Waste-to-energy incineration

Understanding implications for cities

September, 2019

OUTLINE

- Costs
- Financial challenges
- Lock-in effect
- Climate impact
- Energy production
- Disposal system required
- Governance and management challenges
- Jobs creation
- Sustainability

COSTS

Incineration is the **most expensive** waste treatment system - for construction, maintenance and operation

Capex
US$650-1100
per ton/year
(EU/US)

Cost of a 1000 tpd plant between US$ 220 M-380 M

Operational costs of waste disposal - USD / ton

	Low income	Lower Middle	Upper Middle	High Income
Sanitary Landfill	10-30	15-40	25-65	40-100
MRBT				110-140*
Incineration	N/A	40-100	60-150	140-200

+ Collection costs
+ Air pollution monitoring costs
+ Ash and air pollution control residues disposal costs (hazardous waste disposal)

FINANCIAL CHALLENGES

- Long term obligations -30 years
- Financial means in the long term *"The consistent availability of financial means is crucial for long term application of WtE technologies. It must be assumed that WtE projects will lead to higher treatment costs than for sanitary landfills."* - GIZ
- Dependance of foreign currency - *"Access to foreign currency is essential for all spare parts which are not locally available, as part failure will otherwise lead to shut down of operations – or failure to meet operating standards."* - GIZ

Unexpected costs

Detroit, US. Wte cost US$438 million to build. 2 years later, an additional $171.5 million investment was required to upgrade pollution control equipment.

Copenhagen, Denmark. €500 million, 400,000 tpy wte incinerator. Technical installation failed, costing an additional €13 million and delay of 7 months to the launch.

LOCK-IN EFFECT

- 30 year lock-in to burning waste
- Put-or-pay contracts: city has to supply a fix amount of waste for the contract period or pay instead.
- Many cities being sued for not meeting agreed tonnage.
    - **Tuscany, Italy.** Incinerator company sued 6 municipalities for €13 million for not meeting waste tonnage after launching recycling programs. Legal war between 2010 to 2015. The municipalities ended up paying €5 million of fines.
    - **Stoke-O-Trent, UK**. City was penalized with 645,000 pounds by the incinerator company after reducing waste going to the incinerator thanks to a recycling program.
    - **Palma de Mallorca, Spain.** Son Reus incinerator led the city to import waste to meet minimum tonnage. Environmental councillor said *"Citizens have been deceived for 20 years saying that the more they recycle, the less they will pay. The reality is that the more you recycle and less tons enter the Son Reus plant, the more you have to pay because there is an investment made and the contract doesn't end until 2041."*

LOCK-IN EFFECT

- Lock-in effect undermines waste reduction, recycling or composting programs for 30 years.

> “Incinerators are capital intensive and are designed for 20 to 30 year lifespans. If operated by a private contractor, they typically have a “take-or-pay” agreement of guaranteed minimum waste delivery from the city. Therefore once built they discourage waste reduction or recycling. In fact they compete with recycling markets for combustibles such as paper, cardboard, textile and wood.”
>
> World Bank, Urban Development Working Papers East Asia Infrastructure Department: Waste Management in China: Issues and Recommendations May 2005.

LOCK-IN EFFECT

- Lock-in effect undermines future waste reduction, recycling or composting programs.

Reports, i.e. EIB Circular Economy Guide and the EU report on Integration of Environmental Concerns in Cohesion Policy Funds - European Regional Development Fund (ERDF), European Social Fund and the Cohesion Fund (CF) -, have recognised that much of what is currently used as incinerator feedstock could be recycled or composted.

