



MÉXICO-ALEMANIA
DIÁLOGOS POR UN FUTURO SUSTENTABLE | ENERGÍA DE RESIDUOS

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Experiencias y estrategias globales

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Waste – How can we make the best of it?

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MÉXICO
GOBIERNO DE LA REPÚBLICA



SENER
SECRETARÍA DE ENERGÍA

SEMARNAT
SECRETARÍA DE
MEDIO AMBIENTE
Y RECURSOS NATURALES



Embajada
de la República Federal de Alemania
Ciudad de México



giz Deutsche Gesellschaft
für Internationale
Zusammenarbeit (GIZ) GmbH

1. City of Hamburg
2. Climate and resources protection in waste management
3. Waste Management in Germany/Hamburg
4. From Waste to Energy
5. Costs and Revenues



- The metropolitan region of Hamburg: home to 4.3 million people; 1.7 million in the city centre; the population is growing
- Nearly half the area of the city is made up of green spaces, waters, woodlands and agriculture; 8.9 % of surface area consists of designated nature reserve
- Highly industrialised, economic hub with over 500 industrial enterprises; home to Europe's second largest port (74 km² of the city area is covered by the port)
- About 30 % of Hamburg's population have a migrant background.



Local authority Hamburg: Stadtreinigung Hamburg (SRH)

- Owned by Free and Hanseatic City of Hamburg
- Main Duties: waste collection / treatment (households), street cleaning, winter service, services in competition
- Waste management for around 1.1 Mio. tons/a
- 700 vehicles
- 2,600 employees

Hamburg

- *Area:*
755 km²
- *Inhabitants:*
1.8 Mio.
- *Households:*
915,000

4 bin collection system:

- Paper
- Bio + green
- Packaging
- Residuals

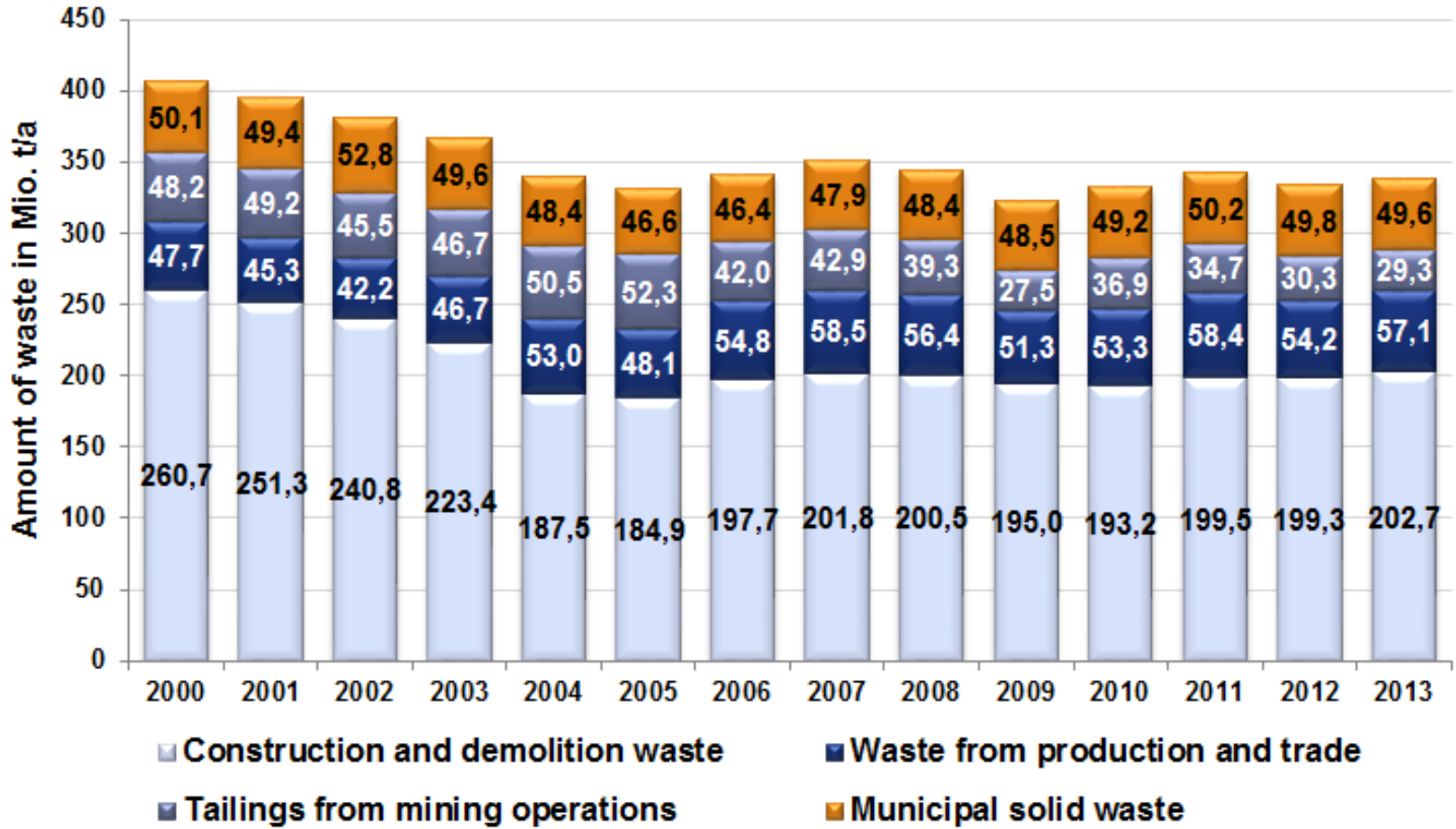


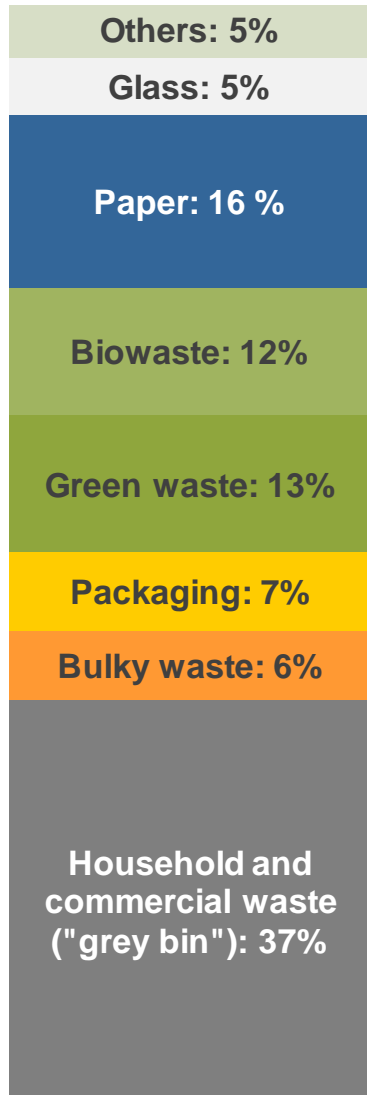
Growing world population, Growing resource demand,
Growing energy demand, CO_{2eq}-emissions / Global warming,
Destruction of environment, Health problems, Shortage in raw materials,
Increase of prices for materials and energy,
Dependence on other countries...

- International agreements, European regulations, German legislation, e.g.
- Kyoto Protocol, 1997: obligatory, international targets for climate protection (Germany: reduction by 21 % between 2008 to 2012 (basis year 1990); in 2008 Germany reached already reduction by 23 %)
 - Target of German government: Reduction of greenhouse gas emissions by 40 % by 2020 (basis year 1990) => -270 Mio. t CO_{2eq}

What can waste management do?

Total amount of waste in Germany





Average composition of total household waste in Germany

- Separate collection is already established, but could be improved as a large part of household and commercial waste (grey bin) still consists of the listed fractions such as paper, biowaste, packaging etc.

Commercial waste: Waste from industry and trade, but similar to household waste

Activity	Benefit
Implementing separate collection systems	Utilization of secondary raw materials
Energy from waste	Reduction of CO ₂ emissions and saving of fossil fuels
Ban on landfilling	Reduction of CO ₂ emissions and utilisation of secondary raw materials
Using best available technologies (waste treatment plants, construction measures, vehicle fleet)	Energy saving, energy efficient, low emissions of hazardous substances
Implementing renewable energies on closed down landfills and other available areas	Reduction of CO ₂ emissions and saving of fossil fuels

International agreements

Concerning mainly the control of transboundary movements of waste



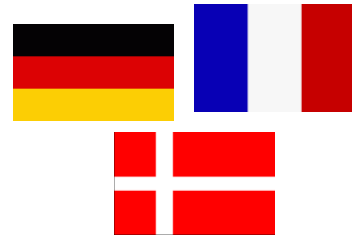
European legislation

EU legislation is superordinate to national legislation in the states
(Waste Framework Directive,
Directives on packaging, landfills, e-scrap ...)



