8th International Waste Management and Landfill Symposium, Sardinia, Oct. 1-5, 2001

15 Years Experience in the Field of Landfill Gas

Disposal, Standards, Problems, solutions, and Procedures

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Via web: DAS – IB GmbH, DeponieAnlagenbauStachowitz

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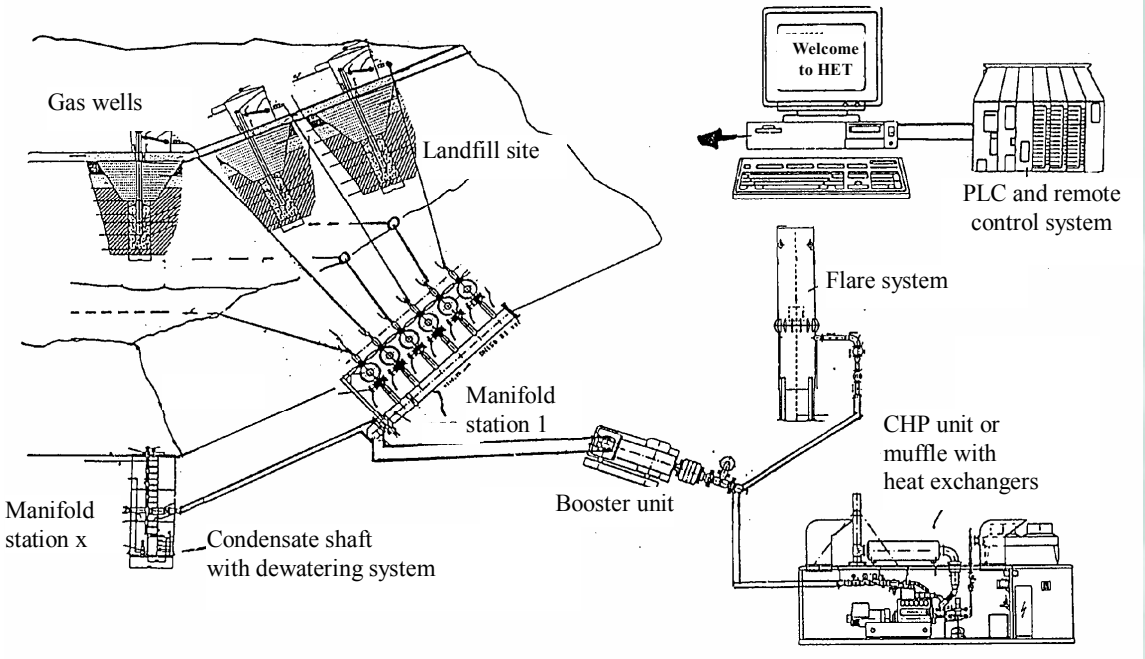
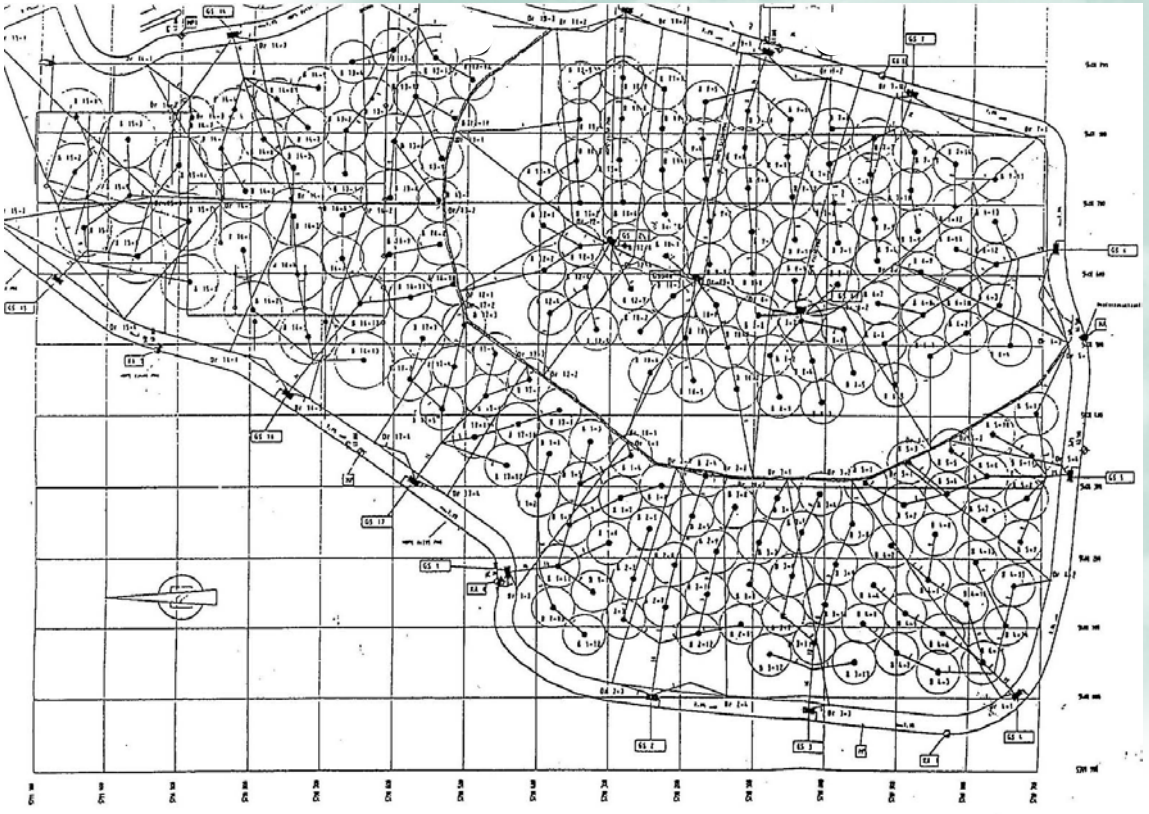
Landfill gas extraction system



