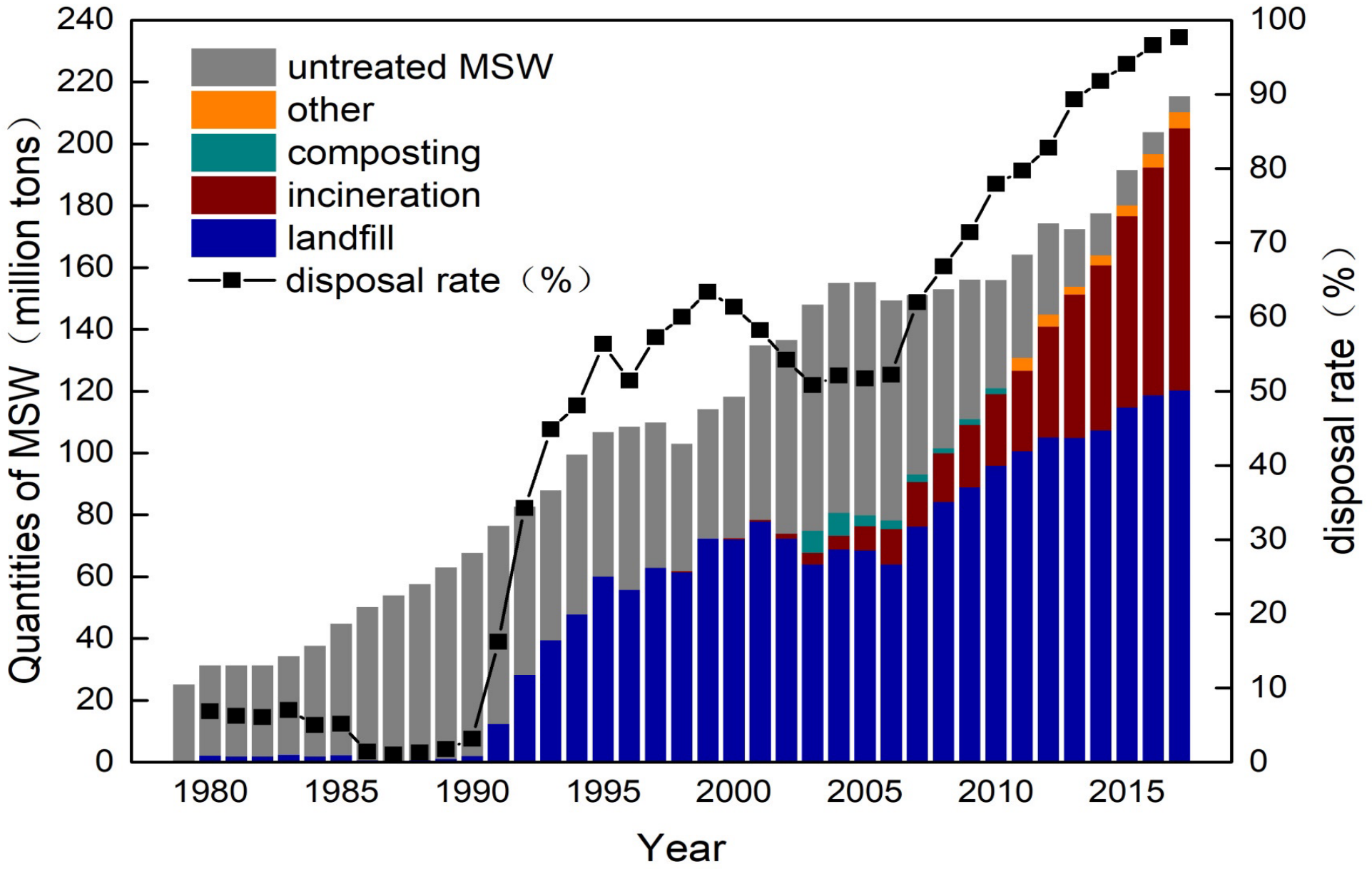
- **Initial capital investment:** Repayment of the capital investment, per ton of MSW processed, is the major cost item of a WTE plant, affecting the gate fee of WTE vs landfilling

- This is true even for the U.S., where the WTE gate fee (e.g. $60/per capita) is one thousandth of the GDP per capita, because investors in waste management infrastructure are either companies or municipalities. There is little state and no federal participation. Situation is worsened by constantly decreasing price of electricity to the grid.

