



**TAITEX Workshop in Mexico City  
on solid waste integrated management in urban areas**

**How can we make the best of it?  
- economic and ecologic aspects of waste management -**



**STADTREINIGUNG HAMBURG**

11 September 2015

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# Content



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1. Waste management in Germany
2. Waste Management by Stadtreinigung Hamburg (SRH)

**How we make the best of it.**



# Waste management in Germany



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“Closed Cycle Management Act” (Kreislaufwirtschaftsgesetz)

- 5-step waste hierarchy

## 1. Prevention of waste

## 2. Preparing for re-use

## 3. Recycling

## 4. Other recovery, e.g. energy recovery

## 5. Disposal



1 Megagram (Mg) = 1,000 Kilogram (Kg) = 1 Metric Ton (t)

# Waste management in Hamburg

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## No landfill for untreated waste from households

- in Germany since 2005
- in the City of Hamburg since 1998



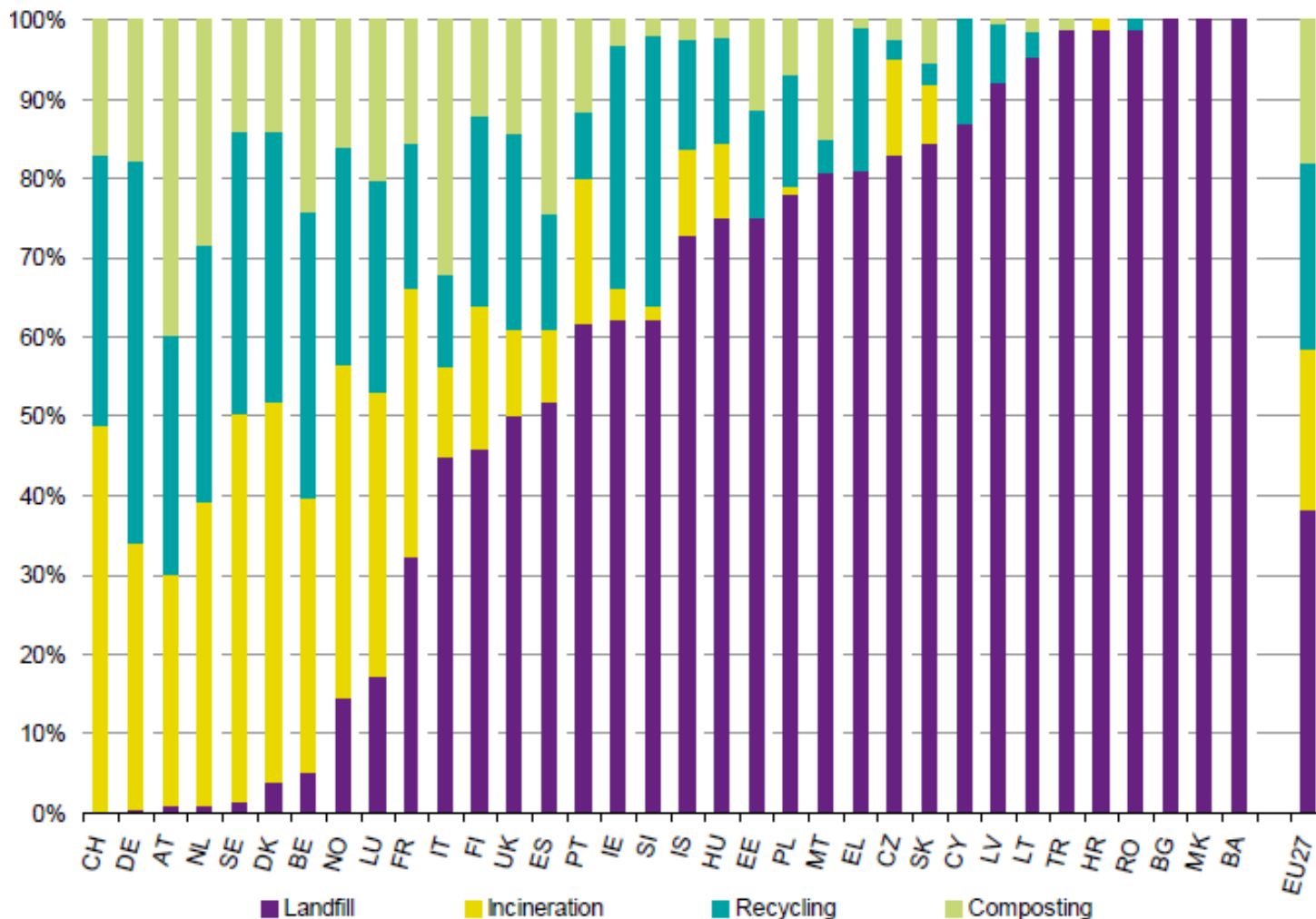
# Waste management in Hamburg

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Municipal waste treated in 2009 by country and treatment category



- AT **Austria**
- BA Bosnia and Herzegovina
- BE **Belgium**
- BG **Bulgaria**
- CH Switzerland
- CY **Cyprus**
- CZ **Czech Republic**
- DE **Germany**
- DK **Denmark**
- EE **Estonia**
- EL **Greece**
- ES **Spain**
- FI **Finland**
- FR **France**
- HR Croatia
- HU **Hungary**
- IE **Ireland**
- IS Iceland
- IT **Italy**
- LT **Lithuania**
- LU **Luxembourg**
- LV **Latvia**
- MK fYR of Macedonia
- MT **Malta**
- NL **Netherlands**
- NO Norway
- PL **Poland**
- PT **Portugal**
- RO **Romania**
- SE **Sweden**
- SK **Slovakia**
- SI **Slovenia**
- TR Turkey
- UK **United Kingdom**
- Marked red: EU states**

