

Thermal treatment facilities and local concerns

Experience in the City of Hamburg

Dr. Rüdiger Siechau

Jörn Franck



STADTREINIGUNG HAMBURG

Seminar on Thermal Waste Treatment

Environmental Protection Department,

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Contents

- **Waste treatment in the city of Hamburg**
 - Historical background
 - Municipal engagement and responsibility
 - Waste management in Hamburg today

- **Application procedure for wte-plant permit**
 - Basics
 - Public involvement and concerns

- **Operating experience with wte-plants**
 - Emissions

Free and Hanseatic City of Hamburg

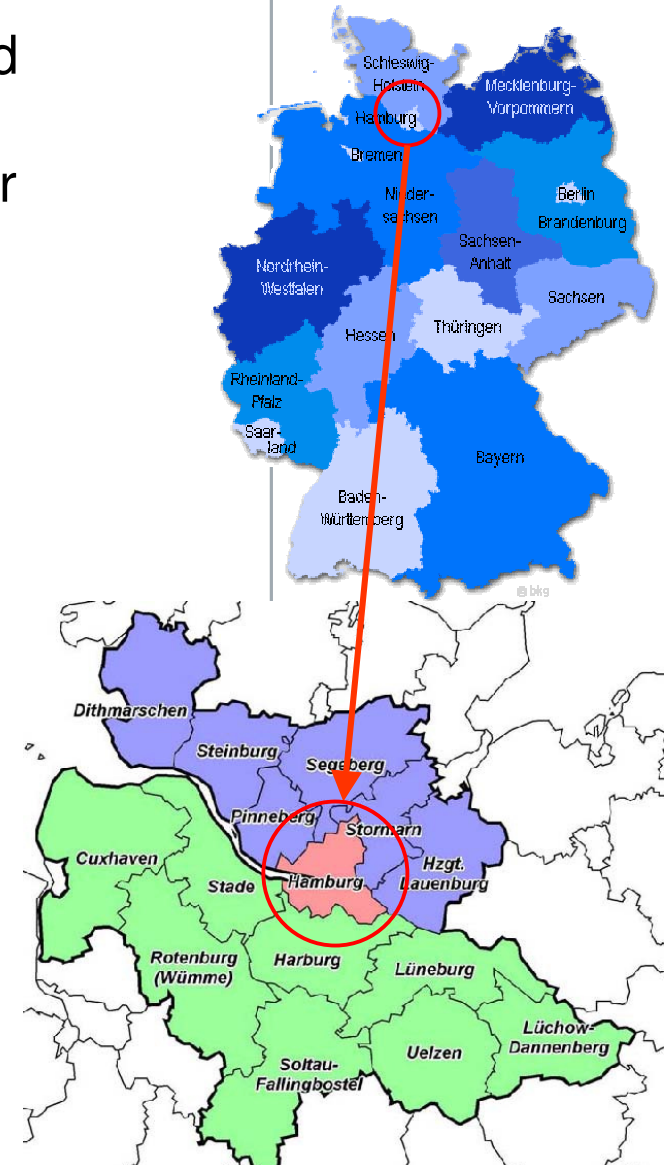


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- From a total of 16 states, Hamburg is the second smallest in the Federal Republic of Germany
- Second largest city in the Federal Republic, after Berlin
- 1.8 million inhabitants / 916.000 households
- 755 km² area
- 2.271 inhabitants / km²
- More than 10.000 km road network

Particularities:

- Industry → Harbour shipyards and aviation
- Commerce → Trade, media and entertainment
- Expansion → metropolitan region



Short history of waste treatment in Hamburg (1)



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- **1886 - Foundation of the first municipal waste collection system**
 - Solid waste was being taken as fertilizer and brought to country-side
 - Effluents were swept into the rivers of the city

- **1892 - Cholera epidemic**
 - Bad conditions in sanitation lead to serious diseases
 - 8.000 Inhabitants died
 - Decision to built first continental waste incinerator



Short history of waste treatment in Hamburg (2)



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- **1896 – 1924 Bullerdeich** →

- 36 Units, 15 MW therm.
- 4 – 5 MJ/kg, 87.000 Mg/y



- **1912 – 1936 Alter Teichweg** →

- 12 Units, 17 MW therm.
- 5 MJ/kg, 110.000 Mg/y



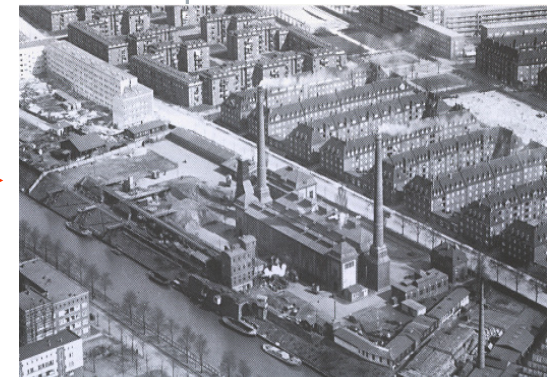
- **1913 – 1961 Ruhrstrasse** →

- 3 Units, 12 MW therm.
- 5 MJ/kg, 65.000 Mg/y



- **1931 – 1994 Borsigstrasse** →

- 5 Units, 67 MW therm.
- 5,8 MJ/kg, 400.000 Mg/y



Characteristics of waste management in the city of Hamburg



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- Public company Stadtreinigung Hamburg is by law responsible for waste collection, treatment and city cleaning
- The senate of the city of Hamburg establishes
 - fees for the Stadtreinigung
 - the Waste Management Plan (WMP)
- High standards of waste management in terms of:
 - ecology, quality, technology, economy and efficiency
 - no more landfilling, monitoring after site closure
- Waste incineration capacity
 - 1 million t/a for household waste
 - 100.000 t/a for hazardous waste
- Separate collection systems for valuable waste
 - paper, glass, biological waste from households, packaging etc.