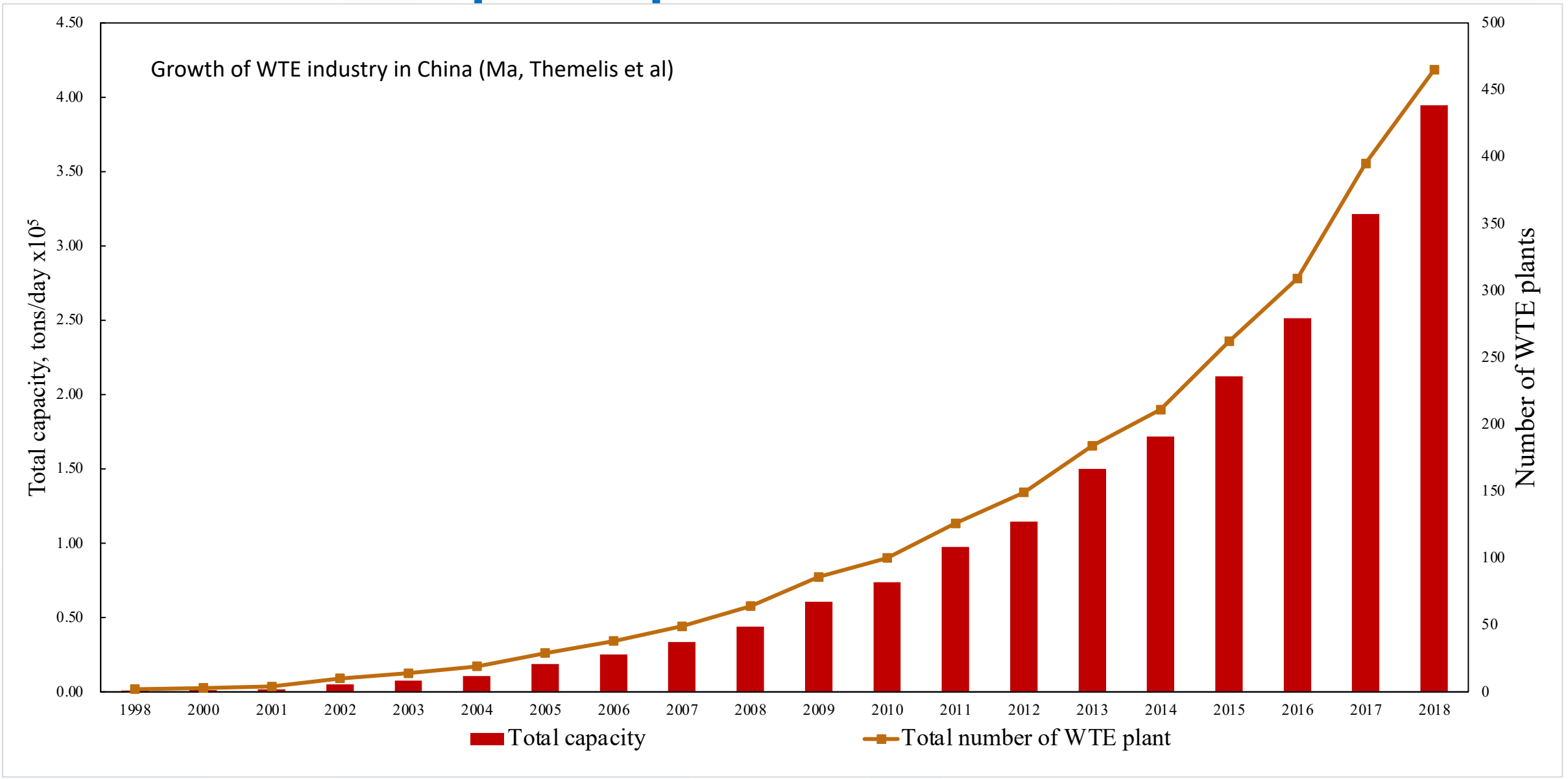
Turning to an emerging world leader in sustainable waste management