National legislation (e.g. Germany)

Closed Cycle Management Act,
lots of ordinances and administrative regulations



State legislation in Germany (e.g. Hamburg, Bavaria)

Concretion/completion of national legislation,
administrative regulations, preparation of waste management plans

Municipal regulations (e.g. Hamburg)

Further guidelines in municipalities
(Hamburg Waste Management Act, City Cleaning Act, Official Fee Act)



“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



What can be done for waste prevention?

- *Government*
 - **Financial incentives** e.g. charges on packaging
- *Industry and trade*
 - **Product design** (improvement of durability, repairable, reduction of number of compounds and/or amount of compound, substitution of hazardous materials, reduction of packaging, life-cycle-assessment...)
 - Alternatives e.g. substitution of plastic bags
- *Households*
 - Use recycling products, refill packs, environmentally sound products, durable products...

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

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

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



- If waste production can not be minimised, the material is to **re-use/recycle**
- **Separate collection** of waste fractions simplifies substantial use
 - *Bio waste from gardening and/or kitchen*
 - *Paper*
 - *Glass*
 - *Packaging / plastics*
 - *Metals*
 - *Bulky waste / wood*
 - *Electrical devices*

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



Examples for recycling (1)

Packagings (metal, plastic, cardboard)

- 33,900 t/a
- 20 kg/a/per head



- Other collection systems
 - **Glass** -> 29,100 t/a from households
 - **Clothes** -> 6,200 t/a from households
 - **Consumer electronics** -> 11,800 t/a

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



Examples for recycling (2)

Paper

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



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



Examples for recycling (3)

Biowaste (green bin)

treated in SRH-owned fermentation and composting plant
'BKW Bützberg' by dry fermentation

- in operation since 2011
- capacity: 70,000 t/a (60,000 t bio + 10,000 t green waste): Cost reduction, climate protection, safety disposal



Biogas supplied to grid: 10,350 MWh
Compost (agriculture): 19,300 t
Total area of plant: 13 ha

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



**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 Stelling Moor, 1973
(closed down since July 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

1,35 Mio. MWh
= 1,35 TWh

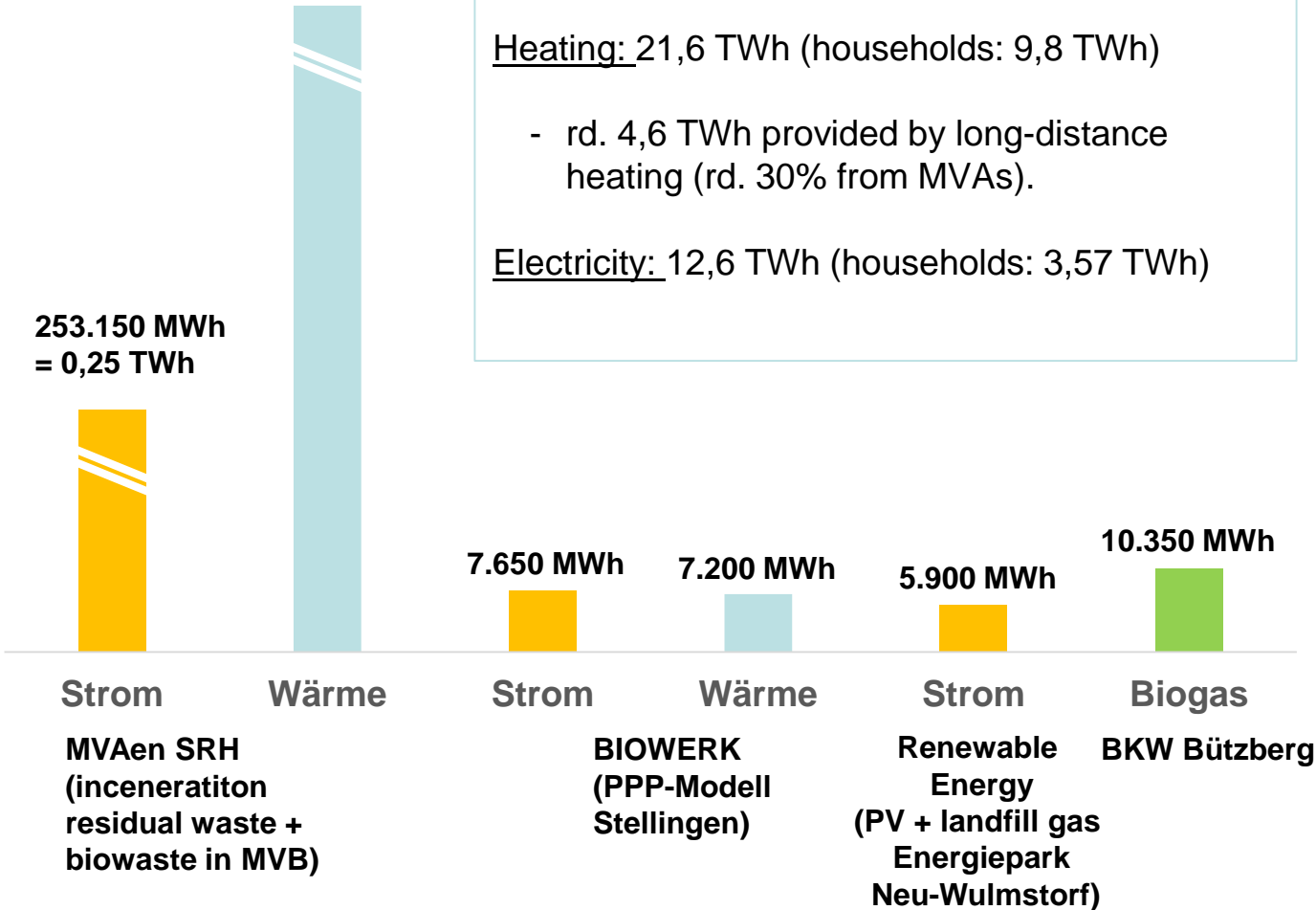
By Comparison: Energy-Demand in Hamburg:

Heating: 21,6 TWh (households: 9,8 TWh)

- rd. 4,6 TWh provided by long-distance heating (rd. 30% from MVAs).

Electricity: 12,6 TWh (households: 3,57 TWh)

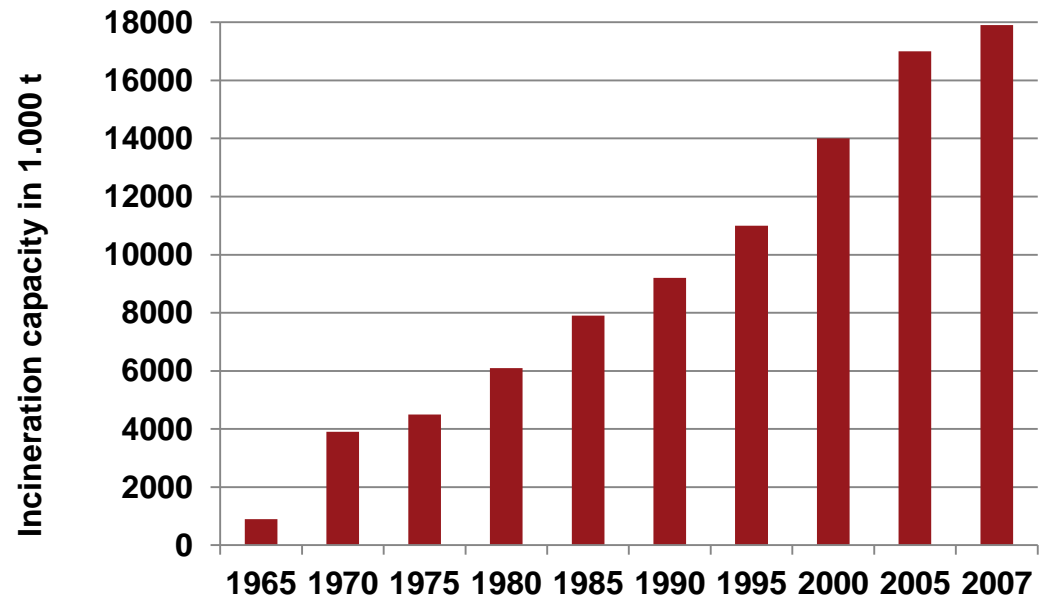
253.150 MWh
= 0,25 TWh



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

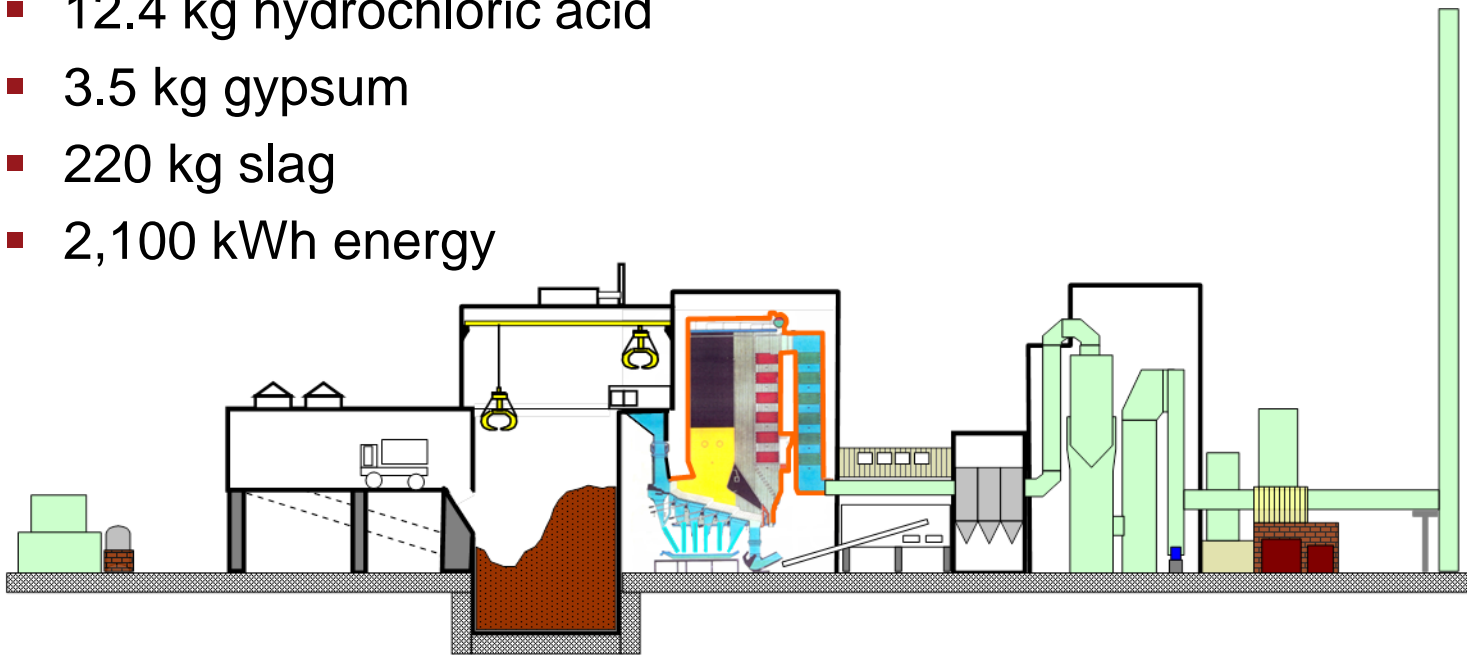
CO₂-reductions by energy recovery in 2014: 513.300 t

- 3 t of household waste can substitute 1 t of hard coal
- Reductions potential from 2005 to 2012 by incinerating waste: 1.5 to 2 Mio. t CO_{2eq} emissions (totally 930 Mio. t CO_{2eq} 2012 in Germany)
- 2014: Around 70 incineration plants with a complete capacity of 19.6 Mio. t/a in Germany



Average Recoveries from 1 t waste after incineration

- 24 kg Fe metals
- 3.4 kg other metals
- 12.4 kg hydrochloric acid
- 3.5 kg gypsum
- 220 kg slag
- 2,100 kWh energy



- Slag (“bottom”) can be used for street building, etc.
- Deposition: rd. 90 kg ash

