



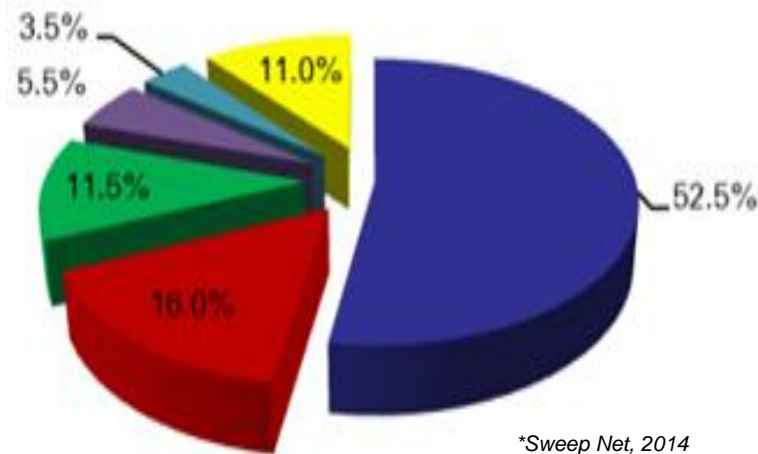
MSW WtE – Incineration

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MSW in Lebanon

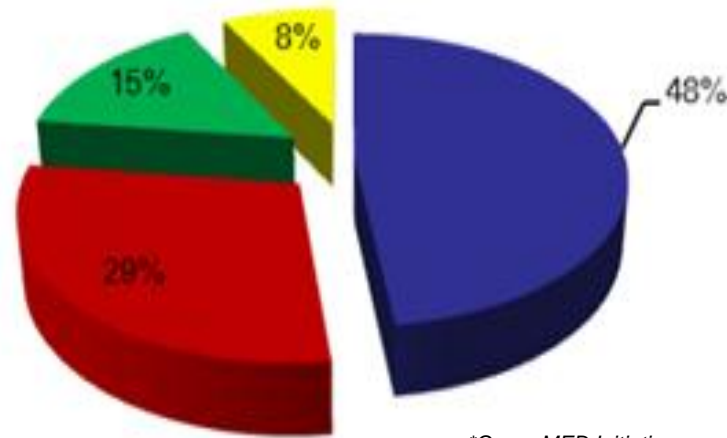
- 2.55M tons of wastes are approximately generated annually in Lebanon
- Each individual generates between 0.8-1.2 kg per day
- Municipal Solid Waste (MSW) is increasing by an annual rate of 1.65%
- Waste produced in Lebanon is (>52.5%) organic, 16% paper and 11.5% plastics



■ Organic ■ Paper/ Cardboard ■ Plastics ■ Metal ■ Glass ■ Others

* Tarek Tabja, AHP Approach: A Decision Making Analysis for Assessing an Integrated Sustainable Solid Waste Management System for AUB Campus and its Neighborhood, ME Thesis, AUB.