CLIMATE IMPACT

- 1 ton of waste incinerated produces 0.7 – 1.7 tons of fossil CO_2

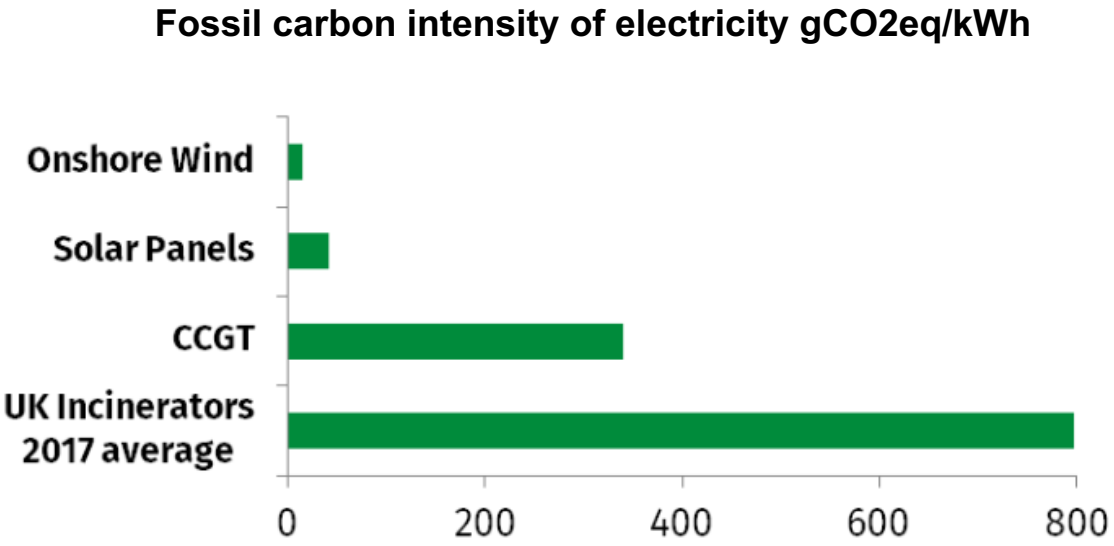
Tons CO_2e emitted from 265,000 tons of waste per year

BASE CASE (DEFAULT WASTE COMPOSITION)	Incineration	Landfill	Relative net
Direct emissions (Methane & Fossil CO_2 but not bio CO_2)	92,088	66,224	25,864
Electricity offset	-50,271	-3,392	-46,879
Biogenic carbon sequestration		-72,955	72,955
TOTAL	**41,817**	**-10,123**	**51,940**

UKWIN, Evaluation of the climate change impacts of waste incineration in the United Kingdom, October 2018

gaia

CLIMATE IMPACT



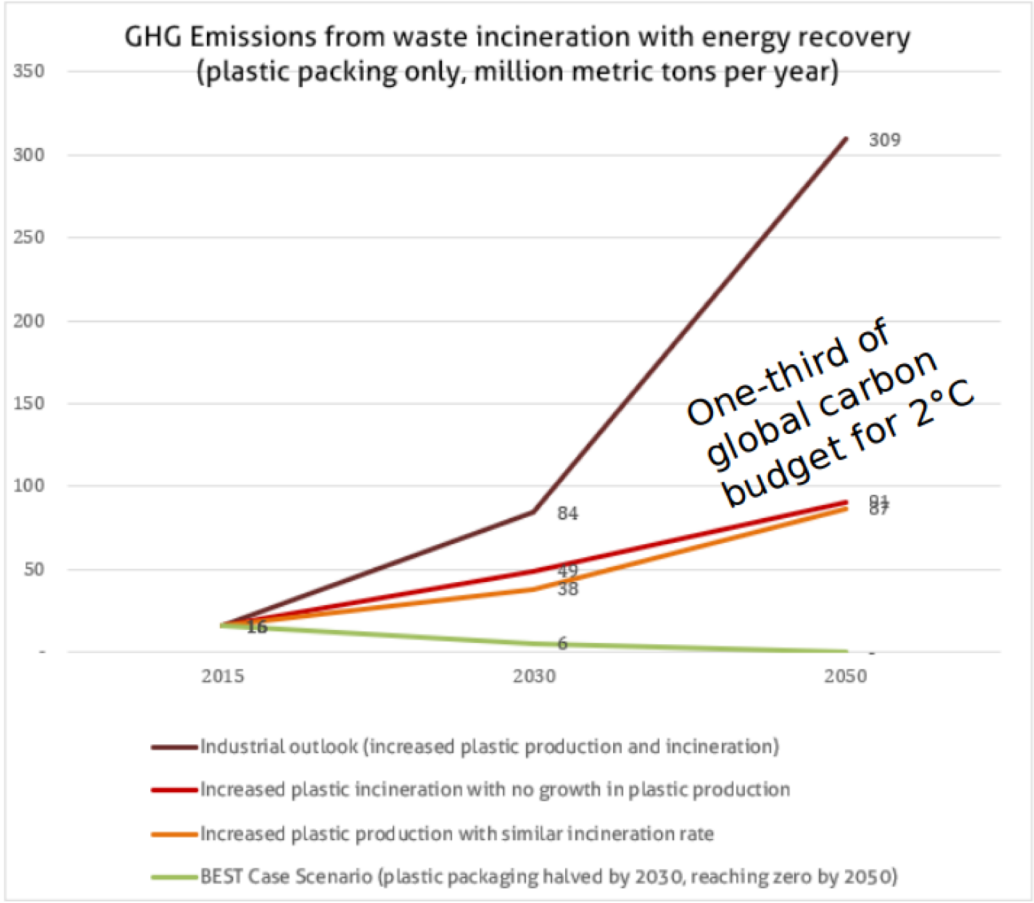
UKWIN, Evaluation of the climate change impacts of waste incineration in the United Kingdom, October 2018