- By the end of the 20th century, China's rapidly growing cities were literally besieged by landfills
  - National 5-year energy plan included energy from WTE
  - Place for WTE in Belt and Road Initiative (BRI) funding

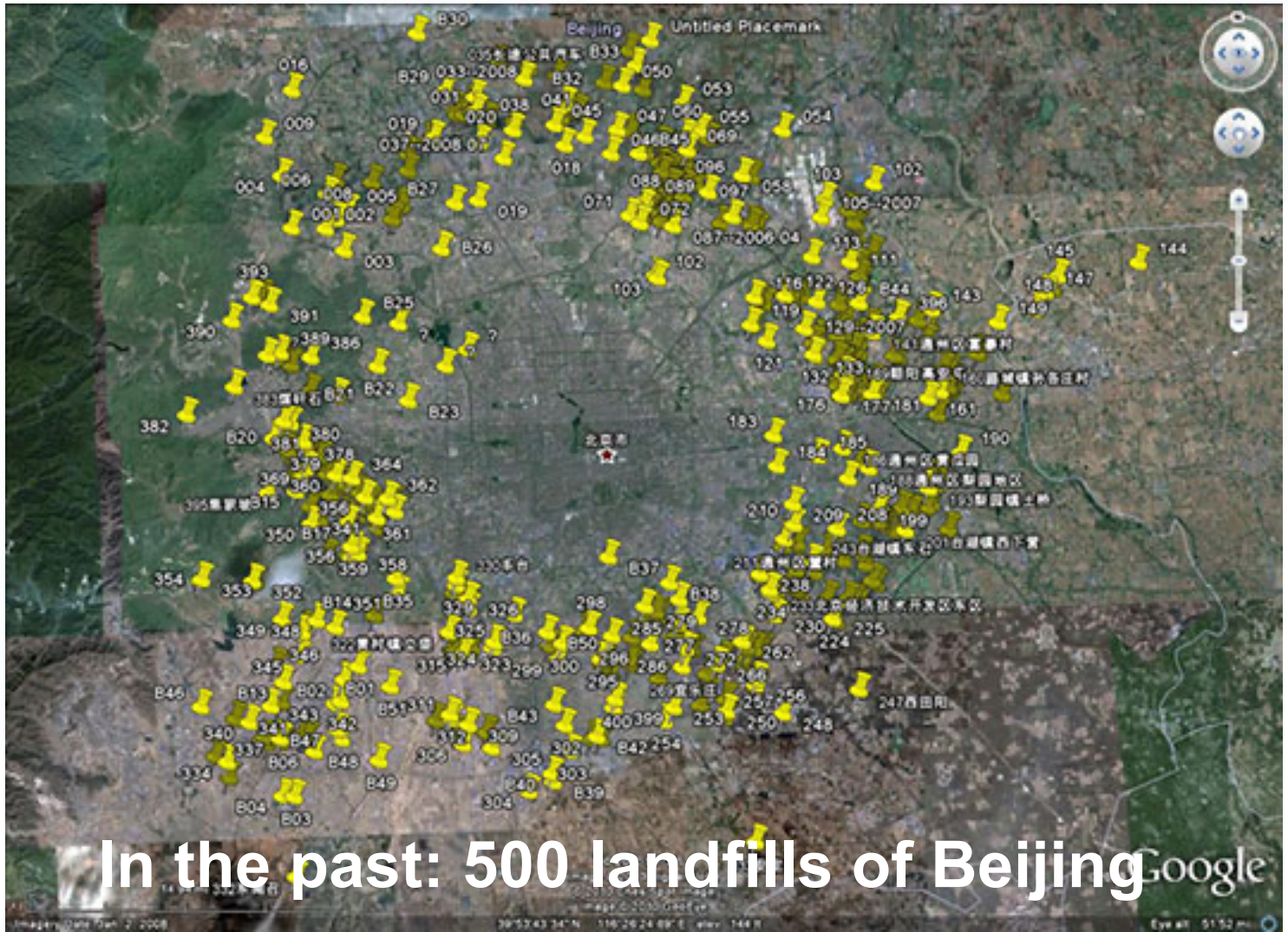
Generation and disposition of MSW in China