- Components:

Gas wells
Gas pipes
Condensate shafts
Gas manifold stations
Booster stations
Flares
CHP units
Telecontrol system

Overview: Landfill site



- Gas extraction system

Gas prognosis: Data

Mobile booster unit with flare

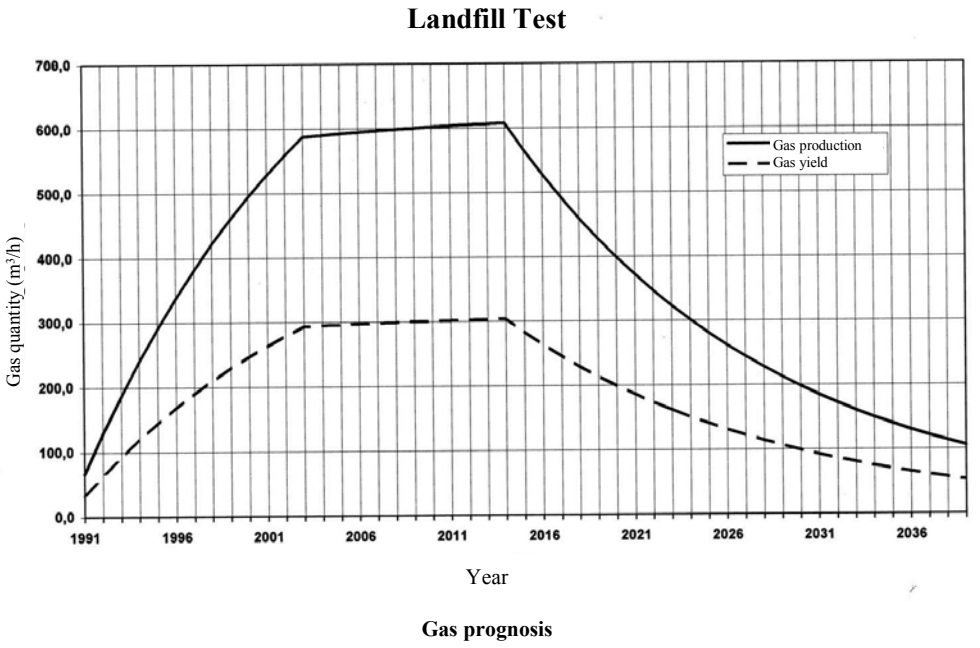
Kostenlose Prognose zum Testen – Free Test Prognosis

Deponieangaben zur Erstellung einer Gasprognose: **Specification of landfill conditions for predicting landfill gas generation:**	
Standort der Deponie (Name, Adresse, Land etc.): **Location of the landfill site (name, address, country ....):**	
Einbaubeginn (Verfüllung): Start of landfill operation:	
Einbauende: End of landfill operation:	
Einbaumenge pro Jahr: Landfill waste p. a. (tonnes/a) [m³/a]:	
Zusammensetzung des eingelagerten Mülls (Müllsorten in %oder t): **Composition of landfilled waste (type of residues in %or t):**	
Hausmüll: MSW (municipal solid waste):	
Sperrmüll: Bulky refuse:	
Bauschutt: Rubble, demolition waste:	
Organischer Müll: Organic waste:	
Hausmüllähnlicher Gewerbeabfall: Ordinary industrial residues (similar to MSW):	
Produktspezifischer Gewerbeabfall: Industrial residues from production processes:	
Klärschlamm & Straßenkehricht: Sewage sludge & road sweepings:	
Sonstiges Abfälle: Other waste: _____	