Stadtreinigung Hamburg - Who we are



STADTREINIGUNG HAMBURG

- Public owned utility company
- Owner 100 % City of Hamburg
- Waste collection, utilisation and disposal
- Cleaning and winter services for roads
- Partner for industry, commerce and administration
- Contract partner for municipalities and associations in the metropolitan area
- One of the largest waste management companies in northern Germany



Data and facts*

- Turn over 323 Mio. EUR
- Income after tax 3,8 Mio. EUR
- 2,502 employees
- 693 vehicles
- 20 locations in 5 regions with 7 bases
- 15 recycling yards
- 3 vehicle- and 2 container repair stations
- 4 petrol stations
- 1 company-owned incinerator as well as "access" to 3 further incinerators

*business year 2006

1 EUR appr. 11 HKD



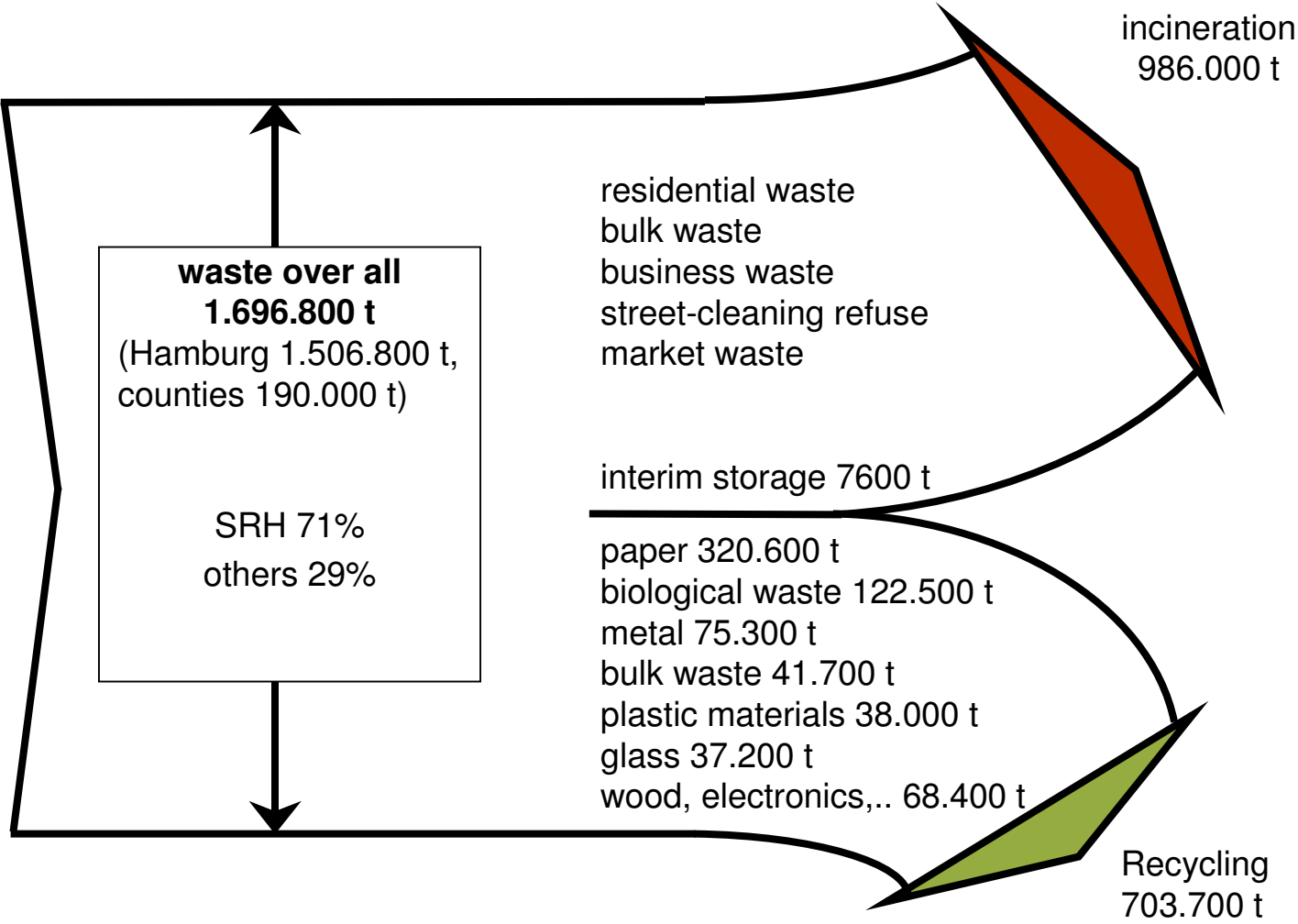
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Municipal solid waste stream Hamburg 2005



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Technical Instruction on Municipal Waste (TASi) from 14.5.1993



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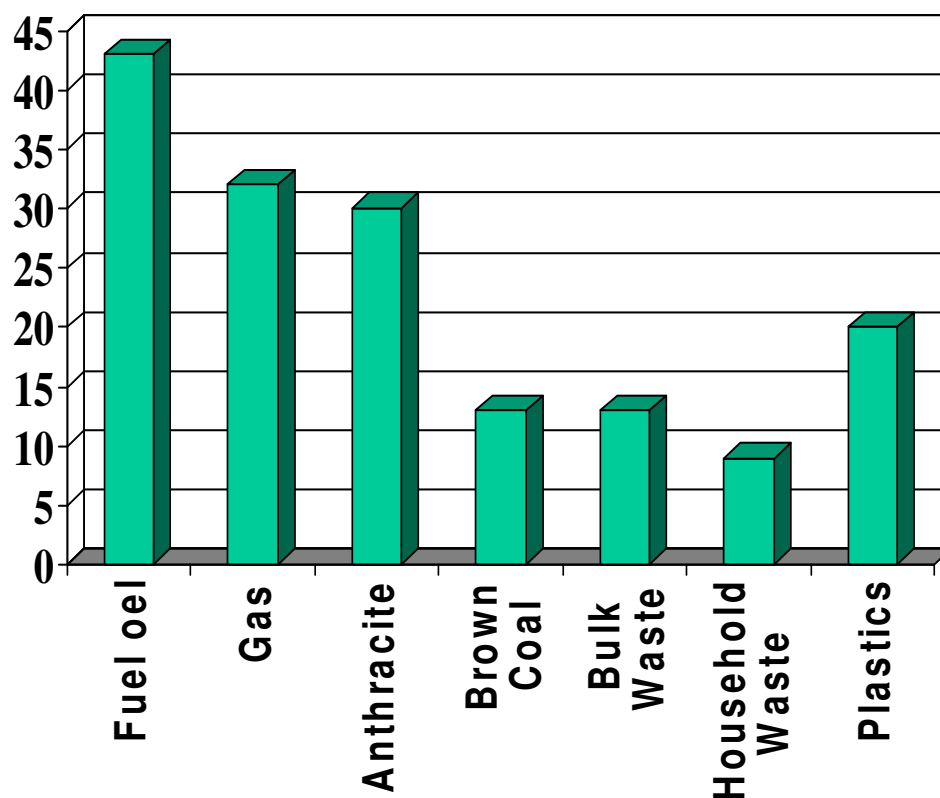
- Growing mountains of rubbish caused a state of emergency in terms of waste disposal
- A ban on dumping untreated waste in landfill sites from the 1st of June 2005
- The transition period took twelve years !
- Objectives
 - to recycle as much of the unavoidable waste as possible,
 - to keep harmful substances of the waste as low as possible,
 - to ensure an environmentally compatible waste treatment
 - to depositing only non-recyclable wastes



