

***Economic conversion of MSW into RDF***

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**High amount of municipal solid waste (MSW) where high demand for Cement**

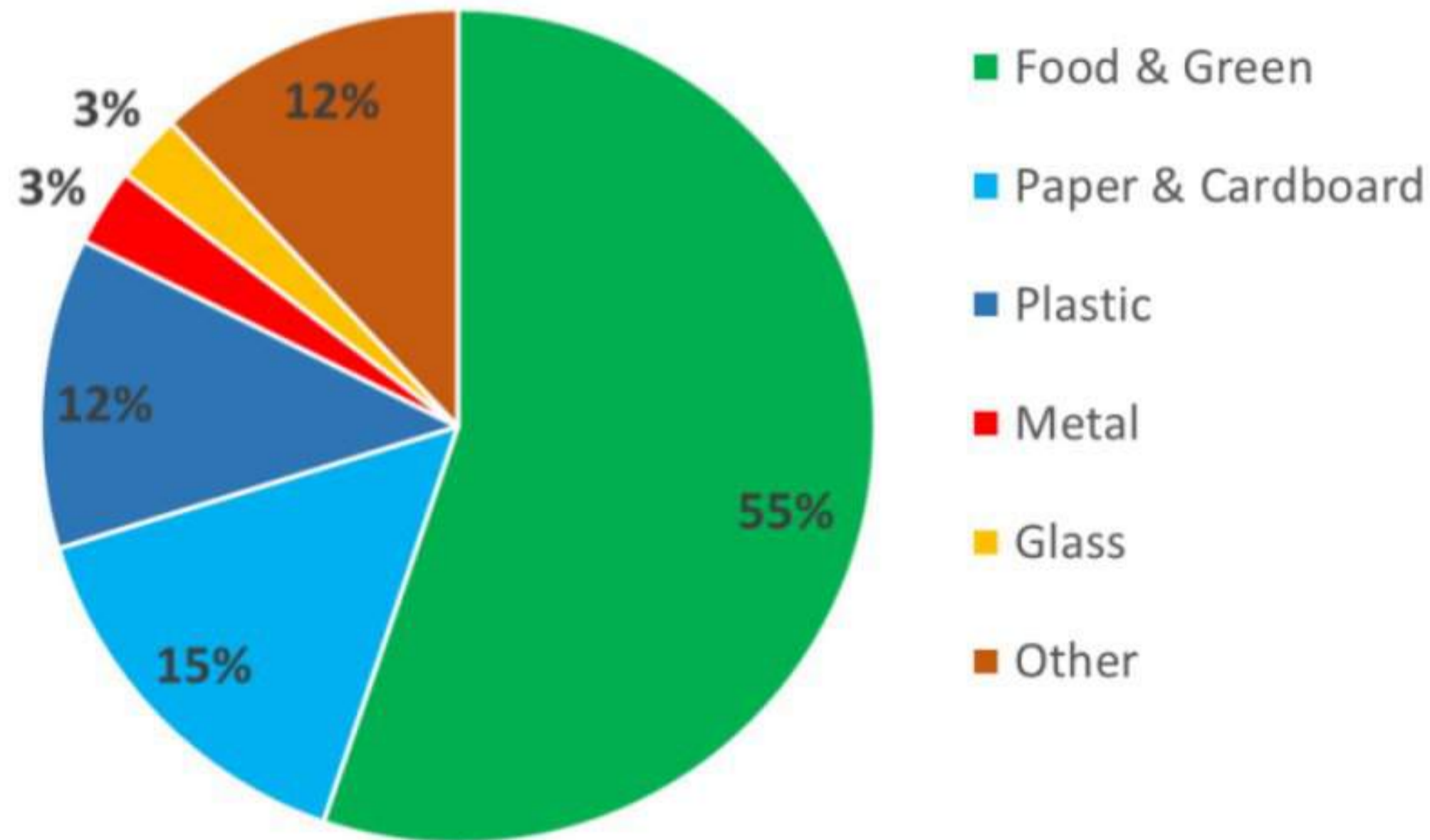


One ton MSW contains sufficient energy to burn one ton clinker



## MSW composition is similar in most countries without separate collection at source

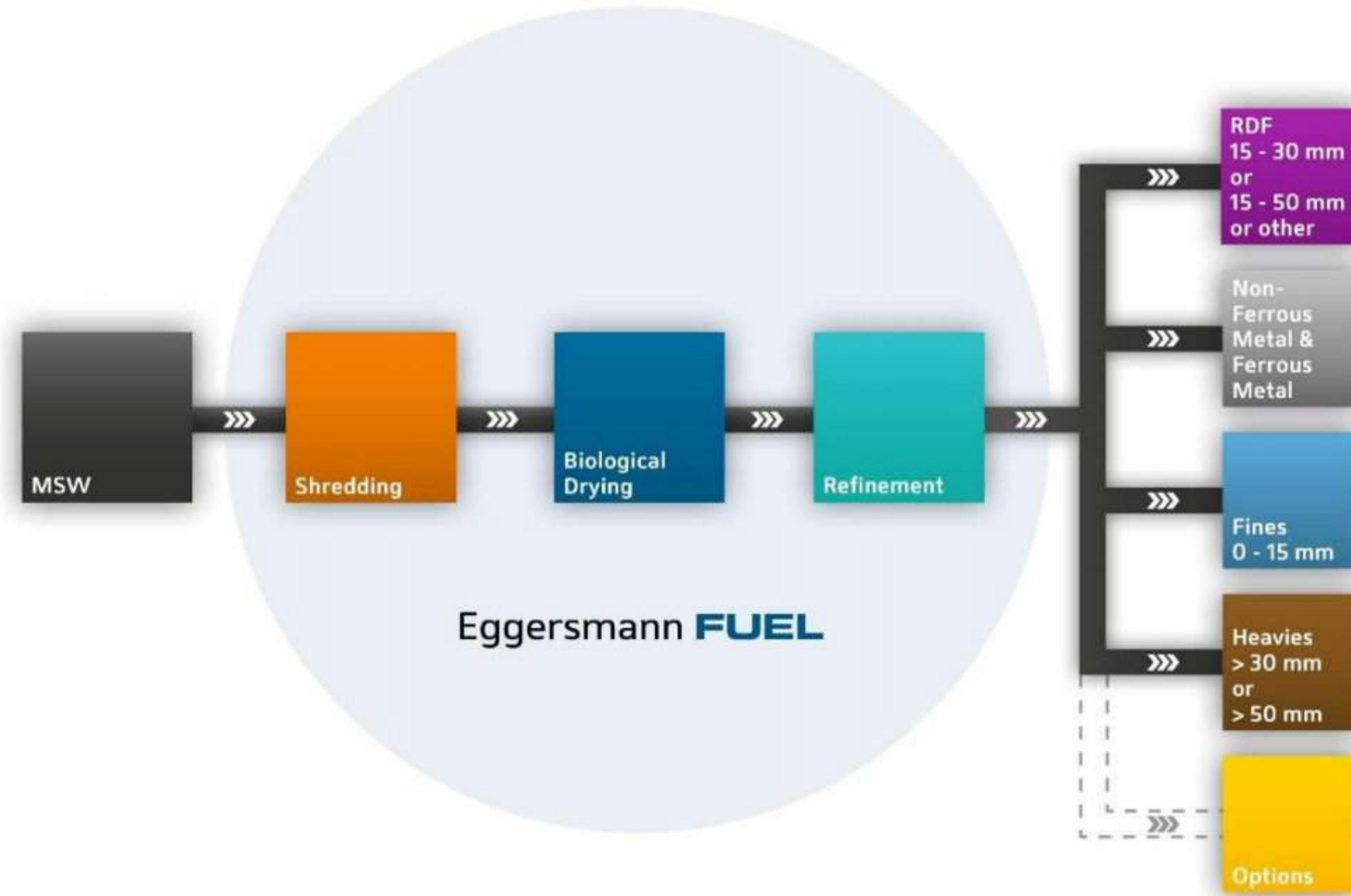
### Fresh MSW composition MENA



### Physical properties - and what it means for waste management

- MSW contains > 50% of water, sometimes 60%
- > 80% of MSW is suitable for RDF... if it is dried!
- Substantial landfill diversion only when organic is converted to RDF
- Only using plastic as RDF does not solve landfill problem!
- RDF from plastic (fossil source) does NOT reduce CO<sub>2</sub> emissions

## Integrated Processes & Machines to convert MSW to RDF



*From 100 to 300 tons/day      From 300 to 2,000 tons/day (or more!)*  
*Fully mobile or permanent installation      Base line + optional additions*