# Waste management in Hamburg

## - How can we make the best of it? -



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### Examples for prevention of waste

- Deposit for multi-trip bottles (glass)
- Design of products
  - less weight (packaging)
  - designed for repair (electric devices)
- Shops / markets without packaging
- Ban of plastic bags

1. Prevention of waste
2. Preparing for re-use
3. Recycling
4. energy recovery
5. Disposal

*Hamburgs täglicher Müll:*

# 340 TAUSEND PLASTIKTÜTEN

**WER HAMBURG LIEBT,  
VERMEIDET MÜLL!**

Weitere Tipps zur Abfallvermeidung  
finden Sie hier:  
[WWW.STADTREINIGUNG.HAMBURG](http://WWW.STADTREINIGUNG.HAMBURG)

**EINKAUFSTASCHE STATT PLASTIK: ALLES ANDERE KOMMT NICHT IN DIE TÜTE.**

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# 151 TONNEN ALTGLAS

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MEHRWEG STATT EINWEG: ALLES ANDERE IST FÜR FLASCHEN

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# 111 TAUSEND GETRÄNKEDOSEN

**WER HAMBURG LIEBT,  
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MEHRWEG STATT EINWEG: ALLES ANDERE IST BLECH

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# 1112 KILOGRAMM BATTERIEN

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AKKUS STATT BATTERIEN: ALLES ANDERE IST ECHT BITZEND

# Waste management in Hamburg

## - How can we make the best of it? -



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1. Prevention of waste
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## Examples for preparing for re-use

- STILBRUCH stores for useful items from bulky waste collection in the city of Hamburg
  - low prices (social aspect) for used furniture, books, consumer electronics
- Retread of worn tires
- Clothes recycling bin / clothes banks



# Waste management in Hamburg

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## Prevention of Waste by STILBRUCH

- Direct marketing of furniture, books, textiles etc. at secondhand store “Stilbruch” (subsidiary of SRH)
  - 1,300 Mg/a (furniture)
  - Source: recycling center, bulky waste collection on demand, direct delivery, dissolving of households (service offered by Stilbruch)



**stilbruch**

Das Kaufhaus für Modernes von Gestern



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### Examples for recycling (1)

- Paper
  - 98,000 Mg/a from households (58 kg/a/per head)
  - 136,000 Mg/a from commerce and industry
  - cost recovery 28 %

1. Prevention of waste
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## - How can we make the best of it? -



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### Examples for recycling (2)

- Biowaste (green bin): 58,500 Mg
  - treated in SRH-owned fermentation and composting plant 'BKW Bützberg' by dry fermentation
  - cost recovery 22 %
  - seasonal surplus: treatment in other composting plants (tender / contracts)
    - ➔ expense for SRH (45 – 60 €/Mg)

1. Prevention of waste
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# 2. Stadtreinigung Hamburg (SRH) How can we make the best of it?



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1. Prevention of waste
2. Preparing for re-use
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## Examples for recycling (2)

- Dry fermentation and composting plant
  - in operation since 2011
  - capacity:70,000 Mg/a (60,000 Mg bio + 10,000 Mg green waste): Cost reduction, climate protection, safety disposal
- Biowaste triple strategy

1. Biogas production by fermentation  
2. Biogas storage

3. Compost production by composting of digestate from fermentation



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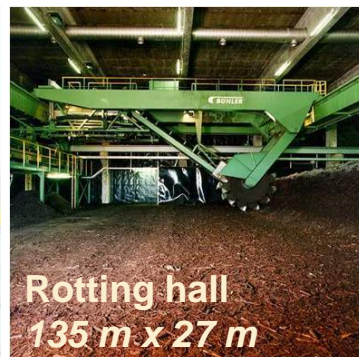


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1. Prevention of waste
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## Examples for recycling (2)

- Biogas and composting process at the biogas and composting plant (dry fermentation)