Energy content of waste (MJ/kg)



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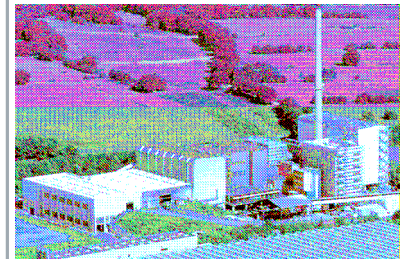
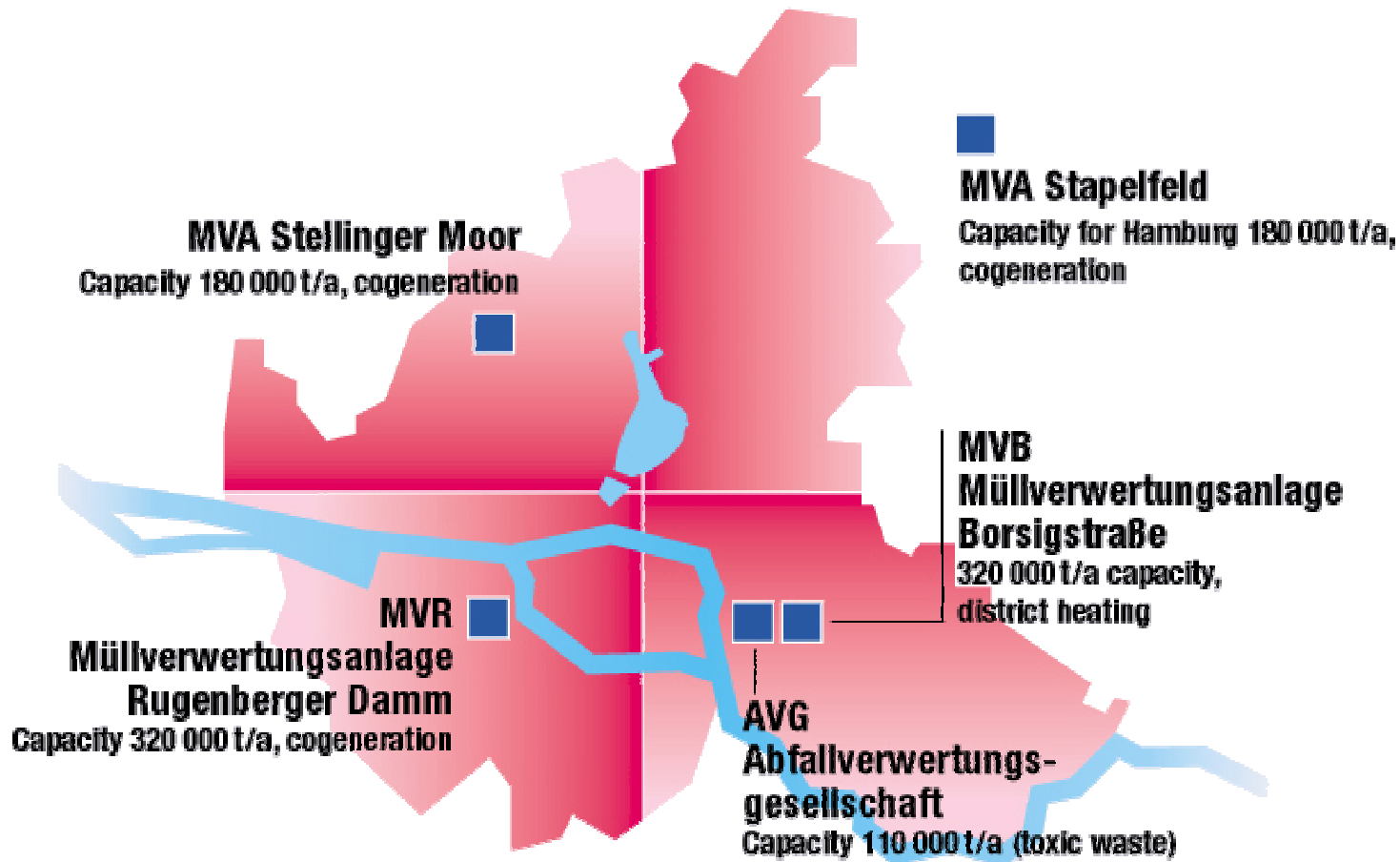


- The energy content (calorific value) of the waste has risen drastically over the past years.
- 3 Tonnes of household waste can substitute 1 Tonne of coal.
- Modern waste economy tries to separate high calorific components to use them as a fuel substitute.

Thermal treatment in Hamburg today



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WtE-Plants and district heating



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● WtE Plant

Common arguments against thermal waste treatment



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- Waste minimisation
 - No interest to reducing the waste
- Ecological waste utilisation
 - WI is not considered to be ecological
- Climatic change
 - WI releases CO₂-emissions
- Air pollution
 - Flue gas cleaning can not retain toxic emissions
- Solid residues
 - Utilisation of the residues disperses toxic substances
- Energy
 - WI is not an efficient way of waste recycling
- Economics
 - WI requires large invest and is the most expensive way of waste treatment

Common arguments for thermal waste treatment



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- Waste minimisation
 - WI reduces the amount of waste by 2/3
- Ecological waste utilisation
 - WI contributes to a cleaner environment compared to land filling
- Climatic change
 - Approx. 50 % of the carbon content is of biological origin and does not contribute to the greenhouse effect
- Air pollution
 - Flue gas cleaning work to the highest standards and are sufficient to ensure no health impact from WI
- Solid residues
 - Treatment to a high standard and techn. regulations ensure no environmental impact
- Energy
 - WI makes the most of the energy content of the waste and substitutes fossil fuels

Thermal waste treatment needs acceptance



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- Obeying the waste hierarchy
 - Avoiding waste
 - Reuse waste
 - Dispose/treat waste
- Two basic options for waste treatment
 - Mechanical biological waste treatment (mbt)
 - Thermal waste treatment (waste to energy, wte)
- Most common questions for the public are:
 - Are there any health impacts?
 - Are there any environmental impacts?
 - What are the economical impacts?