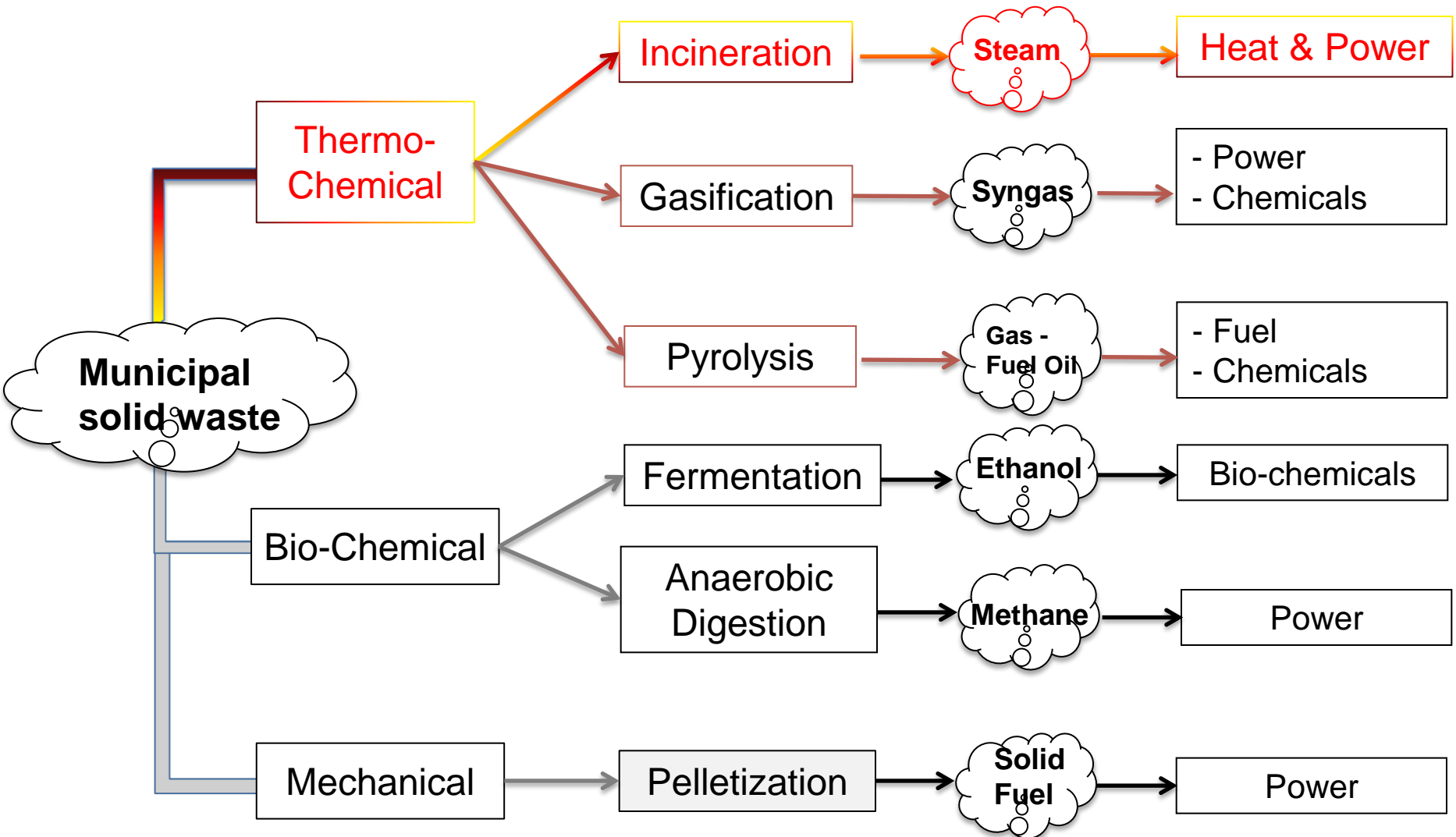
- 48% of the generated wastes are landfilled
- 28% are dumped in open areas
- 15% are composted
- 8% are only recycled



**Green MED Initiative*

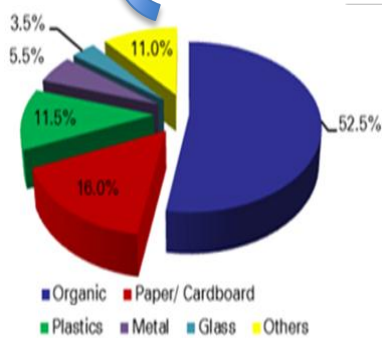
■ Landfilled ■ Openly Dumped ■ Composted ■ Recycled