CLIMATE IMPACT

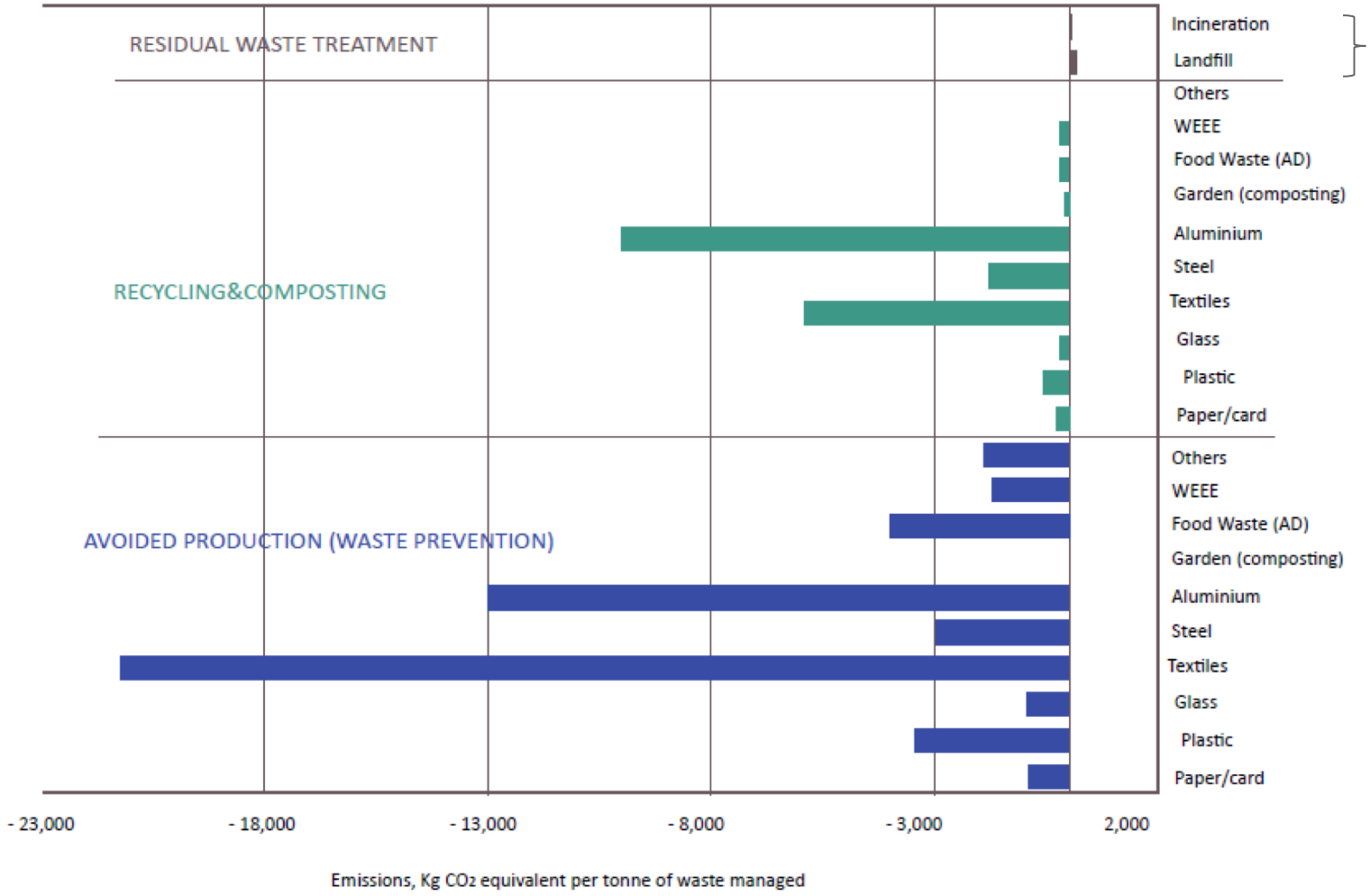
“In the future if plastics demand continues to grow as projected, and a larger share of landfilling is replaced with incineration, cumulative CO2 emissions associated with plastics could grow very large. - 287 billion tonnes by 2100. This corresponds to more than a third of the whole carbon budget for a 2°C economy”