# Waste management in Hamburg

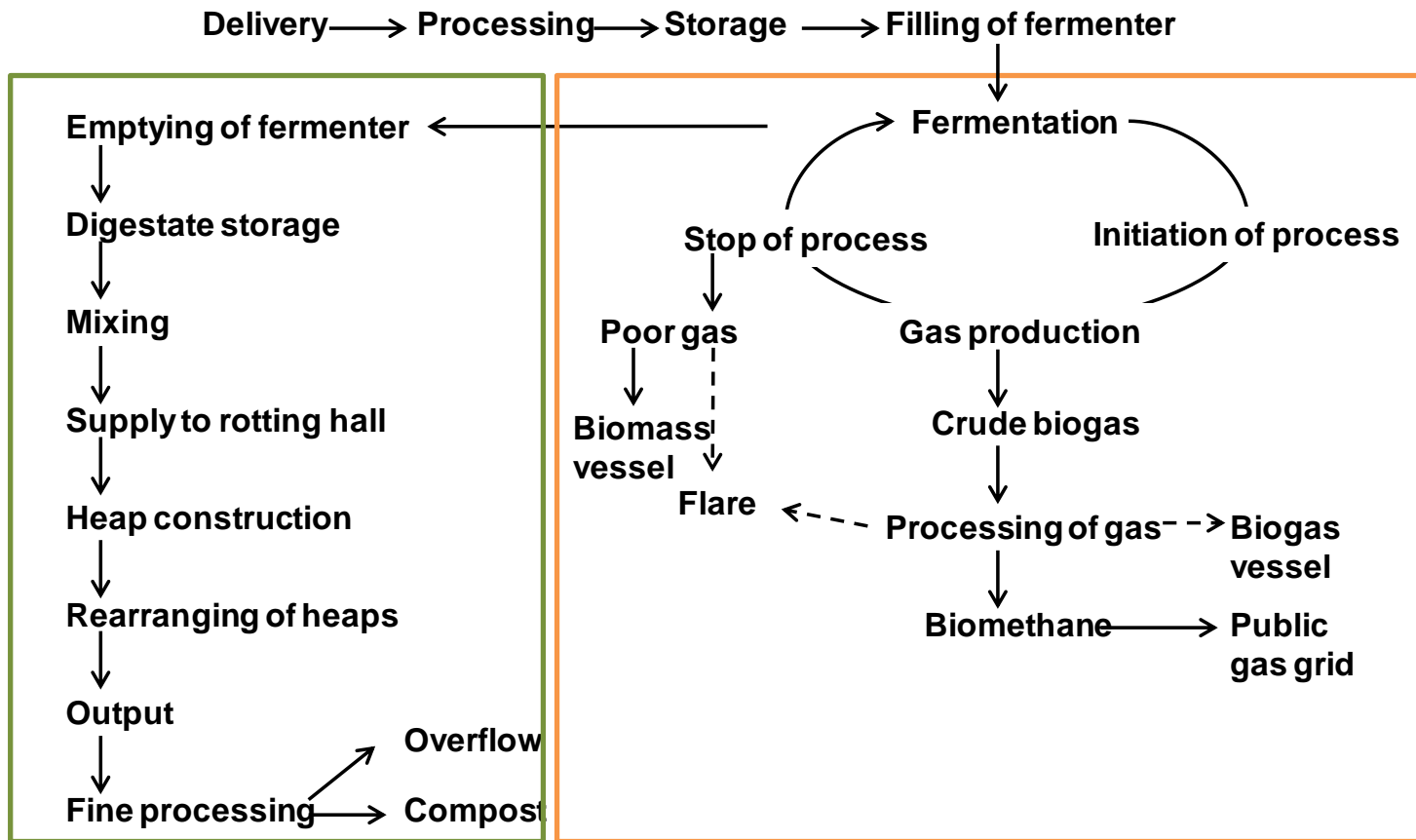
- How can we make the best of it? -



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## Examples for recycling (2)



2. step: Composting

1. step: Dry fermentation

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### Examples for recycling (2)

- Biogas supplied to grid: 11,900 MWh
- Compost (agriculture): 19,300 Mg
- Total area of plant: 13 ha

1. Prevention of waste
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### Examples for recycling (2)

- Leaves (street cleaning/gardens): 12,700 Mg / a
- Tender, expense for SRH (40 – 55 € / Mg)
- Cleaned, pressed to pellets, enriched with minerals, used in agriculture as soil conditioner



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## Examples for recycling (2)

Waste fraction <i>(separate collected)</i>	<u>General possibilities for treatment</u>	<u>Main ways of treatment at SRH</u>	<u>Marketing by SRH: Other treatment ways*</u>
Biowaste	Fermentation, composting	Fermentation + composting	Seasonal surplus: Composted
Green waste	Fermentation, composting, incineration	Incineration	Seasonal surplus: Composted
Leaves	Fermentation, composting, incineration, gasification, pelletizing	-	Leaves (leaf-bags): Composted  Leaves (street cleaning): Processed to pellets
Wood <i>(furniture, construction wood etc.)</i>	Reuse, recycling, incineration, gasification	Reuse / recycling of bulky waste <i>(furniture)</i>	Recycling <i>(chipboards),</i> incineration



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### Examples for recycling (2)

- Glass
  - brown
  - green
  - colorless
  - 29,100 Mg/a from households
  - 8,200 Mg/a from commercial

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## Examples for recycling (5)

- Other collection systems
  - Glass -> 29,100 Mg/a from households
  - Clothes -> 6,200 Mg/a from households
  - Consumer electronics -> 11,800 Mg/a
  - Hazardous waste -> 2,300 Mg/a



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### Examples for recycling (3)

- Packagings (metal, plastic, cardboard)
  - 33,900 Mg/a
  - 20 kg/a/per head

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## Examples for recycling (4)

- Recycling center

1. Prevention of waste
2. Preparing for re-use
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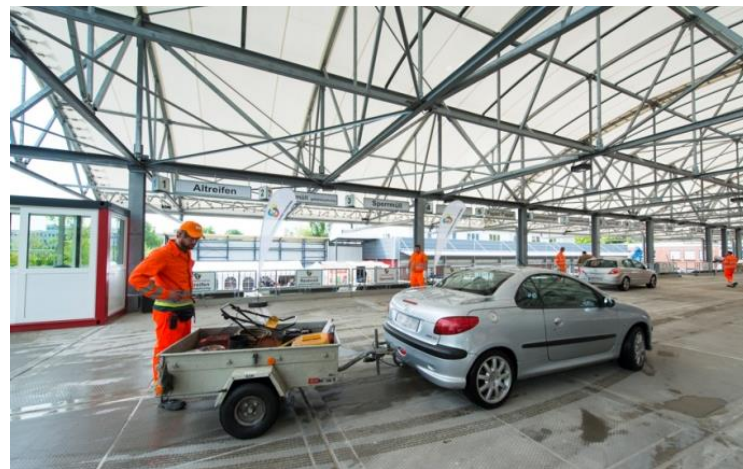


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1. Prevention of waste
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## Examples for recycling (4)

- Recycling center (12)
  - wood -> 30,000 Mg/a
  - garden waste -> 20,500 Mg/a
  - scrap metal -> 5,500 Mg/a
  - fridges -> 1,300 Mg a
  - 25 fractions of waste -> total 100,000 Mg/a



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- How can we make the best of it? -



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## Examples for energy recovery

- Biogas plants
  - one plant for commercial biowaste (wet fermentation)
  - one plant for organic waste from households (dry fermentation)
- Incineration plants