21st century growth of WTE industry in China
2020: 470 WTE plants plus over 100 under construction



China has gone a long way since the Wang Juliang film “Beijing besieged by landfills”



In the course of the last fifteen years, China has become a major player in the global WTE industry

China has demonstrated that it is possible to reduce the capital cost of WTE plants by means of :

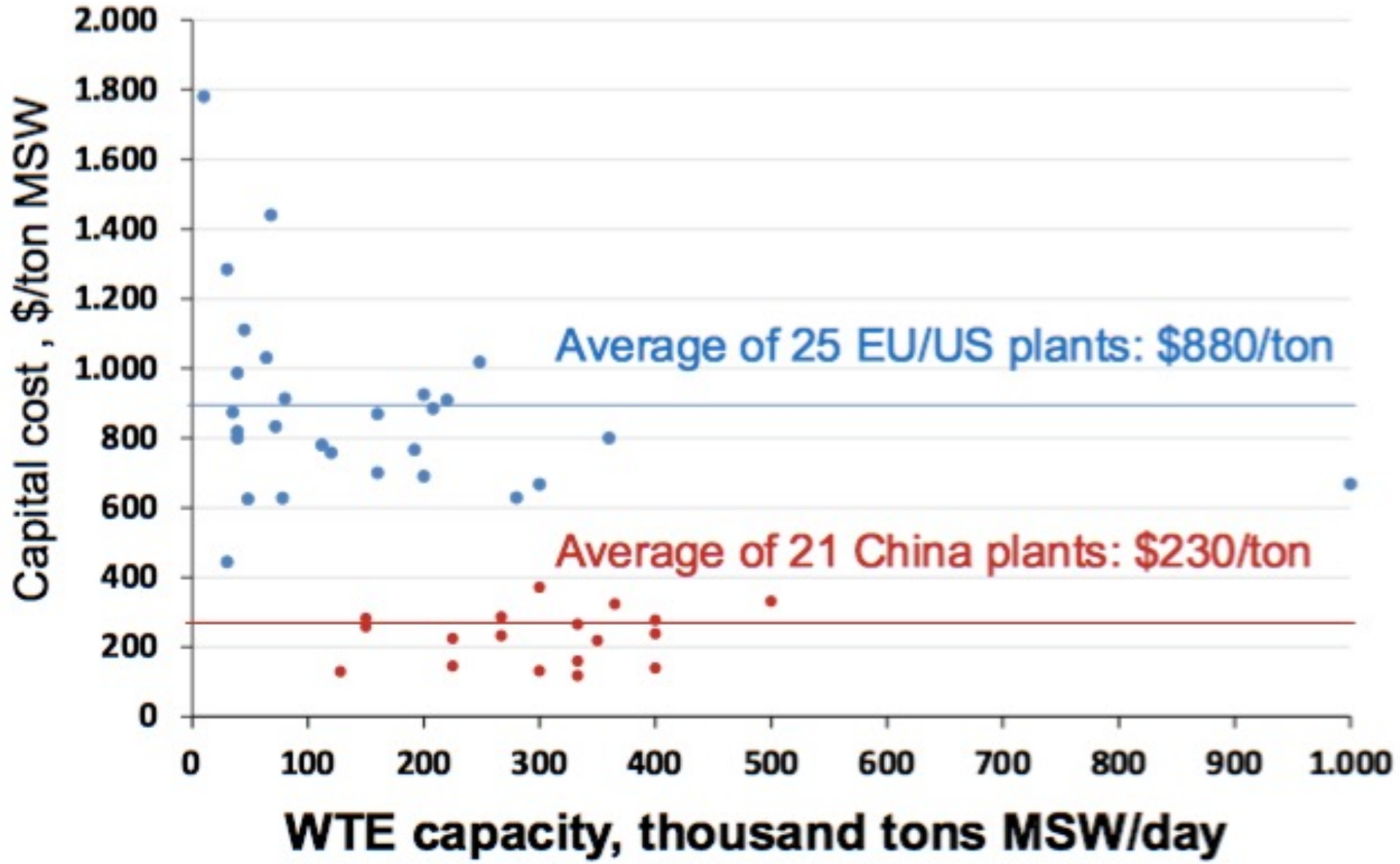
- Dedicated Industrial and academic R&D
- Rapid growth of industry, instead of custom building one plant at the time
- Assembly line fabrication of WTE equipment
- Favorable national policy (e.g., $30/MWh credit to WTE electricity)