The Circular Economy - a Powerful Force for Climate Mitigation(2018), Material Economics.

CLIMATE IMPACT



Source: Center for International Environmental Law (CIEL). Plastic and Climate: The Hidden Costs of a Plastic Planet. May 2019.



Climate change impact by material / treatment

Bellinger, Ann y Hogg, Dominic: The potential contribution of waste management to a low carbon economy. Eunomia Research and Consulting, october 2015

ENERGY PRODUCTION

- Materials with higher calorific value are mostly recyclables - need to burn them for WTE viability
- Minimum calorific value of waste must be on average at least 7 MJ / kg and always higher than 6 MJ / kg. Waste in most low-income cities is too wet to burn
- Auxiliary fuel to burn may be required - increases costs and GHG emissions
- MSW is not renewable energy
- Efficiency and renueves drop considerably if heat is not used

"If the project is located in areas with no or only moderate heat or gas demand, revenues from energy sales will be lower. The transformation of all the heat into electricity is an option but not the most economical, as the efficiency rate is much lower than a direct use of gas or steam. Locations with a poor connection to energy end- users are substantially disadvantaged for WtE as this implies limited use of recovered energy and increased net operating costs."

GIZ: Waste-to-Energy Options in Municipal Solid Waste Management. A Guide for Decision Makers in Developing and Emerging Countries