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- Beyond household waste: Treatment of commercial biowaste at SRH in a ppp-model (SRH 47.5%)
  - **Biowerk:** Wet fermentation plant with CHP aggregate
  - Plant fed with biowaste from gastronomy, canteens, supermarkets (expired food, food residuals, fat/oil etc.)
- Data 2013
  - Biowaste (input): 18,400 Mg
  - Electricity (to grid): 6,100 MWh
  - Heat (local heat grid): 5,800 MWh
  - Digestate (agriculture): 20,000 Mg



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SRH-owed dry fermentation  
and composting plant, 2011

Capacity: 70,000 tons/a



Incineration plant  
Stapelfeld, 1978

Contract with SRH  
until 2016 for treatment  
of 200,000 t/a



PPP-model (SRH 47,5%)  
wet fermentation plant, 2006

Capacity: 20,000 tons/a



SRH-owed incineration plant, 1973  
(closed down since Jul 2015)

Capacity: 180,000 tons/a

Hamburg

Incineration plant  
Rugenberger Damm, 1999

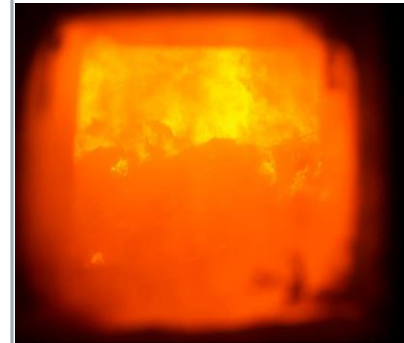


Contract with SRH until  
2019 for treatment of  
320.000 t/a

SRH-owed incineration plant  
Borsigstraße, 1994  
(bought by SRH in Dec 2014)



Capacity: 320,000 tons/a





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### Incineration plants

- Globally 2,500 incineration plants, in more than 30 countries, are in operation
  - With 400 plants in Europe
- Incineration technology is not realisable in all countries (weather conditions, waste composition (heat value!) financing, logistics etc.)

Household waste heat value comparison for various countries:

Country	Heat Value
Germany	9 – 11 MJ/kg
China	4 – 7.3 MJ/kg
Brazil	3 – 6.9 MJ/kg
India	< 4 MJ/kg

# Waste management in Hamburg

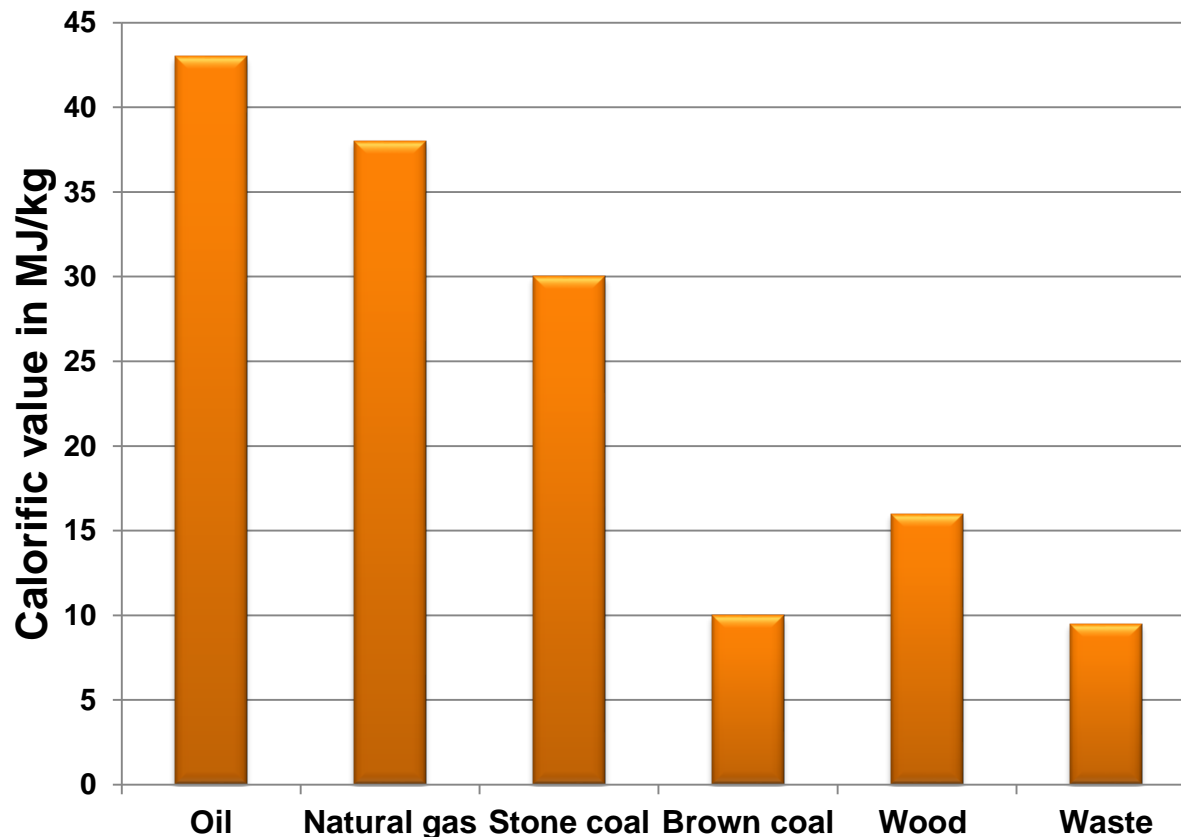
- How can we make the best of it? -



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## Waste as energy source

- Comparison of heat values (= usable energy content during incineration) of different energy sources



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- How can we make the best of it? -