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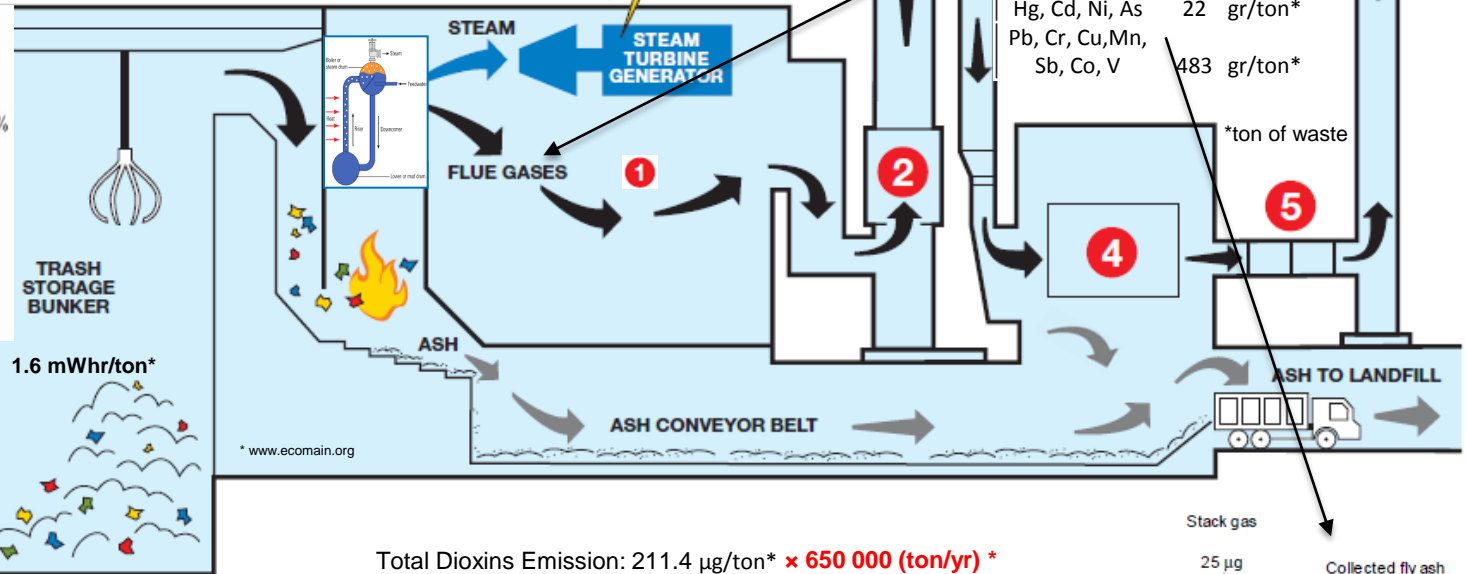


Is Waste Incineration an Option For Lebanon?

2.55 MT/yr of which max 400kT/yr suitable for incineration in Lebanon



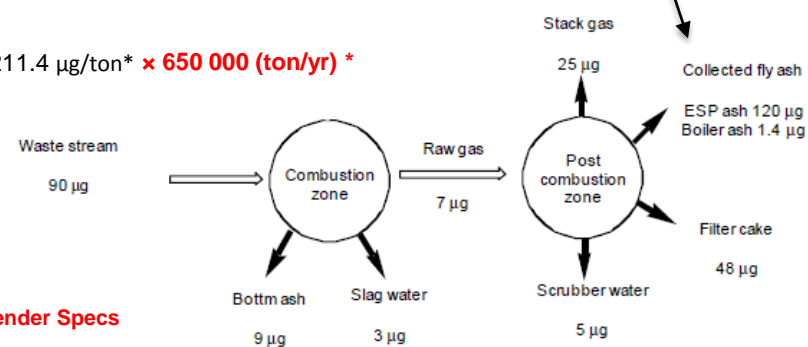
1.6 mWhr/ton*



BTM Ash	170 Kg/ton*
Fly Ash	30 Kg/ton*
Flue Gas	5080 Kg/ton*
Dust	8.79 Kg/ton*
CO2	882.31Kg/ton*
CO	1.74 Kg/ton*
HCL	2.64 Kg/ton*
HF	22 gr/ton*
SO2	1.10 Kg/ton*
Nox(as NO2)	1.54 Kg/ton*
Hg, Cd, Ni, As, Pb, Cr, Cu, Mn, Sb, Co, V	22 gr/ton*
	483 gr/ton*