ENERGY PRODUCTION

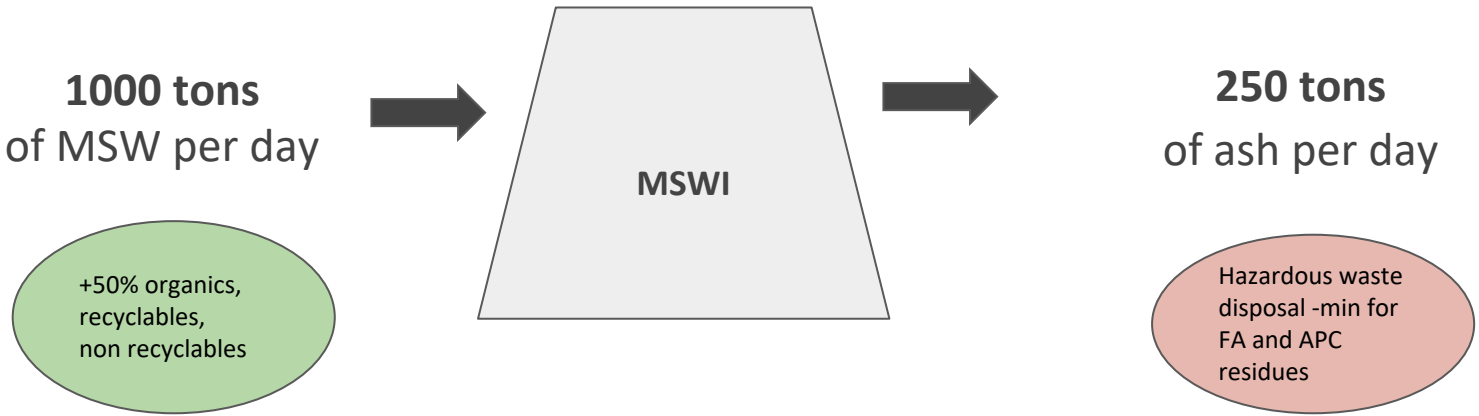
"Thermal treatment (incineration) can recover a fraction of the energy required to produce the materials. However, when looked at from a systems perspective , and particularly considering the carbon impact, incineration does not produce clean or renewable energy. Even when all the hazardous exhaust pollutants are cleaned (at great expense), thermal treatment technologies release carbon to the atmosphere through the combustion process, rarely offsetting fossil fuels carbon emissions"

C40 - Advancing Towards Zero Waste Declaration technical note

DISPOSAL SYSTEM REQUIRED

25 - 30% of tons treated is released as ash and air pollution control (APC) residues