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## Incineration plants



Incineration plant MVB in Hamburg

1. Prevention of waste
2. Preparing for re-use
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# Waste management in Hamburg

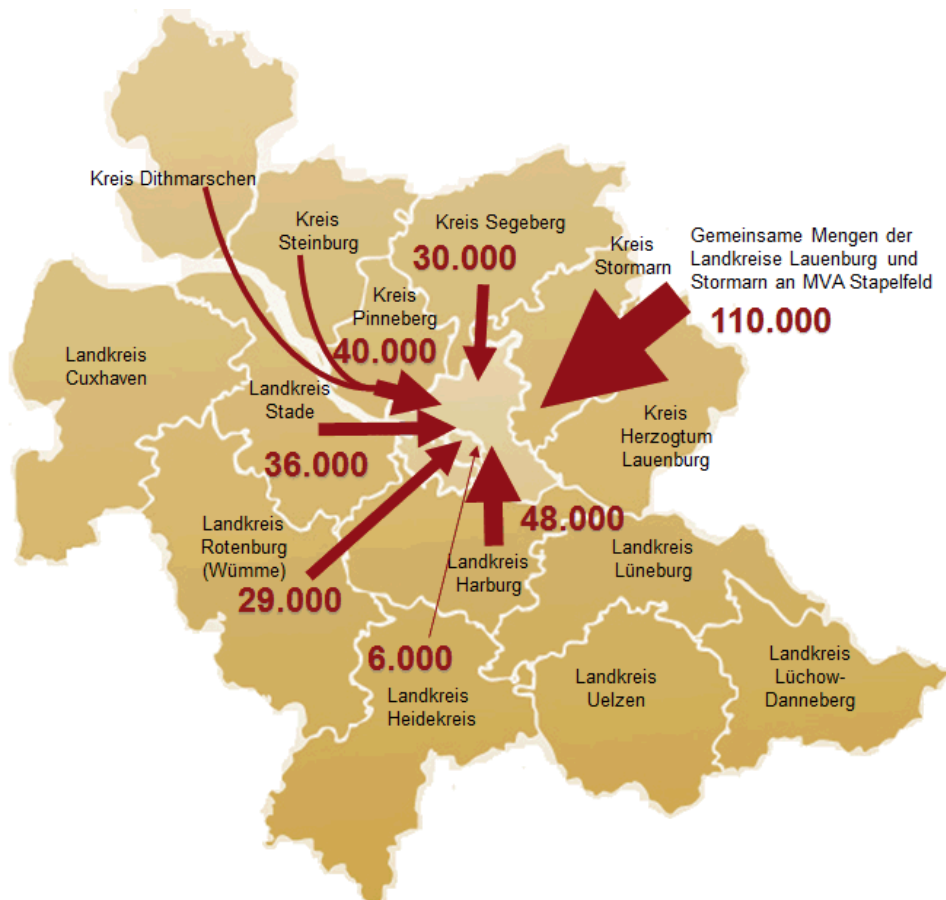
- How can we make the best of it? -



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## Incineration plants

1. Prevention of waste
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- How can we make the best of it? -



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## Incineration plant (MVB) with three incineration lines

1. Prevention of waste
2. Preparing for re-use
3. Recycling
4. energy recovery
5. Disposal



- One line for wood (polluted and non-polluted)
- Two lines for production of electricity and steam for district heating system

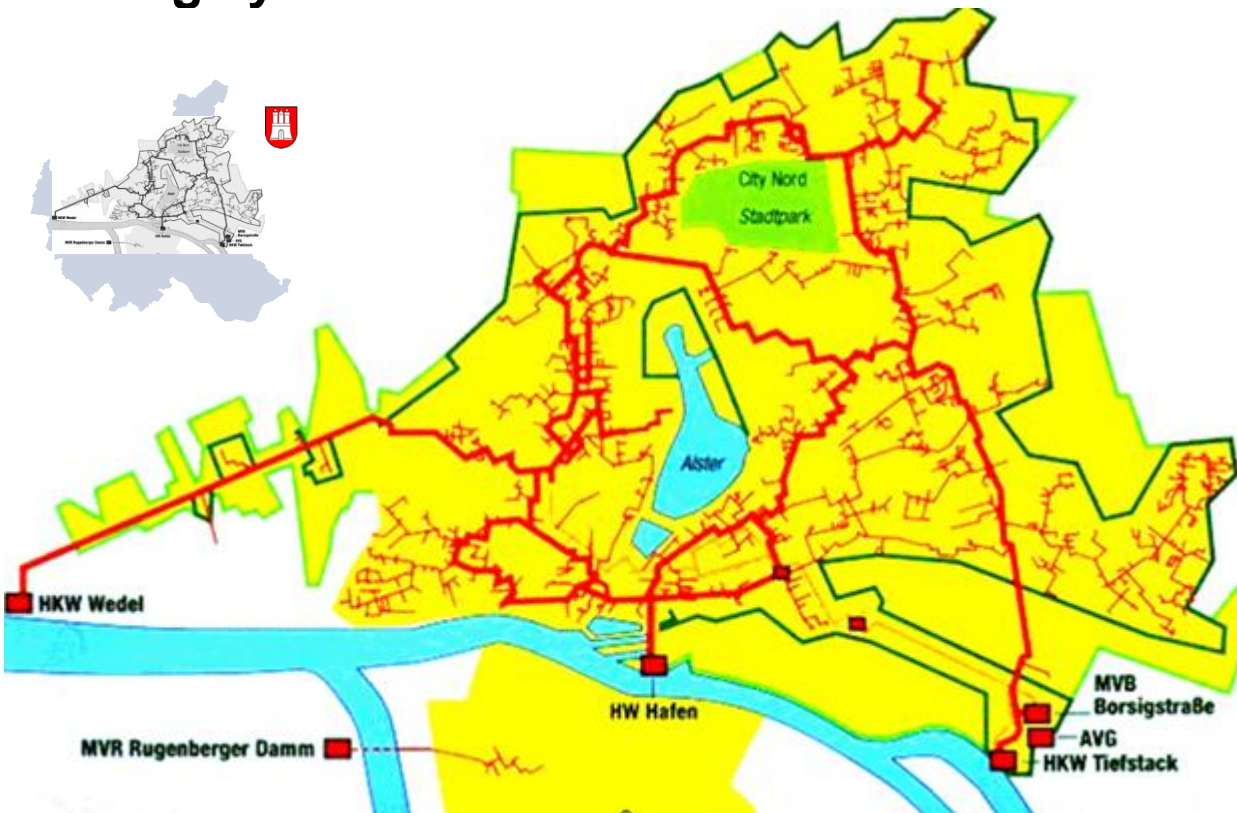
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Incineration plants produce steam for district heating system