Lower CAPEX offered by Chinese companies makes the WTE technology more cost-competitive with sanitary landfills (for sure in Greece)

- As the use of WTE grows in Asia, it will force developed countries (e.g., U.S., Canada and Australia) to re-evaluate WTE vs sanitary landfilling, *especially with regard to GHG emissions*

- Cities in the developing world can skip the sanitary landfill stage and move directly from **waste dumps** to **WTE power plants** (e.g. Azerbaijan, Ethiopia, Belarus, Vietnam).

All types of WTE are much less costly in China



Why landfilling of wastes is not a good solution:

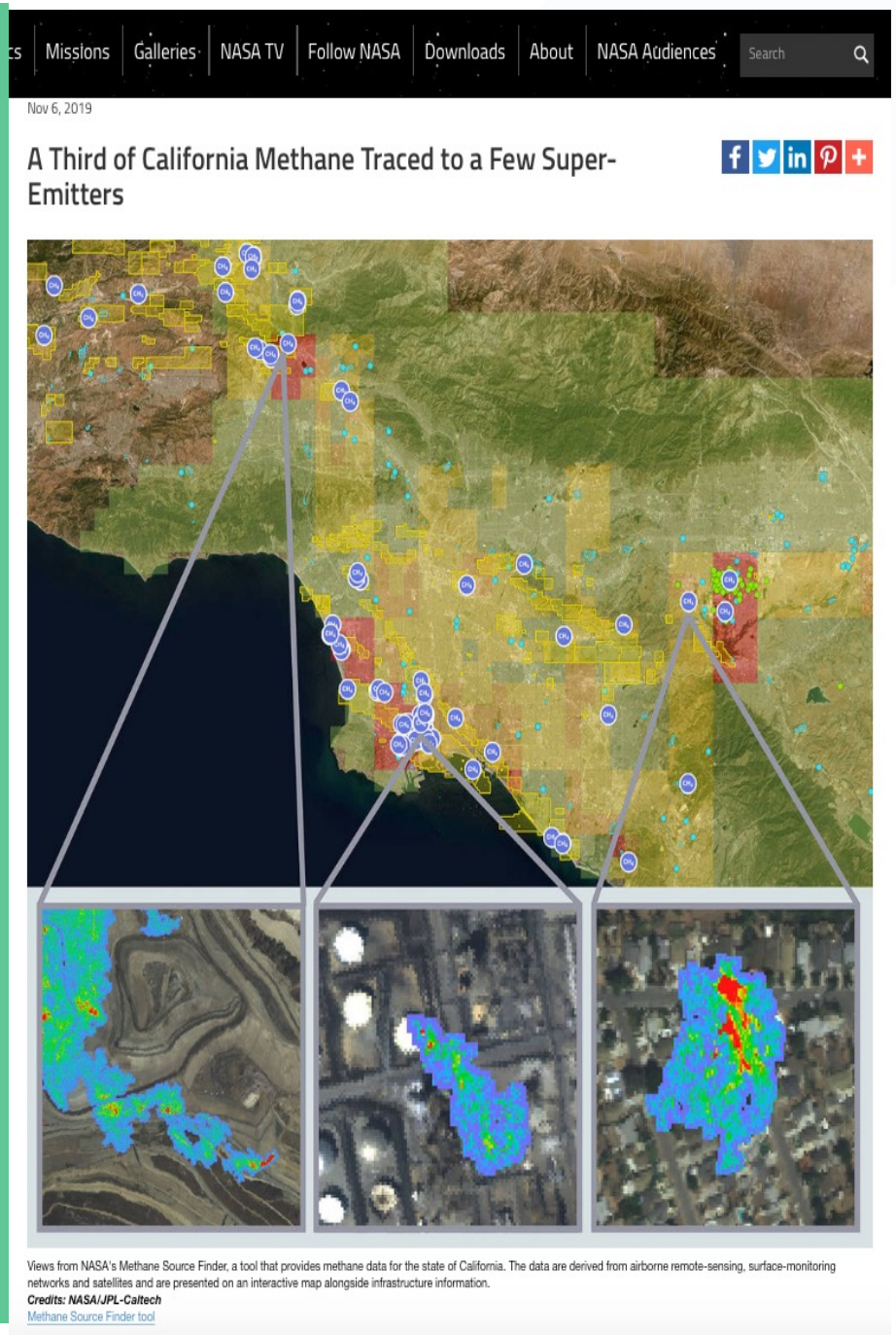
- Mixed waste contains organic as well as hazardous substances:
    - Production of landfill gas (best case scenario only 50% can be collected and treated; the remaining 50% are a hazard to climate)
    - Production of leachate (long term collection and treatment is necessary – which is expensive)
    - Engineered barriers will not work for ever but fail in ???
- Landfilling shifts problems only to the future – opposite to sustainability
- Remediation of old landfills may be necessary (problem for future generations) – but how?
- On the long term, landfill is the most expensive „solution“ and the contrary of sustainability
- Landfill of waste, therefore, has already the lowest priority in many countries
- Exemptions for inert (no longer reactive) wastes, if not recyclable