Fly ash and APC is 5% of tons treated. Classified as hazardous waste



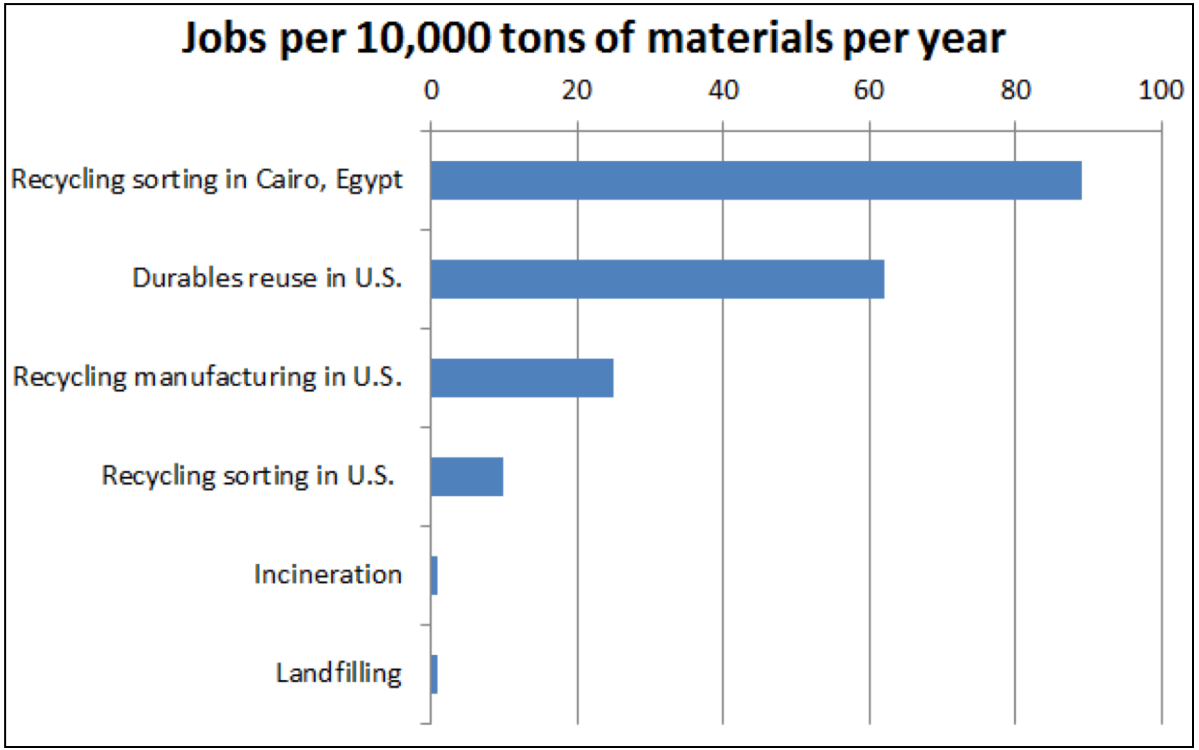
GOVERNANCE & MANAGEMENT CHALLENGES

- Continuous monitoring of air emissions, ash, effluent
  - BAT: Quasi-continuous dioxin monitoring
- Complex system - need qualified technical staff to operate
- Operation conditions differ from theoretical assumptions (prepare for accidents)
- Unpopular: odor, traffic, public health concerns, resistance of wastepickers due to loss of livelihoods

Incinerator accidents in Europe

https://english.arnika.org/ipen-cee/waste-incinerators-accidents

JOBS CREATION



Zero waste is a pathway to formalize waste pickers work - much needed in low-income economies

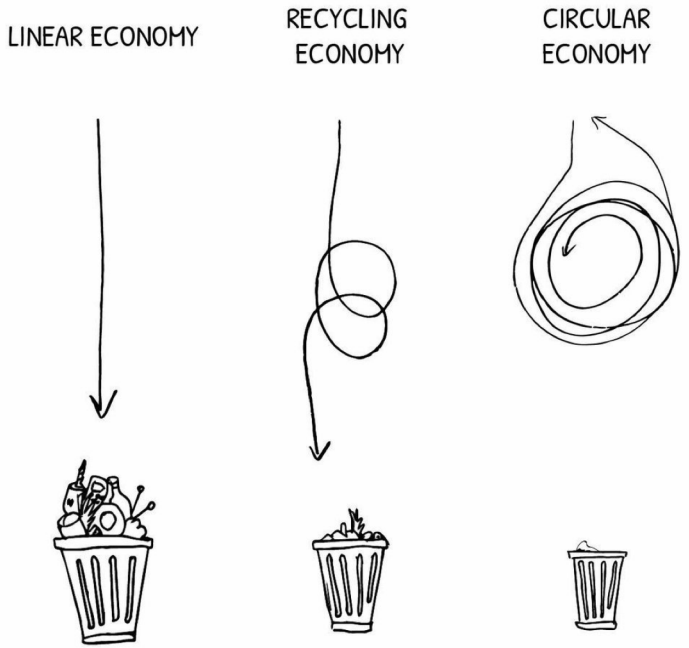
Institute For Local Self-Reliance, Job Creation: Reuse and Recycling Vs. Disposal, 1996

SUSTAINABILITY

- **The world is moving towards a Circular Economy**
  - keeping products and materials in the economic processes for as long as possible and in high quality.
  - Europe removing subsidies to wte - increasing targets for recycling and organics collection.

- Current ecological challenges -such as climate change, plastic pollution- show the need to make more efficient use of resources - shift from “safe disposal” perspective to upstream measures