Total Dioxins Emission: 211.4 µg/ton* × 650 000 (ton/yr) *

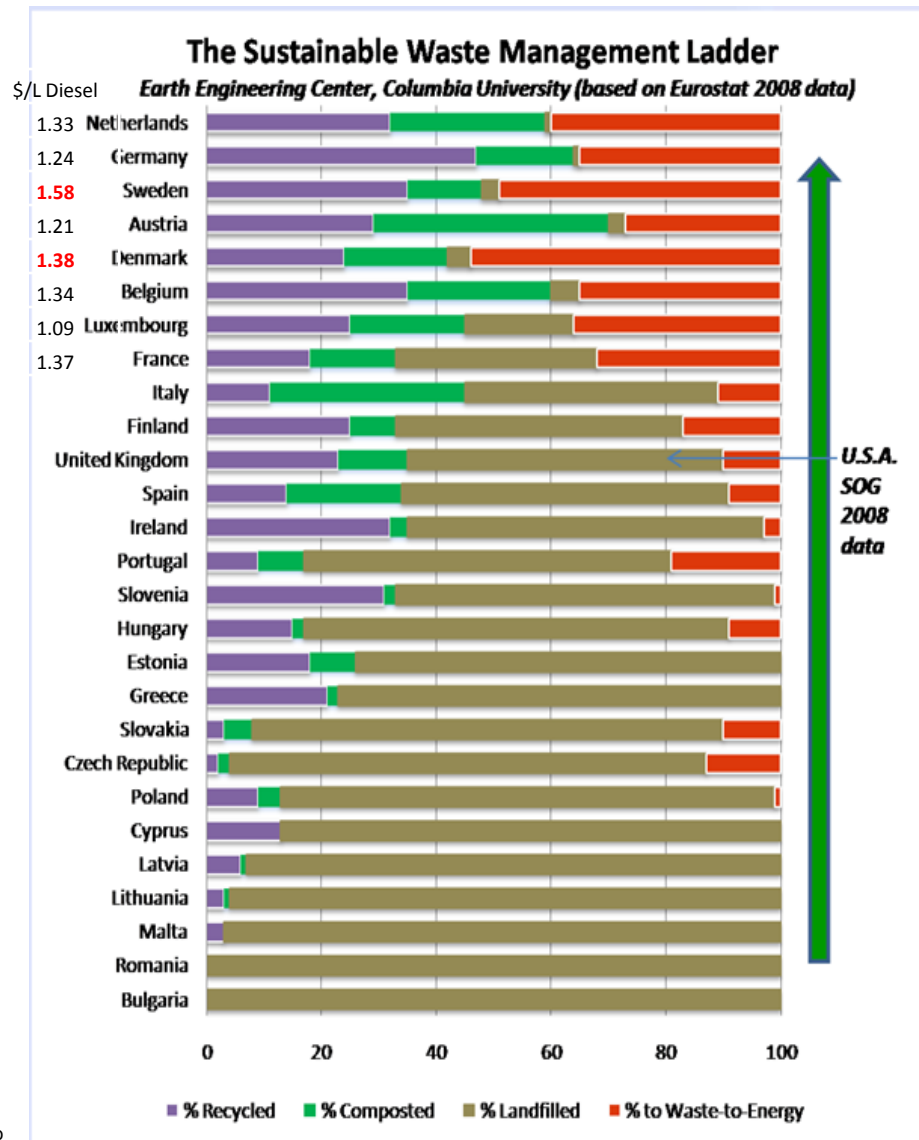
POLLUTION CONTROL SYSTEM



*Beirut Municipality Tender Specs

- Advanced EU countries use not only incineration. Larger waste amounts are recycled and composted (complete waste management system)
- The composition of waste in developing countries is often questionable in terms of its suitability for auto-combustion/incineration
- The complexity of an incineration plant requires very skilled staff and advanced Air Pollution Control systems (APC)
- Residues from flue gas cleaning can contaminate the environment and must be disposed-of in controlled and well-operated toxic-waste landfills to prevent ground and surface water pollution

*The International Bank for Reconstruction and Development / THE WORLD BANK, Decision Makers' Guide to Municipal Solid Waste Incineration