- While Carbon Dioxide is emitted from Power plants and cars, primary emitters for methane are waste management, dairy farming, and oil and gas operations. In the 5th Assessment Report of the IPCC (Intergovernmental Report on Climate Change) Methane, over a 100-year cycle has a GWP (Global Warming Potential) of 34 times that of CO2 or 86 times GWP over CO2 based on a 20-year cycle.

- NASA's Scientific Evaluation of Methane from Landfills used airplanes with special detection technology.

Methane from the three largest sources in California:

>40% from Landfill Gas (=> most landfills are underreporting)
26% Dairy Industry
26% Oil and Gas Operations



Paper : Materials and energy recovery at six European MBT plants

Prof. Bourtsalas and Prof. Themelis, visited six MBT facilities in Europe that use different approaches for the recovery of materials and energy from mixed MSW.
These plants were studied with respect to feedstock composition, operating conditions, capital expenditure, financial viability and environmental impacts. The compost product of most facilities examined did not comply with agricultural standards and, therefore, it was classified as compost-like output (CLO) and used as daily cover in landfills.

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Materials and energy recovery at six European MBT plants

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ABSTRACT

Mechanical Biological Treatment (MBT; called "dirty" Materials Recovery Facilities in the U.S.) is a waste management method, developed mostly in Europe, which combines sorting of recyclable materials (metals, paper, plastics, glass) with composting/digestion of green/ food wastes and, in some cases production of a fuel material. In 2018–19, the authors visited six MBT facilities in Europe that use different approaches for the recovery of materials and energy from mixed MSW. These plants were studied with respect to feedstock composition, operating conditions, capital expenditure, financial viability and environmental impacts. The compost product of most facilities examined did not comply with agricultural standards and, therefore, it was classified as compost-like output (CLO) and used as daily cover in landfills. The best composting practice used source

WtERT- Projects

Key main project developments

Training Workshop of Waste to Energy

Organize several specific workshop to exchange with professionals about waste management and renewable energy challenges

Columbia Video Network

CVN will offers certificates and degrees for students and managers in the fields of waste management and Waste-to-Energy.

Pre-feasibility for WtE

Optimizing the technical and financial viability of the integrated waste management system to extract and recycle of usable materials, combined with energy recovery of waste.

Site visit to WtE facilities

Organize business trip to visit State-Of-The-Art Waste-to-Energy plant around the World

THANK YOU.

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