- **Investments in waste management need to follow this trend**

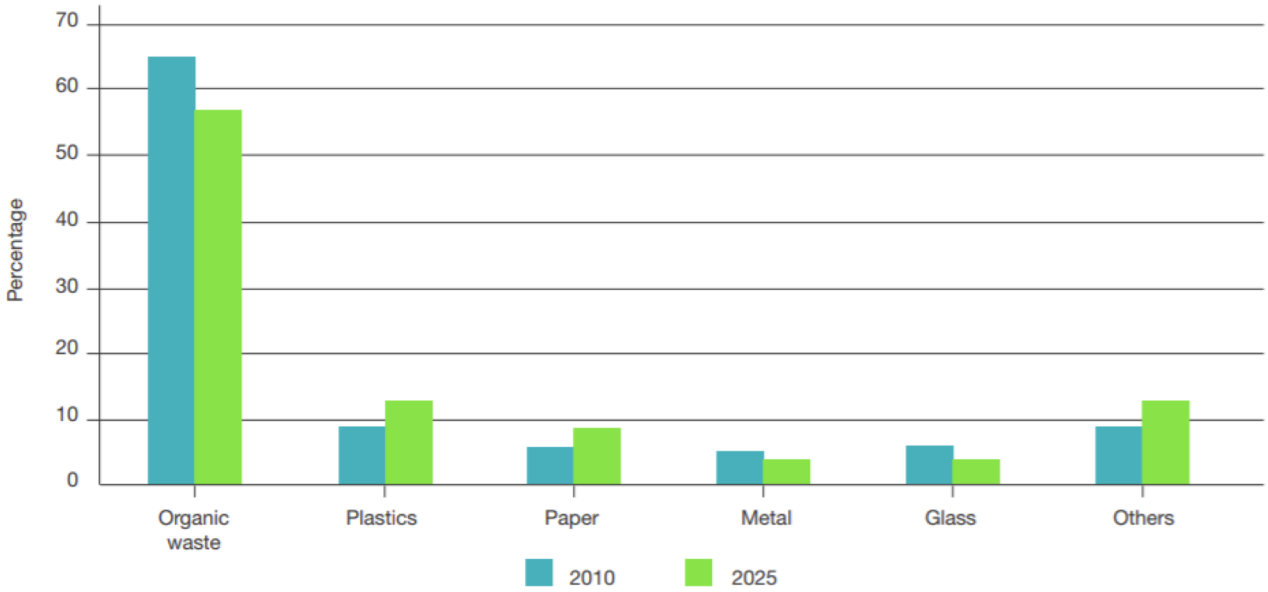


PLAN C Empowering circular futures

gaia

WASTE COMPOSITION IN AFRICAN CITIES

Figure 1.3 Changing composition of wastes in African cities



Source: Hoornweg and Bhada-Tata (2012)

+80% compostable or recyclable

Investment priority

gaia

Thank you!

www.no-burn.org
www.ZeroWasteEurope.eu

References:

- Council recycling success leads to £400k shortfall claim by incinerator operator. 360 Environmental, 15/10/2010. http://www.360environmental.co.uk/news/264/ Stoke council faces £645k bill for incinerator tonnage shortfall. MRW, 20/10/2010.
- C40 (2019) Advancing Towards Zero Waste Declaration - technical note https://c40-production-images.s3.amazonaws.com/other_uploads/images/2114_Zero_Waste_Technical_Note_FINAL_%28FEB_2019_UPDATE%29_-_Zachary_Tofias.original.pdf?1551804802
- Dowen et al. (2019). Evaluation of the climate change impacts of waste incineration in the United Kingdom. UKWIN.
- GIZ (2017): Waste-to-Energy Options in Municipal Solid Waste Management. A Guide for Decision Makers in Developing and Emerging Countries
- Hogg & Ballinger (2015). The potential contribution of waste management to a low carbon economy. Eunomia.
- Hoornweg & Bhada-Tata (2012). What a Waste: A Global Review of Solid Waste Management. World Bank.
- Institute for Local Self-Reliance jobs comparison.
- Kistler et al. (2019). Plastic and Climate: The Hidden Costs of a Plastic Planet. Center for International Environmental Law.
- The big burn. Detroit Metro Times, 2 April, 2008. https://www.metrotimes.com/detroit/the-big-burn/Content?oid=2191791
- World Bank (2005): Urban Development Working Papers East Asia Infrastructure Department: Waste Management in China: Issues and Recommendations. Working Paper No. 9
- Zero Waste Europe (2017): “Deliver or pay”, or how waste incineration causes recycling to slow down. https://zerowasteeurope.eu/2017/10/deliver-pay-waste-incineration-causes-recycling-slow/
- Zero Waste Europe (2017): “Copenhagen goes all in on incineration, and it’s a costly mistake”. https://zerowasteeurope.eu/2017/10/copenhagen-goes-all-in-on-incineration-and-its-a-costly-mistake

gaia