Legal framework for emission protection in Germany



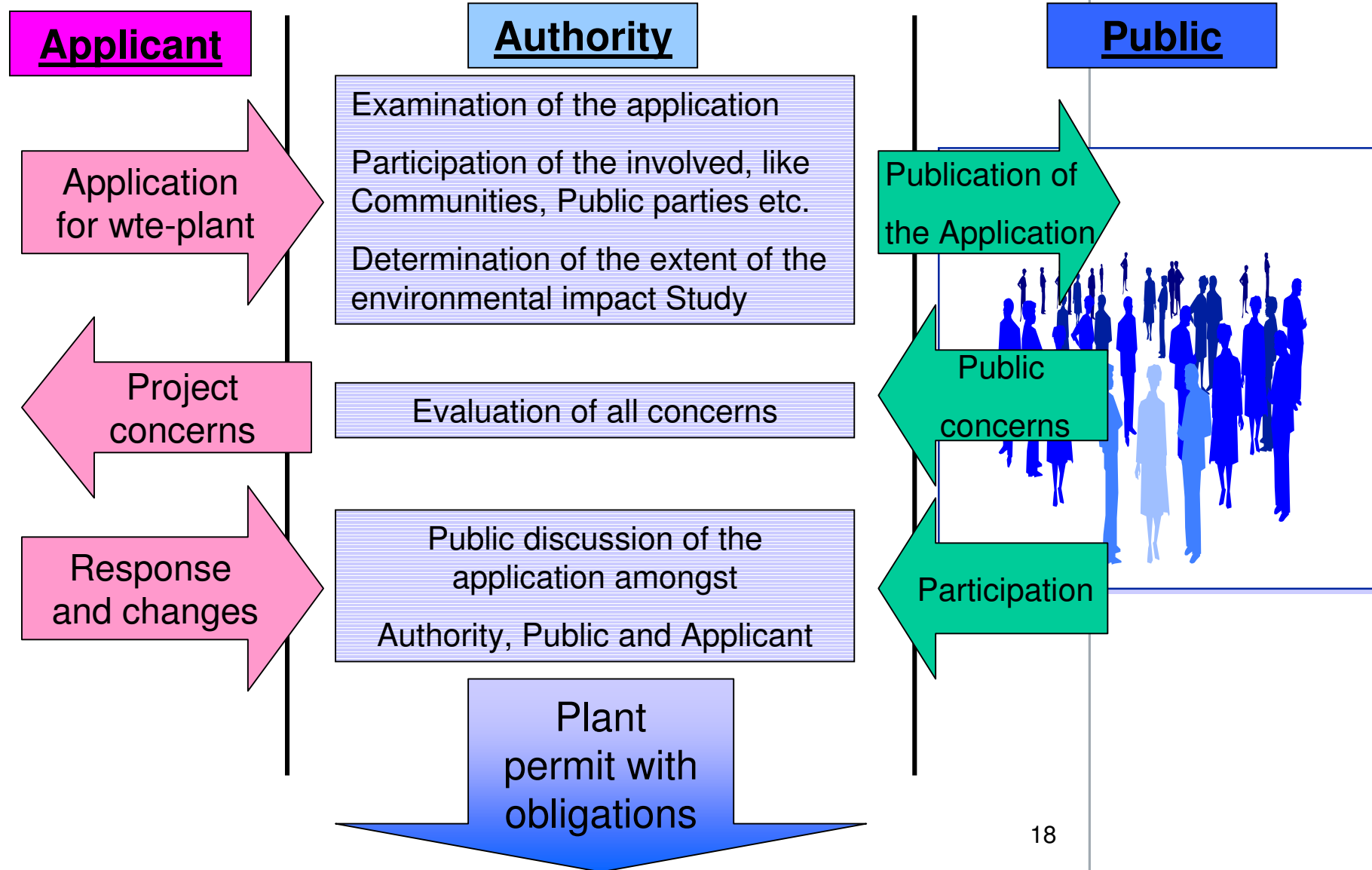
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Procedure of application and permit



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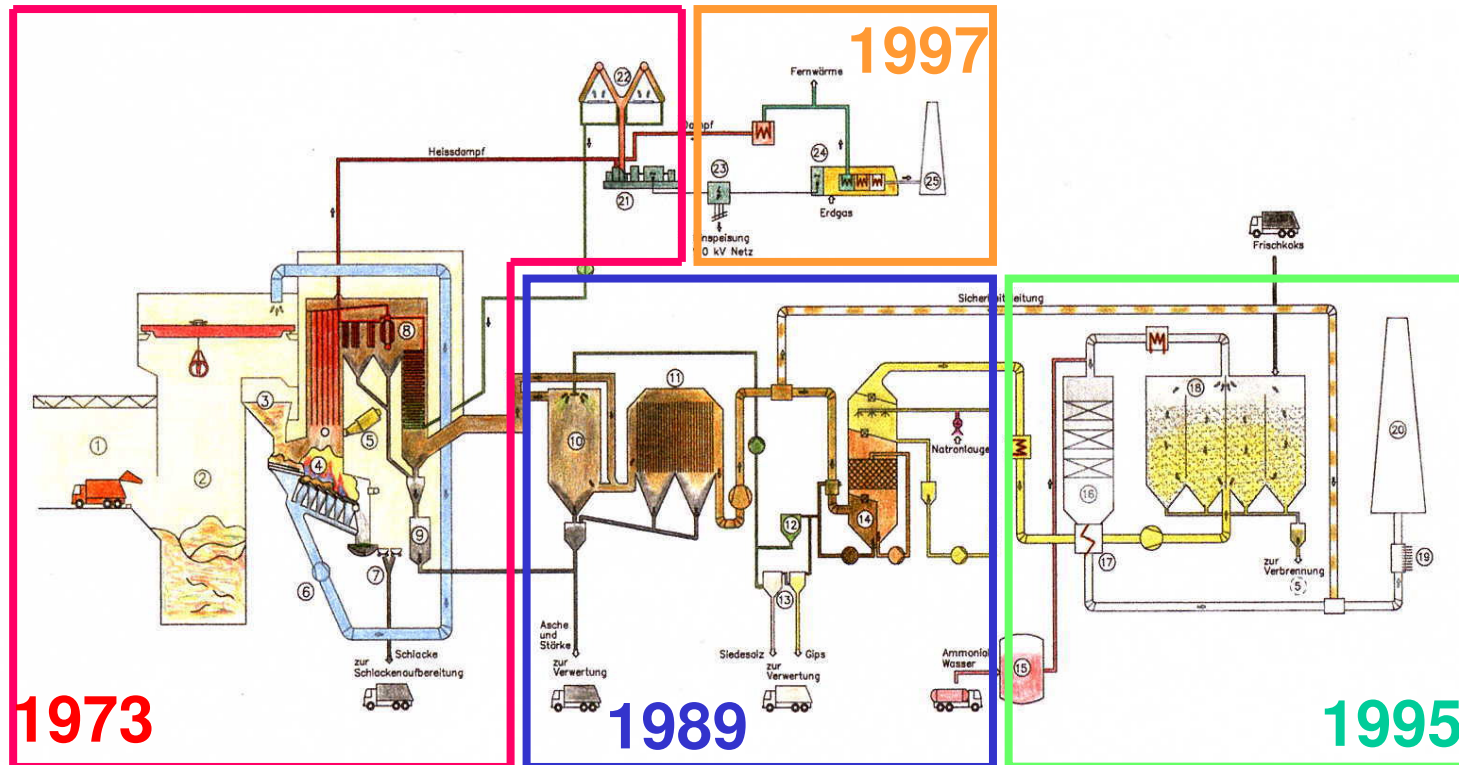
Content of a WI-application