## Process design data

### MSW composition example Mexico

Input	percentage by mass
Organics	62.92 %
Paper	1.64 %
Cardboard	2.46 %
Glass	3.00 %
PET	2.18 %
Film	7.00 %
Hard plastics + Tetra	1.29 %
Iron	0.43 %
Aluminium	0.08 %
Textiles	1.00 %
Other combustibles	13.50 %
Other non-combustibles	4.00 %
Hazardous	0.50 %
<b>Total</b>	<b>100.00 %</b>

### MSW physical properties

- Input moisture 52% (48% dry matter)
- $\geq 50\%$  organic dry matter of total dry matter
- Calorific value dry basis: 16.3 MJ/kg

### MSW reception & site operation

- MSW: 300 t/d
- 7 days per week, 360 days per year
- 1 operation shift + 1 cleaning & maintenance shift per day
- RDF 15-50 mm;  $\leq 20\%$  moisture;  $> 14$  MJ/kg

## 1 Mechanical pre-treatment

- Primary shredding
- 250-300mm



## 2 Biological drying

- Membrane covered with turner
- **No fossil fuel for drying required**
- Defined turning process with CON



## 3 Refinement (post-treatment)

- Screening
- Wind-shifter
- FE-Separator
- Fine shredder
- Option



## RDF – Sustainable Fuel

RDF quality and humidity is stable

$\leq 20\% \text{ H}_2\text{O}$



### MSW fresh

Significant variation within days

Moisture 50% - 65%  $\text{H}_2\text{O}$

21 DAYS





## Mass balance - design

### Mass balance

<b>RDF</b>	<b>14,4 t/h</b>	<b>110 t/d</b>	<b>36,8%</b>
<b>Recyclables</b>	<b>0,3 t/h</b>	<b>2 t/d</b>	<b>0,7%</b>
<b>Fines</b>	<b>4,0 t/h</b>	<b>31 t/d</b>	<b>10,2%</b>
<b>Heavies</b>	<b>1,5 t/h</b>	<b>12 t/d</b>	<b>3,9%</b>
<b>Mass loss (drying)</b>		<b>146 t/d</b>	<b>48,5%</b>
		<b>300 t/d</b>	<b>100,0%</b>

- Fines can be used as landfill cover
- Metal include ferrous metal; additional non-ferrous metal if option is applied



## **RDF 10-50 mm**

- 14 – 16 MJ/kg



## **Fines < 10 mm**

- 5 – 6 MJ/kg
- Sometimes also used for Clinker production, mixed with clay as CaCO<sub>3</sub> source (alternative raw material)

	Emission reduction [t CO <sub>2equi</sub> / a]	Project emissions [t CO <sub>2equi</sub> / a]
Methane (CH <sub>4</sub> ) from landfill	<b>141,000</b>	
MBT site operation (electricity, diesel)	-	<b>- 1,500</b>
Replacement fossil fuel for clinker production (heavy fuel oil)	<b>47,500</b>	
Accounting for plastic in RDF (=fossil based fuel)		<b>- 22,000</b>
CO <sub>2</sub> reduction per year	<b>165,000 [t CO<sub>2equi</sub> / a]</b>	

The annual reduction is comparable to the CO<sub>2</sub>-emissions of a town with 34,000 inhabitants\*

\*...worldwide average 4.8 t CO<sub>2equi</sub> per capita per year

Source: Hannah Ritchie and Max Roser (2020) - "CO<sub>2</sub> and Greenhouse Gas Emissions". Published online at [OurWorldInData.org](https://www.ourworldindata.org).



**Supplier:** Eggersmann

Teuton ZS 50/ 55 slow speed shredder

**Capacity:** 45 t/h (guarantee)  
> 50 t/h with MSW

## Pre-Treatment

**Machine:** Slow speed shredder

**Function:** bag opening, particle size approx. <250 mm

**Interface:** truck loading or drop point





**Supplier:** Eggersmann

**Drying:** 52% -> 20% H<sub>2</sub>O in 20 days

**Lanes:** 21 lanes

**Turning:** 1 lane per hour



## **Bio-Dry**

CONVAERO membrane covered, pressure aerated lanes

**Machine:** BACKHUS CON 60 turner

**Function:** biological drying of MSW down to 20% moisture

**Interface:** pre-shredding & refinement –  
material transfer via trucks or wheel loader



**Supplier:** Eggersmann

Lots of options & additions possible but not mandatory

## Refinement

Various machines & conveyors

**Function:** removal low CV fractions, fine shredding to 50 mm (optional 30 / 60 / 80 mm)

**Interface:** trucks or wheel loader with dried MSW; truck-loading for products & rejects