1. Prevention of waste
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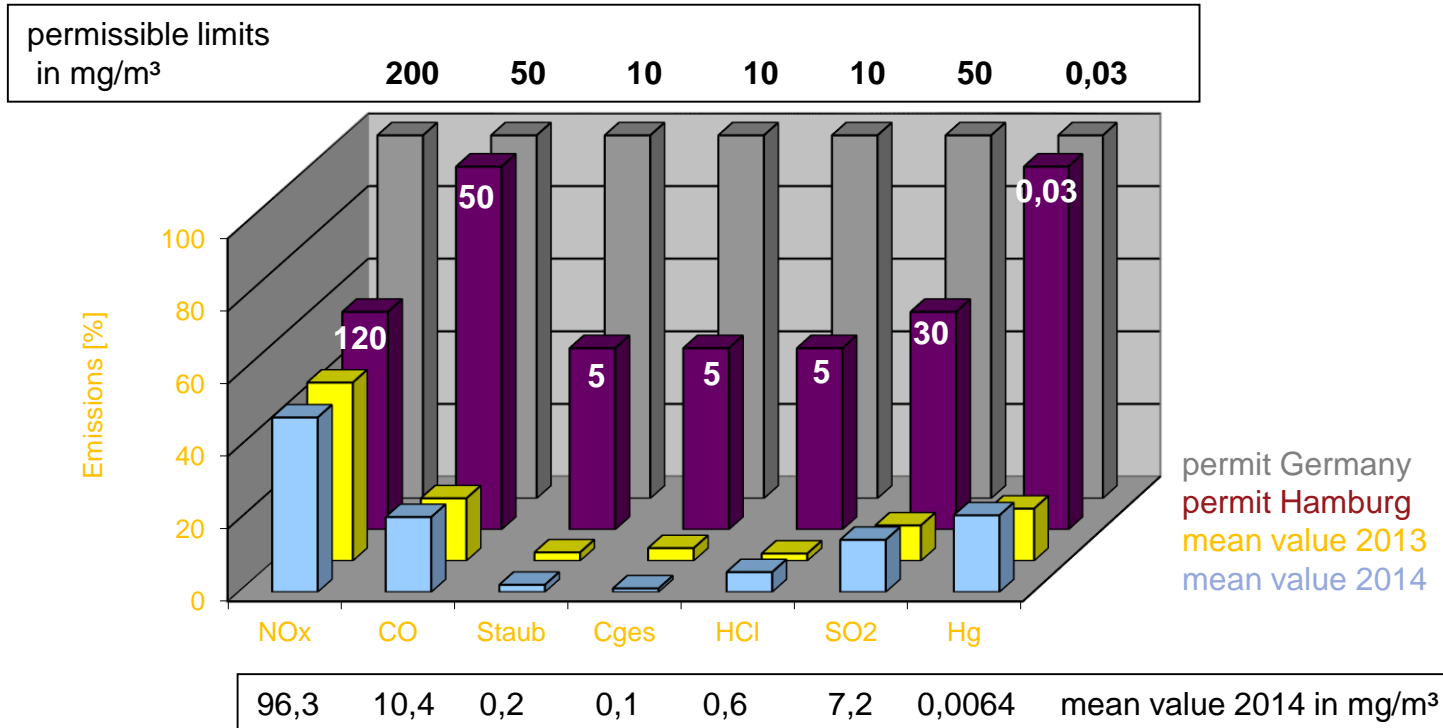
- How can we make the best of it? -



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## Emissions of incineration plants (MVB)

1. Prevention of waste
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# Waste management in Hamburg

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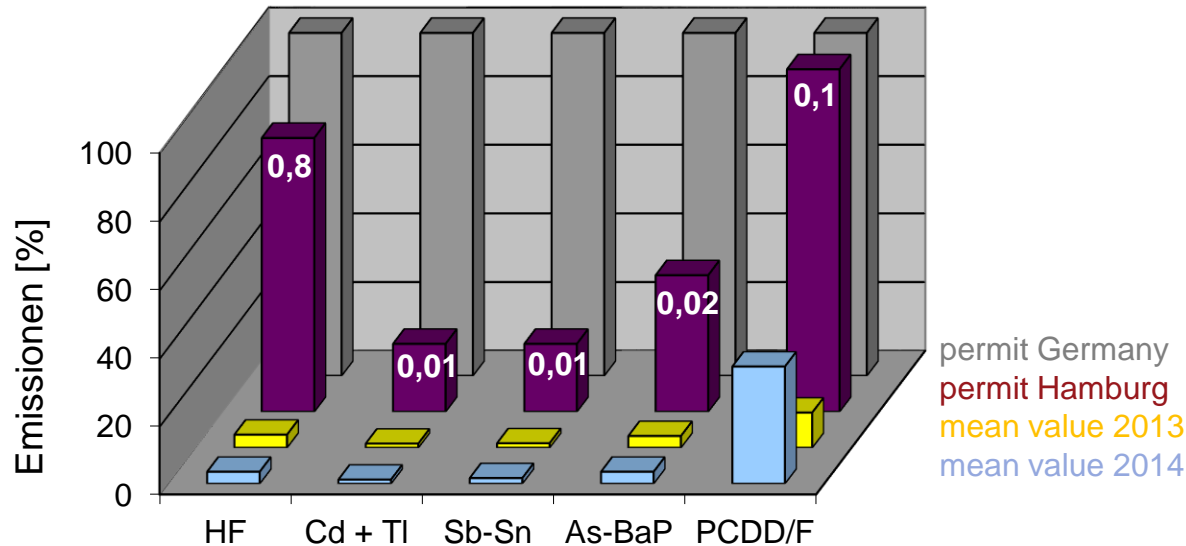