- Description of the project and the site location
- Building concerns and site drainage
- Detailed description of the plant operation
- Materials and waste management
- Handling of water polluting substances
- Air pollution control
- Energy usage
- Protection against noise and vibration
- Safety aspects of the plant
- Fire prevention and water containments
- Occupational health and safety aspects
- Environmental impact study and nature protection

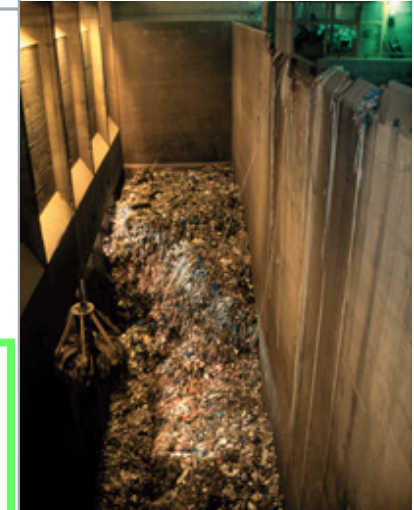
Cross sectional view the wte-plant Stellinger Moor



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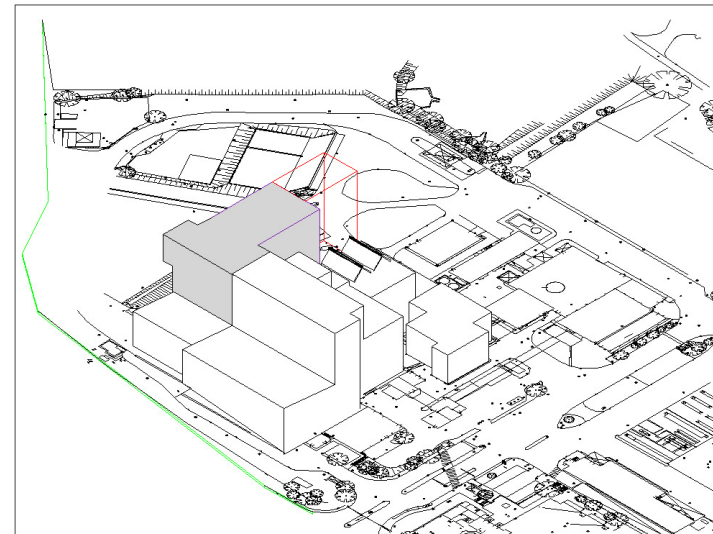
- | | | | | |
|-----------------------------------|--|----------------------------|-----------------------------|------------------------|
| 1. Kipphalle | 6. Verbrennungsluftzufuhr (Primärluft) | 11. Elektrofilter | 16. Entstickungskatalysator | 21. Turbogenerator |
| 2. Müllbunker mit Krananlage | 7. Schlackenaustrag und -transport | 12. Neutralisation | 17. Rekuperator | 22. Luftkondensator |
| 3. Krankanzel mit Aufgabetrichter | 8. Dampfkessel mit Überhitzer | 13. Abwasseraufbereitung | 18. Aktivkohlsorber | 23. 110 kV- Trafo |
| 4. Verbrennungsrost | 9. Kesselascheseparierung | 14. Abgaswäsche (3-stufig) | 19. Emissionsmessung | 24. Blockheizkraftwerk |
| 5. Altkoksverbrennung | 10. Sprühtrockner | 15. Ammoniakwasser-Lager | 20. Kamin | 25. Kamin BHKW |



Case study: new incinerators in the Stelling Moor plant (1)



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Case study: new incinerators in the Stelling Moor plant (2)



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- Replacement of the two 35 year old lines of incinerators
- Adaptation to the increased heat content of the waste
 - Design 1968: 6.280 kJ/kg
 - Today: 10.500 kJ/kg
- Increase of the capacity of the plant
 - Thermal: 2x 33 MW → 2x 55 MW
 - Waste: 180.000 Mg/y → 275.000 Mg/y
- Increase in energy efficiency
 - Electrical and thermal output
- Use the existing flue gas cleaning



Emissions from waste incineration plants



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- Emissions are generally airborne
 - Point source emissions (e.g. chimney)
 - Diffuse emissions (e. g. tipping mall)
- Gaseous emissions
 - HCl, SO₂, NO_x, CO, Metals (Hg), fine dust particles etc.
 - Odours
- Noise (plant, traffic)

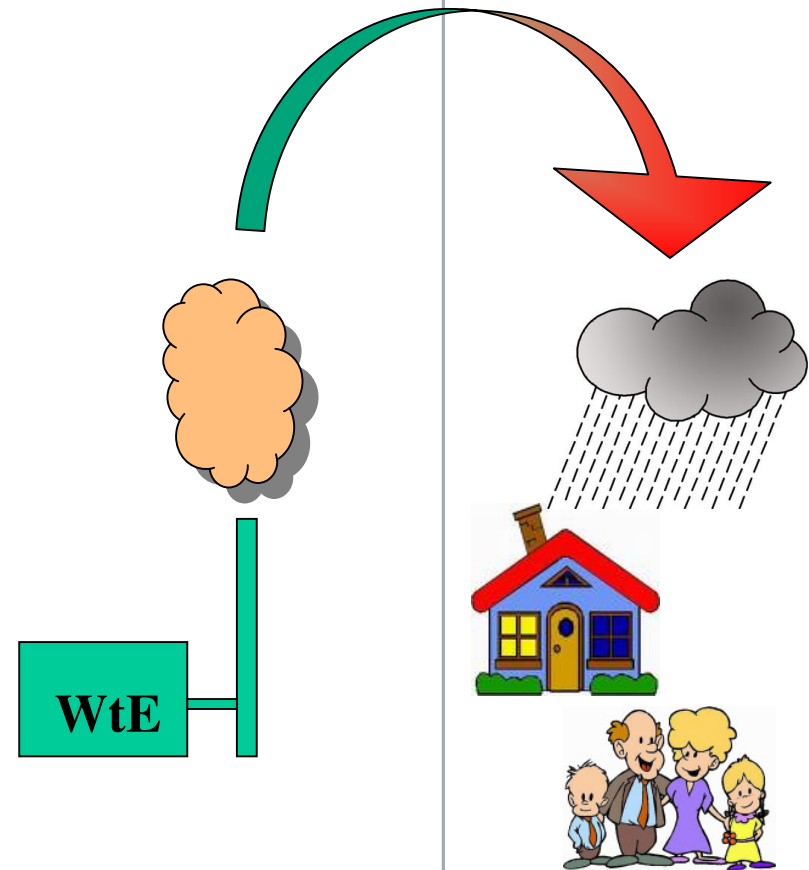
- Mathematical calculation for the distribution of all emissions
- Calculation of the immission-rate and thereby verification of the legal emission-rate, i.e. limit values