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

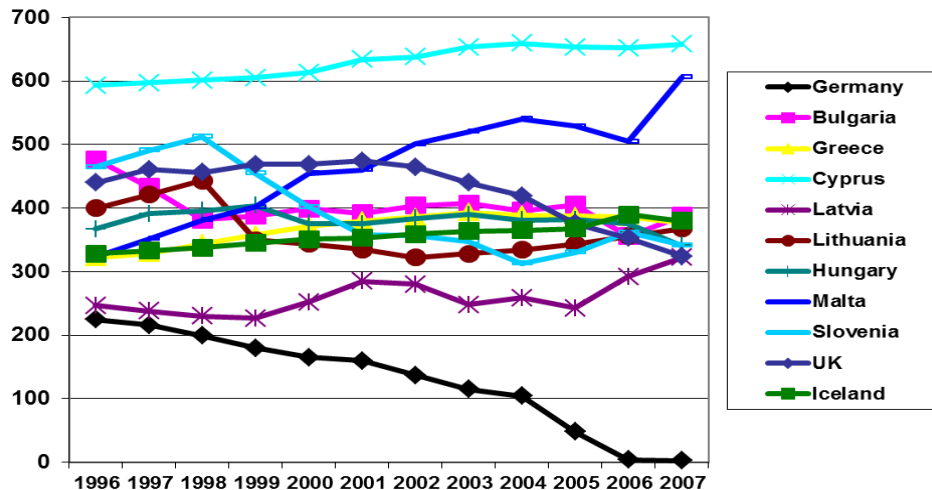
Household waste heat value comparison for various countries:

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

- Incineration of organic waste is not energy efficient
- Organic waste has a low calorific value (3 to 4 MJ/kg (residual household waste: 9 to 11 MJ/kg)) and a high water content
- Separate collection of organic waste (green waste from gardening and kitchen waste like food-leftovers, expired food, spoiled food etc.) enables appropriate treatment

- Methane emissions (CH₄ - gas) are caused by degradable (= organic) waste
- Methane is 21 times as damaging the climate as CO₂
- In Germany it is prohibited to deposit untreated household waste at landfill sites since 2005
- In EU landfill are prohibited since 2009
- **A number of European states still do use landfills**

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



Residual waste treated in incineration

Costs (167,46 Mio. €)



Revenues (167,46 Mio. €)



1) aus Abfallbehandlung

468.700 t residual waste treated in incineration

Costs /t (rd. 357 €)



Revenues /t (rd. 357 €)



1) aus Abfallbehandlung

Costs (21,41 Mio. €)



Revenues (21,41 Mio. €)



1) aus Gasverkauf

70.000 t treated in SRH-owned fermentation and composting plant 'BKW Bützberg' by dry fermentation

Costs /t (rd. 306 €/t)



Revenues /t (rd. 306 €/t)



1) aus Gasverkauf

Fee structure and revenues

- Fee structure has three basic functions
 - **Financing function:** To cover the costs of MSW disposal
 - **Allocation function:** To transfer the costs of service to service user
 - **Guidance function:** To provide an opportunity for the consumer to influence their behaviour (incentive)
- Fee system has to be
 - Economically stable
 - Cost covering
 - Legally compliant (no internal cross-subsidisation)
 - Equal for all citizens

Fee per month per household in Hamburg

- Example (2 person household):



private financed

6.56 € + 11.57 € + 1.72 € + 0 € + 4*0.85 €

GRUND- GEBÜHR	BEHÄLTERGEBÜHR RESTMÜLL			BEHÄLTERGEBÜHR BIOABFALL			BLAUE ALTPAPIERTONNE			TRANSPORTGEBÜHR ABFALLBEHÄLTER				
	Behälter- größe in Litern	Gebühren- klasse	Gebührensatz in Euro/Monat wöchentliche (14-tägliche) Leerungen	Behälter- größe in Litern	Gebühren- klasse	Gebührensatz in Euro/Monat 14-tägliche (wöchentlich) Leerungen	Behälter- größe in Litern	Gebühren- klasse	Gebührensatz in Euro/Monat ohne Extra- leistungen	Behälter- größe in Litern	Transport- weg in Metern	Maximale Stufenzahl	Gebühren- klasse	Gebührensatz in Euro/Monat je Transport innerhalb von 4 Wochen
6,56 €	+			+			+							
		60'	R0060	11,57 (7,52)										
		80'	R0080	13,29 (8,64)		80'	B0080	1,72 -						
		120'	R0120	15,18 (9,87)		120'	B0120	1,96 -		120'	P0120	Ohne gesonderte Gebühr*		
		240'	R0240	23,95 (15,18)		240'	B0240	3,02 -		240'	P0240			
		500	R0500	68,70 -		500	B0500	8,89 (13,87) ⁵						
		770	R0770	86,93 -		770	B0770	11,25 (17,30) ⁵						
		1.100	R1100	105,57 -		1.100	B1100	13,66 (21,01) ⁵		1.100	P1100			

➔ 24.97 € per month and household

Thank you for listening !

Michael Pollmann

State Secretary for Environment and Energy
Free and Hanseatic City of Hamburg