MSW in Lebanon

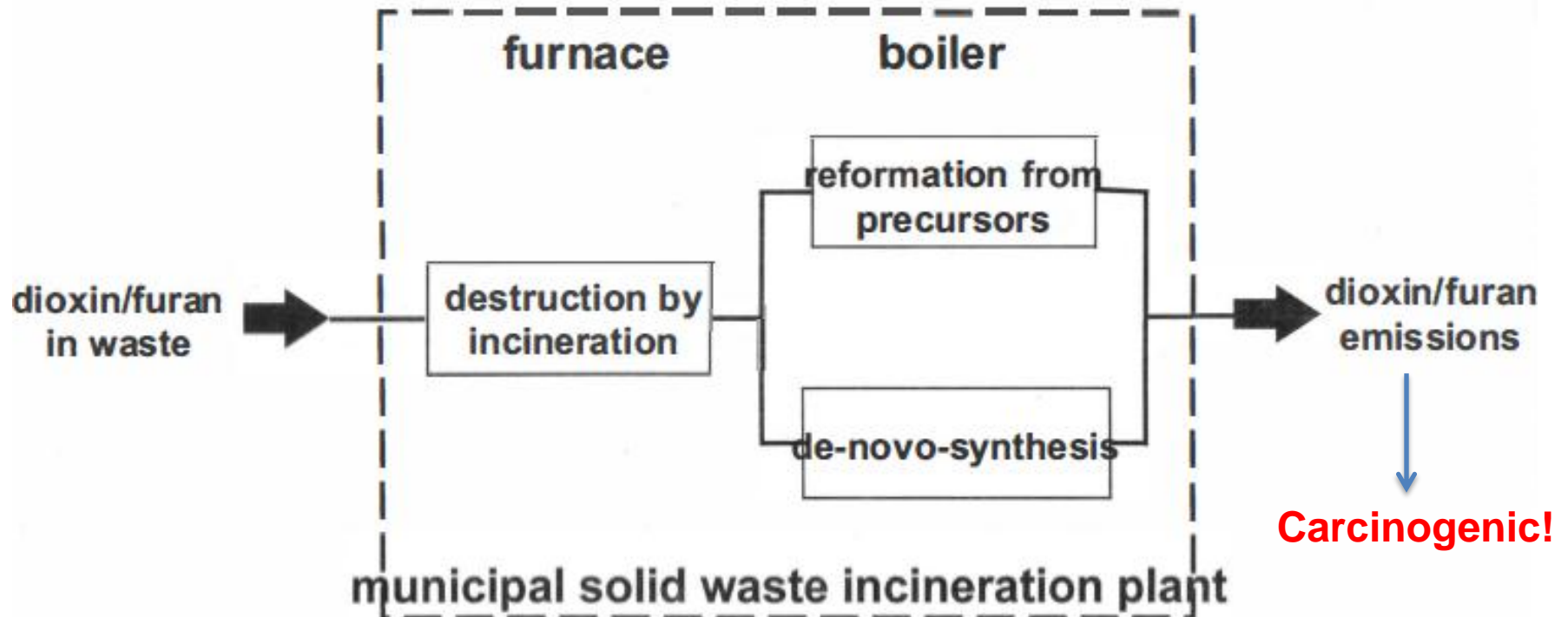
MSW Composition by country (%)	Organic	Paper	Plastic	Glass	Metal	Other	kJ/kg
Denmark*	29	27	1	5	6	32	7047.8
Sweden*	0	68	2	11	2	17	7189.5
Lebanon*	63	18	7	5	3	4	4334.9

Very low due to Composting/AD!!

Lebanon should first tackle organic waste

Minimum required for incineration >6000 kJ/kg

*Urban development series – Knowledge Letters- World Bank



*Modern technologies to reduce Dioxins and Furans from Waste Incineration by Hans-Ulrich Hartenstein and Anthony Licata.

Medium	Accumulation per t of treated waste	Unit	Average concentration	Unit	Specific release (µg I-TEQ/t waste)
Bottom ash	220	kg	46	ng I-TEQ /kg	10.12
Fly ash	20	kg	2,950	ng I-TEQ/kg	59
Filter cake	1	kg	4,000	ng I-TEQ/kg	4
Wastewater	450	l	0.3	ng I-TEQ/l	0.135
Air	5,000	Nm ³	0.02	ng I-TEQ/Nm ³	0.1
Total release					73.355 × 650 000 (ton/yr)*

*Beirut Municipality Tender Specs

These values are 5-10 times higher during plant startups. A single startup could contribute to **60% of Dioxins emissions for one whole year of normal operations!!!** Even worse, a typical incineration plant experiences 3 startups every year on average.

*GUIDELINES ON BEST AVAILABLE TECHNIQUES AND PROVISIONAL GUIDANCE ON BEST ENVIRONMENTAL PRACTICES relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants, MAY 2007, GENEVA, SWITZERLAND.

MSW incineration projects are applicable only if :

- A mature and well-functioning **waste management hierarchy** has been in place for a number of years (e.g. sorting, recycling etc.)



- **Environmental policies/agency** to monitor and regulate emissions
- Employ **advanced air pollution control (APC)** with state of the art technologies to capture harmful flue gas emissions
- A mechanism to dispose-of incinerator solid waste in special **chemical toxic waste landfills**
- **Skilled staff** can be regularly recruited and retained
- Ensure **high plant operating budgets** to cover for costs associated with maintaining process emission abatement systems

*The International Bank for Reconstruction and Development / THE WORLD BANK, Decision Makers' Guide to Municipal Solid Waste Incineration

- Lebanon's waste is mainly bio-organic, more suitable for composting and Anaerobic Digestion
- Only 12%-16% of Lebanon's waste (i.e. ~400 kton/yr) is suitable for incineration => **incinerators do not solve the current waste problem of 2550 kton/yr!**