Environmental impact



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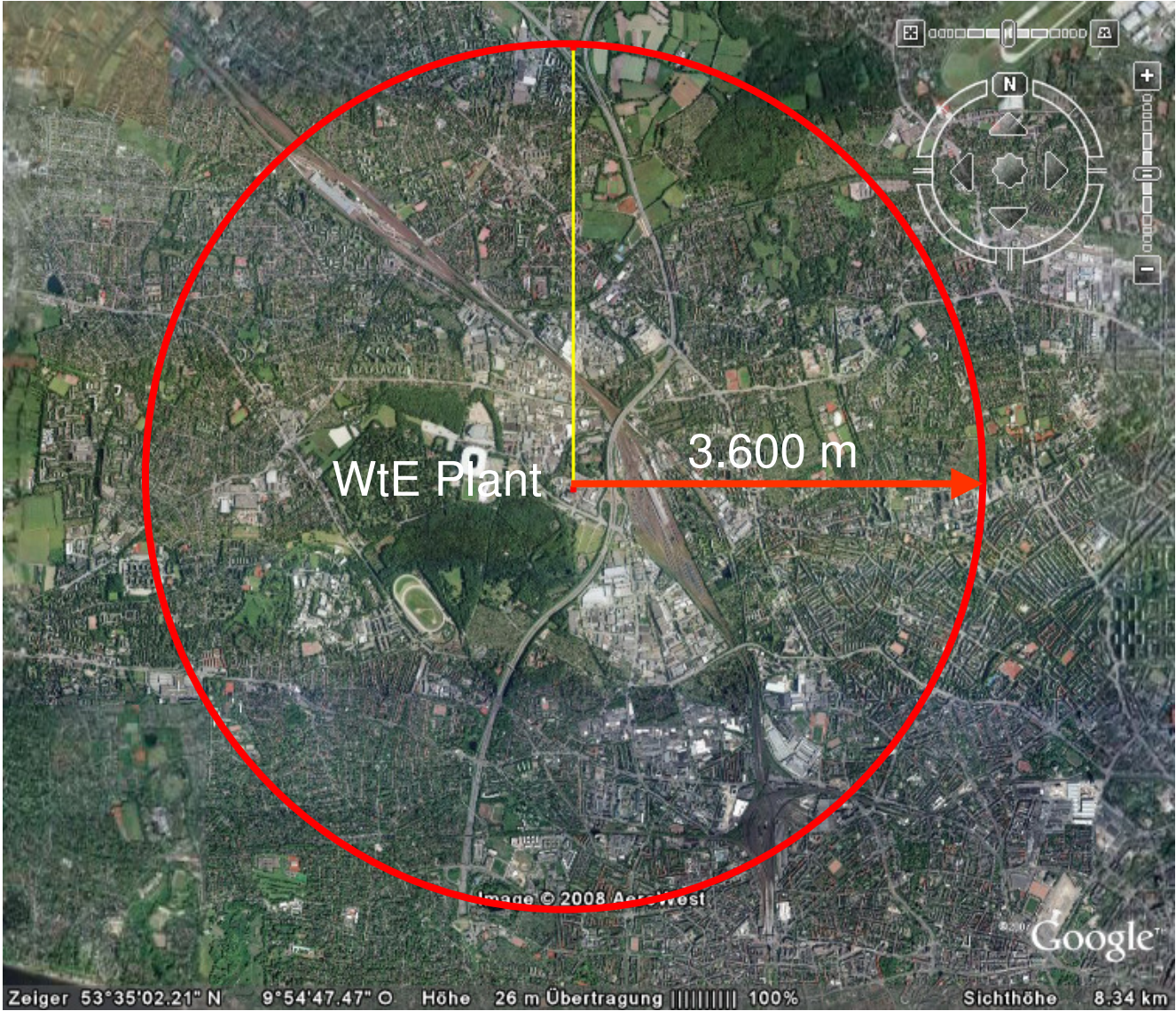
- Verification of any possible additional immissions from the plant by detailed dispersion calculations
 - If the calculations come out to proof, that a new plant will not have any significant impact, a general environmental impact study has to be performed
 - If there is a significant impact a long term measurement campaign in the areas of high concentrations has to be performed, in order to determine any initial level of pollution



Environmental impact study



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Content of an environmental impact study



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- Subject of protection
 - Air
 - Climate
 - Soil
 - Water
 - Animals and vegetation
 - Landscape
 - Cultural aspects
 - Humans
- Consideration of the plant impact as a comparison of the existing situation
 - Not only for operation of the plant but also for building it

Example: Odours from the WtE-plant (1)