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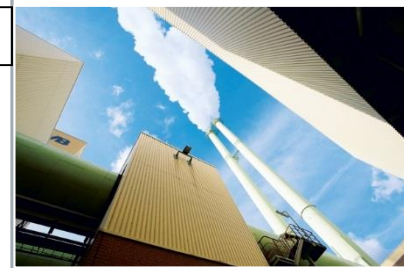
1. Prevention of waste
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## Emissions of incineration plants (MVB)

permissible limits in mg/m<sup>3</sup> 1      0,05      0,5      0,05      0,1 ng/m<sup>3</sup>



0,04    0,0006    0,0082    0,0018    0,0345 ng/m<sup>3</sup>    mean value 2014    in mg/m<sup>3</sup>





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- How can we make the best of it? -

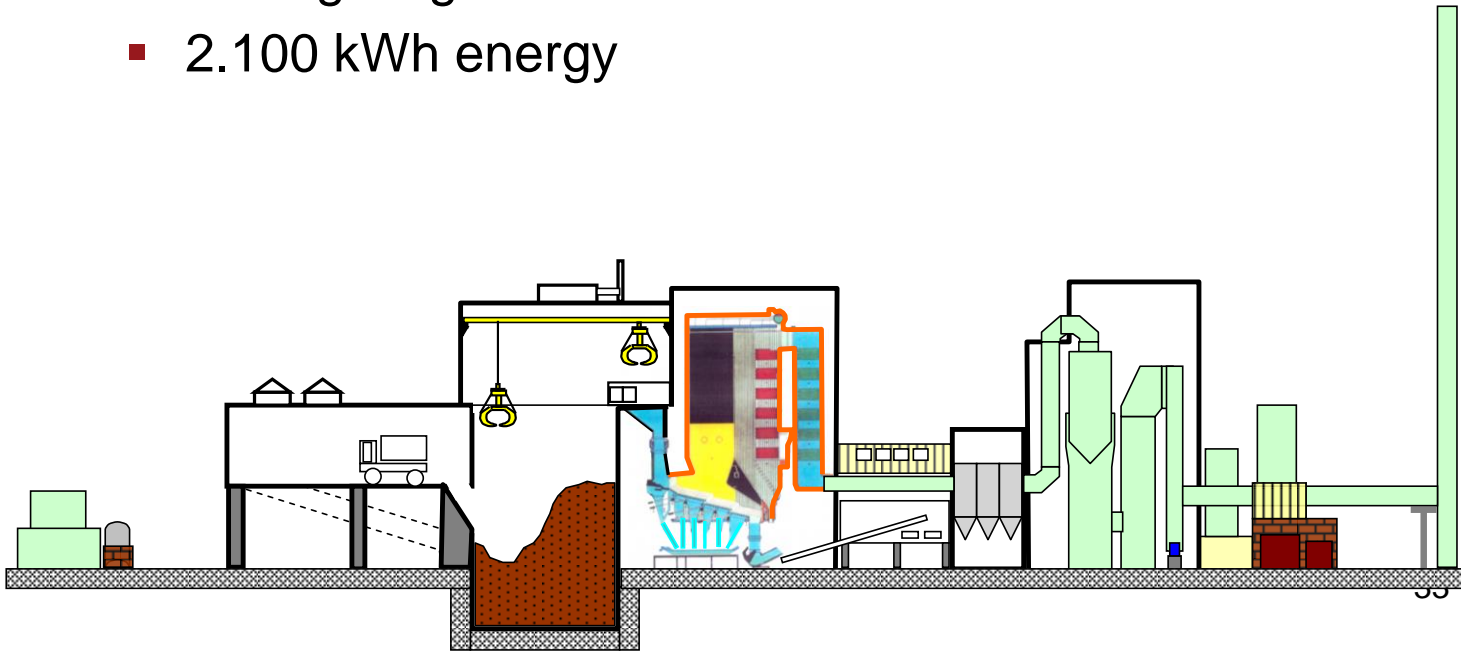


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## Recoveries from 1 Mg waste (MSW) after incineration

- 24 kg Fe
- 3,4 kg other metals
- 12,4 kg hydrochloric acid
- 3,5 kg gypsum
- 220 kg slag
- 2.100 kWh energy