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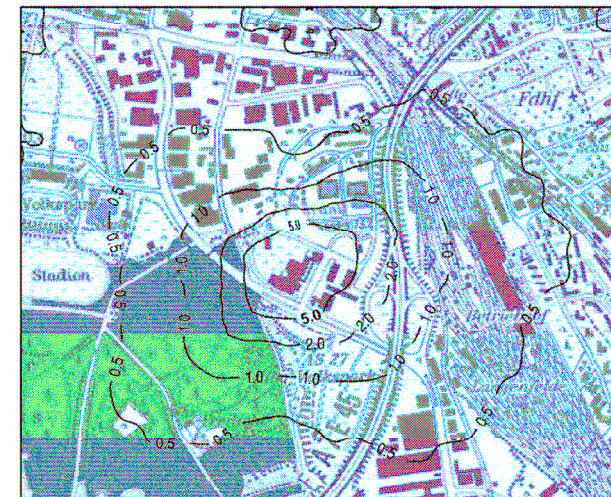
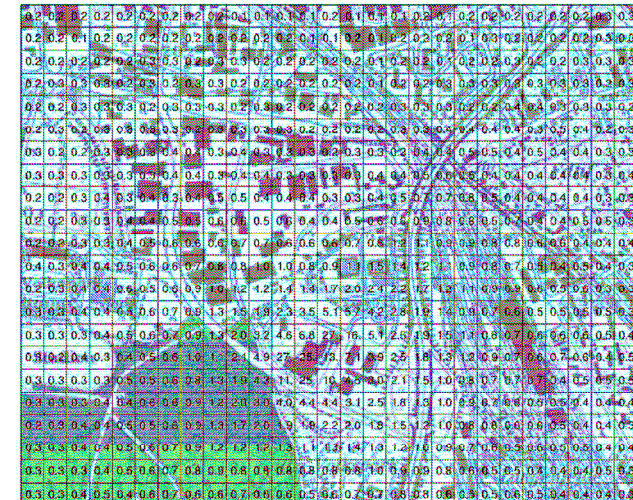
- Sources of Odour
 - Chimney of WtE plant
 - Chimney of Gas Engines
 - Diffuse emissions e. g. from the tipping mall
- Odour emissions
 - Gas volume (m^3/h)
 - Odour concentration (U/m^3)
 - Duration of emission (h/y)
- Meteorological data
 - Wind strength
 - Wind direction





Odours from the WtE-plant (2)

- Distribution of Odour
 - Calculation model
 - No measurements
- Grid size of model variable
 - 70 m x 70 m for the whole impact area (r = 3.600 m)
 - Calculation for 8 nearby points of particular interest
- Results
 - Additional odour impact by new plant
 - Overstepping of the reference value for odour (%/h p.y)



Emission measurements from wte-plants



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- Only certified systems
 - Functional testing and calibration
- Proof of limit values
 - Certified calculation system
 - Transfer to the local authorities
 - Long term documentation
- Continuous measurements
 - CO, C_{Tot}, SO₂, HCl, NO_x, O₂, Hg, NH₃, Dust
- Non-continuous measurements
 - e.g. PCDD/PCDF, Heavy metals
 - 3 times per year over 8 hours by external authority



Emission limit values for wte-plant Stelling Moor



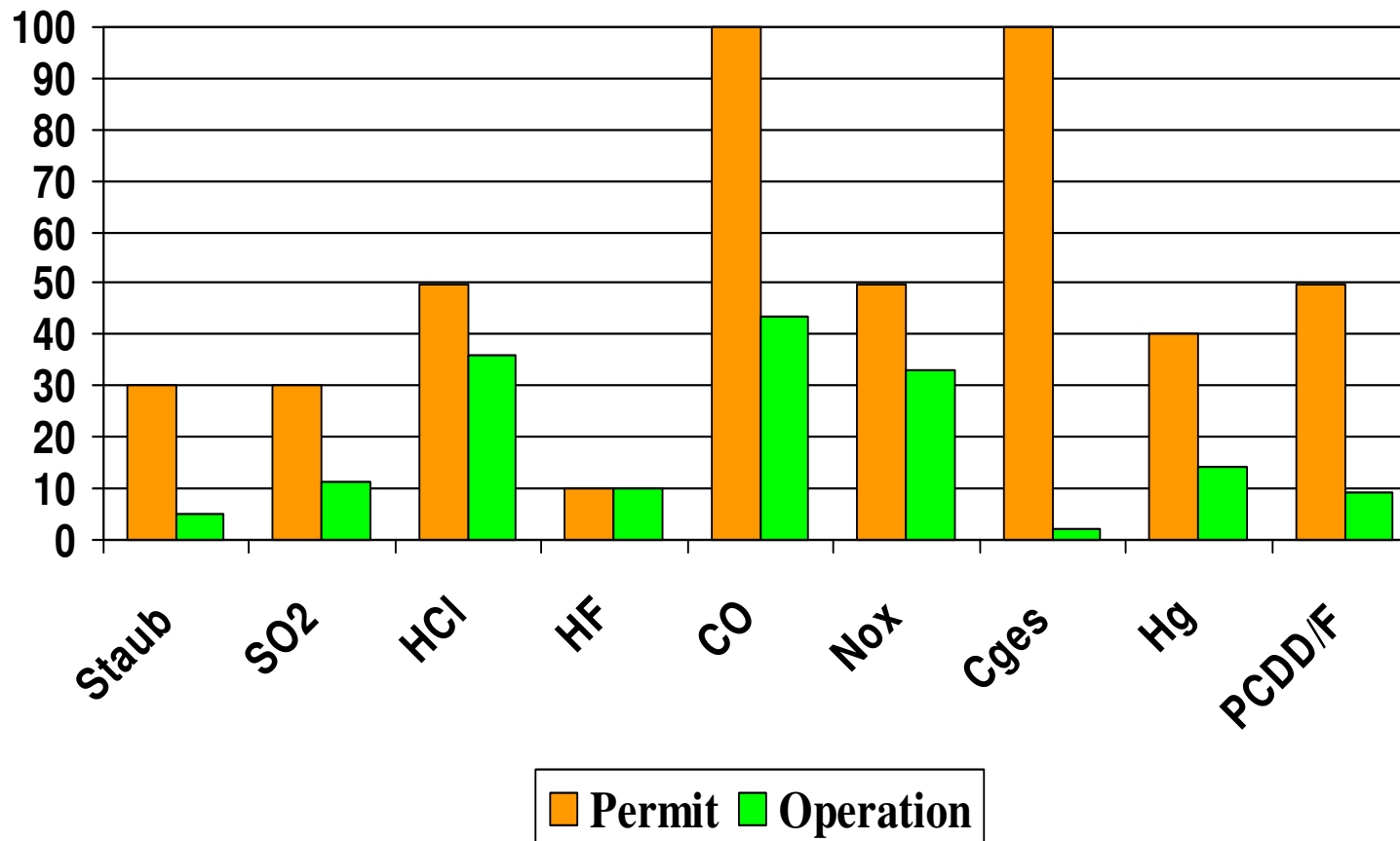
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| Substance | Permit 1972 | Permit 1978 | Permit 1989 | Additions 1989 | Application 1992 | | 17.BImSchV 2002 | Units |
|---|----------------|----------------|----------------|-------------------|------------------|-------|--------------------|--------------------|
| | | | | | TMW | JMW | | |
| Dust | 150 | 100 | 20 | 10 | 10 | 3 | 10 | mg/Nm ³ |
| Sulphur (SO ₂) | | 1000 | 75 | 50 | 25 | 15 | 50 | mg/Nm ³ |
| Chlorine (HCl) | | 100 | 25 | 10 | 5 | 5 | 10 | mg/Nm ³ |
| Fluorine (HF) | | 5 | 1 | 1 | 1 | 0,1 | 1 | mg/Nm ³ |
| Carbonmonoxid (CO) | | 1000 | 50 | 50 | 50 | 50 | 50 | mg/Nm ³ |
| Hydrocarbons (C _n H _m) | | 300 | 20 | 10 | 10 | 10 | 10 | mg/Nm ³ |
| Nitrogene Oxides (NO _x) | | 500 | 400 | 100 | 100 | 100 | 200 | mg/Nm ³ |
| Dust Kl. I TA-Luft 1986 | | | 0,2 | | | | | mg/Nm ³ |
| Dust Kl. II TA-Luft 1986 | | | 1 | | | | | mg/Nm ³ |
| Dust Kl. III TA-Luft 1986 | | | 2 | | | | | mg/Nm ³ |
| Cadmium/Tallium | | | | 0,1 | 0,05 | 0,002 | 0,05 | mg/Nm ³ |
| Mercury (Hg) | | | | 0,1 | 0,05 | 0,02 | 0,05 | mg/Nm ³ |
| other heavy metals | | | | 1 | 0,1 | 0,04 | 0,5 | mg/Nm ³ |
| Dioxine/Furane | | | | | 0,1 | 0,05 | 0,1 | ng/Nm ³ |