1. Prevention of waste
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# Waste management in Hamburg

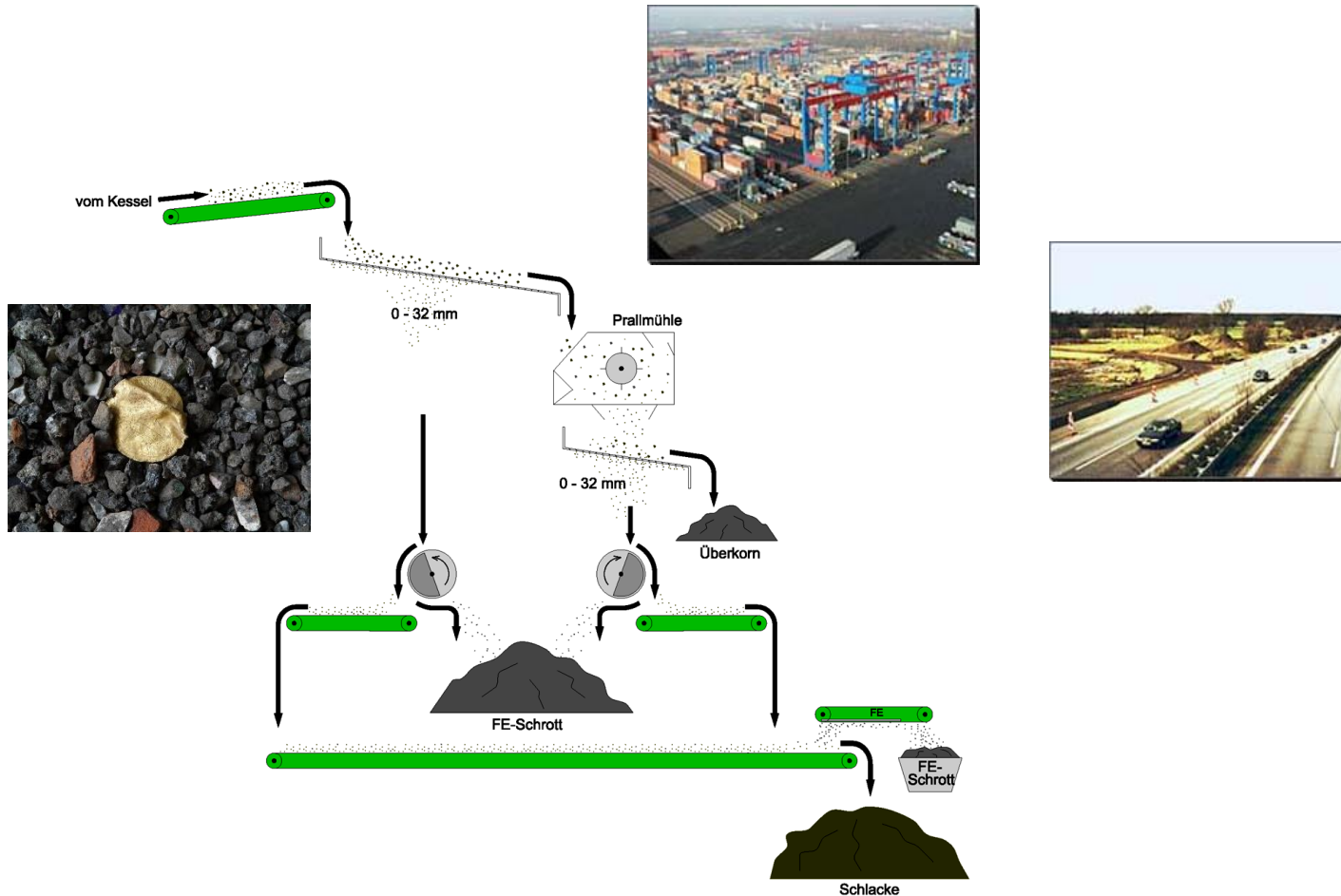
- How can we make the best of it? -



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## Slag ("bottom ash") becomes a building material

1. Prevention of waste
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# Waste management in Hamburg

## - How can we make the best of it? -

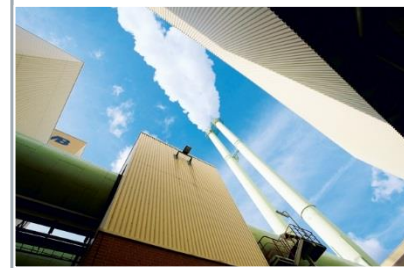


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### Waste incineration in Hamburg

- clean and safe
- controlled technical process
- accepted technique by citizens
- essential for energy supply
- a lot of recycling products
- on long-term view financial advantageous

1. Prevention of waste
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# Waste management in Hamburg

- How can we make the best of it? -



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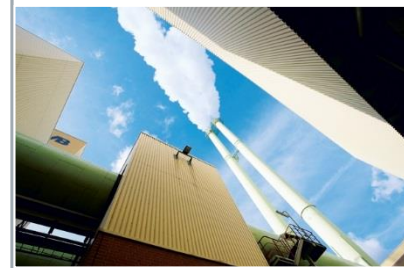
# 99%

of waste from households in Hamburg will be recycled or used for energy production

# 1%

of waste from households in Hamburg goes to landfill (treated hazardous waste, contaminated ashes)

1. Prevention of waste
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# Waste management in Hamburg

## - How can we make the best of it? -



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### Planning of treatment plants: How to decide for a waste treatment process with energy recovery?

Where might the plant be located?

Which kind of waste is to be treated (fraction / amount)?

How is the economic situation of the company?

Which end products are generated?

Which pollutants are emitted / destroyed / generated?



How is waste collected (e.g. separate collection, (municipal) politics)?

Which kind of recycling process is possible/useful?

What are the ecological and economical benefits (long-term)?

What are the legal conditions (e.g. approval for plant)?

Which by-products are generated / How can these be used / disposed of / avoided?

How is the market situation (currently and in future) for waste fractions, end products, by-products?

What kind of pre-treatment is useful / necessary?

Which kind of waste treatment plants already exist?

From point of view of a public or a private company?

# Thank you for listening !

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