Specific emissions (Percentage of the limit value of the 17. BImSchV)



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Recommendations

- Waste management is an ongoing serious problem which has to be handled with the people and for the people
 - Solving the problems is a joint effort
 - There must be confidence and acceptance
 - There must be an open and fair discussion
 - There must be a benefit to the people
- Waste management requires state of the art technique
 - The Technologies must be proven and reliable
 - The Technology must be transparent
 - The Technology must be payable



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EMAS

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Dialogue is most important ...




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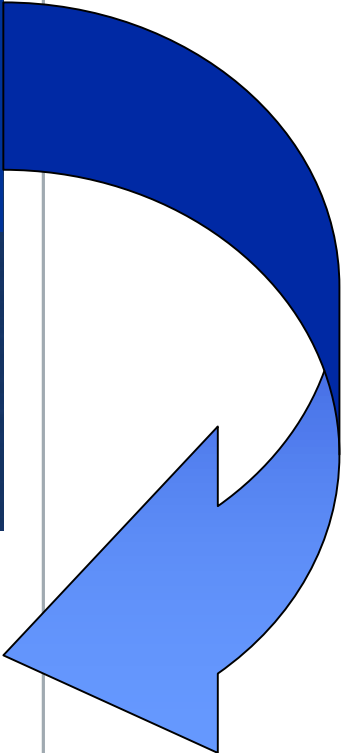
How much energy does a light bulb need?

1 Tonne !

Here we are producing Energy for 12.000 households



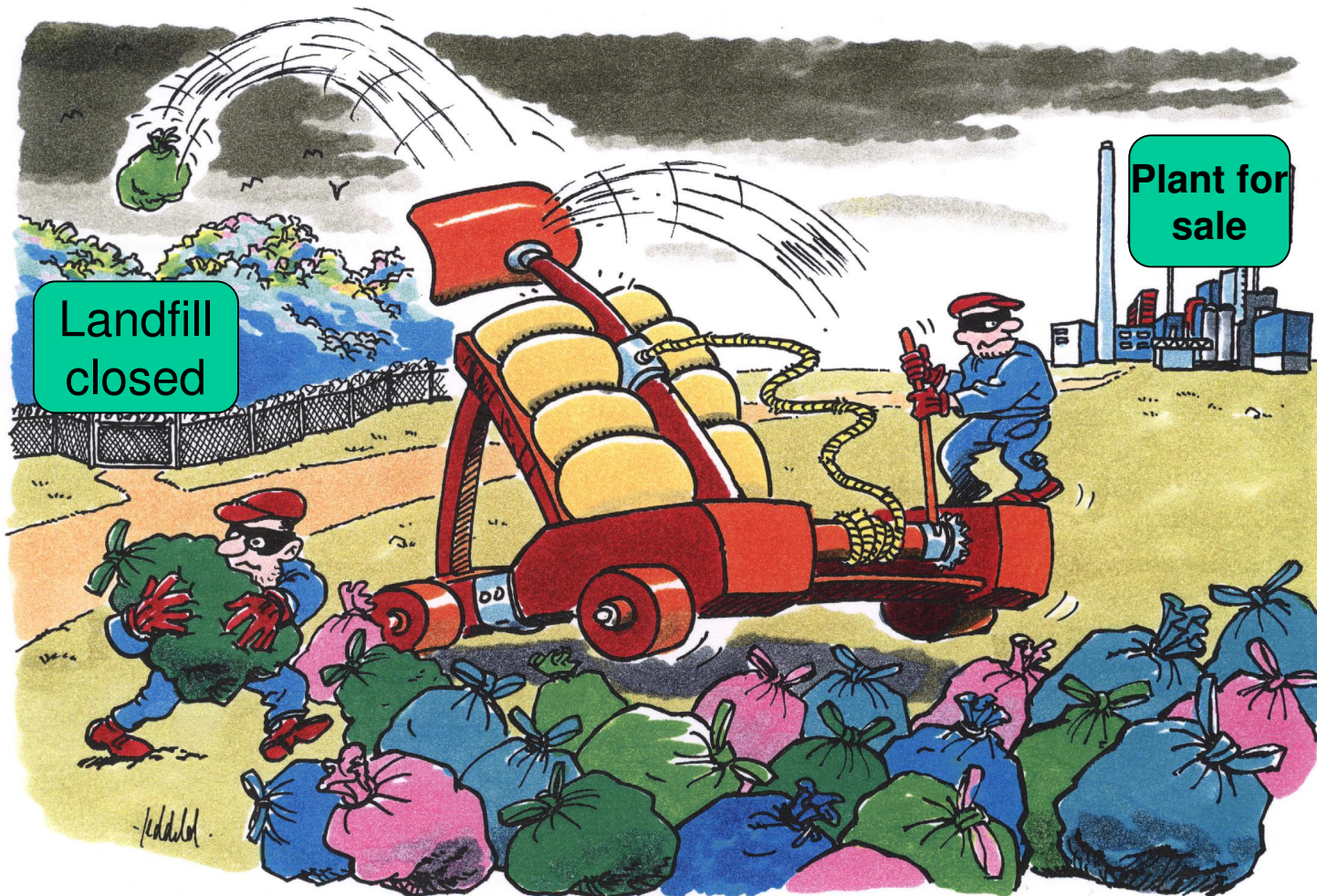
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And don't make the mistake ...



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Thank you very much for your interest



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