Basisabdichtung: Landfill bottom liner:	? Ja ? Yes	? Nein: ? No:	
Oberflächenabdichtung: Surface sealing/Landfill cap:	? Ja ? Yes	? Nein: ? No:	

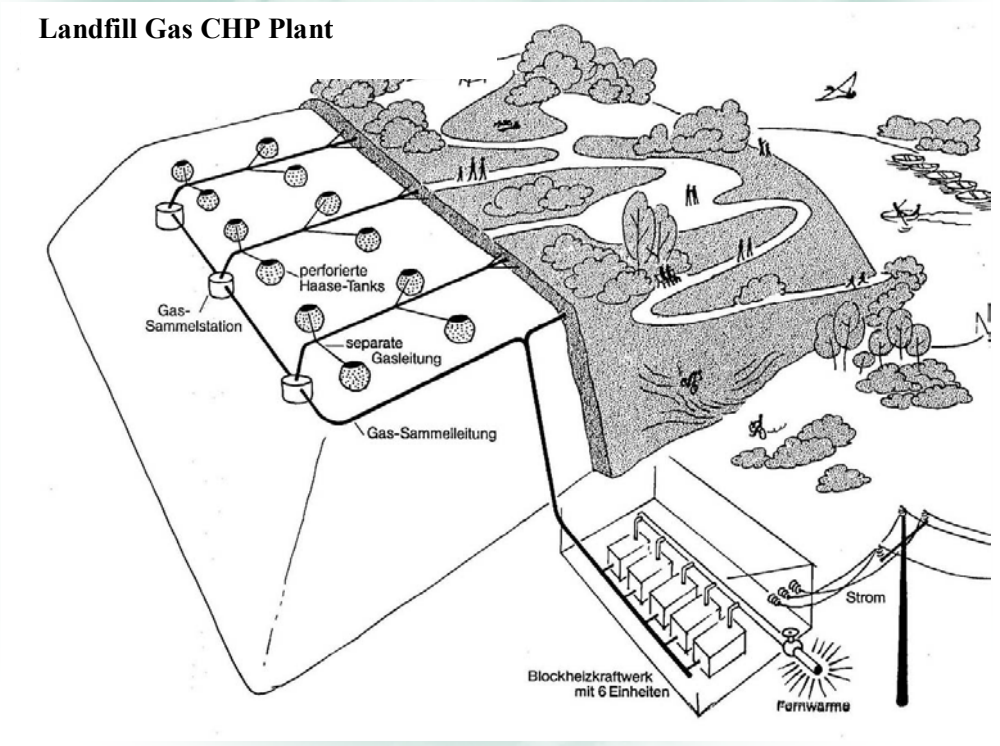
Dünnschichteinbau (ab wann): Thin layer compaction (since ....):	

Gas prognosis: Results



Gas prognosis

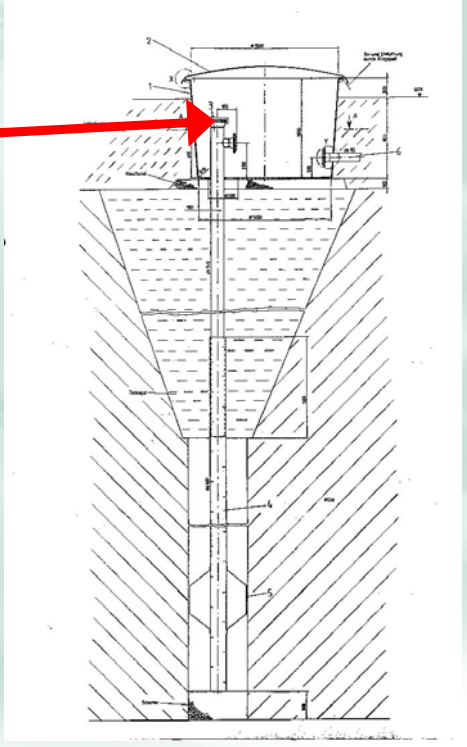
Pioneer project: Neumuenster landfill site, 1984



Historic gas wells

- Gas wells: Learning by experience

Today‘s gas wells



- Gas wells: State-of-the-art

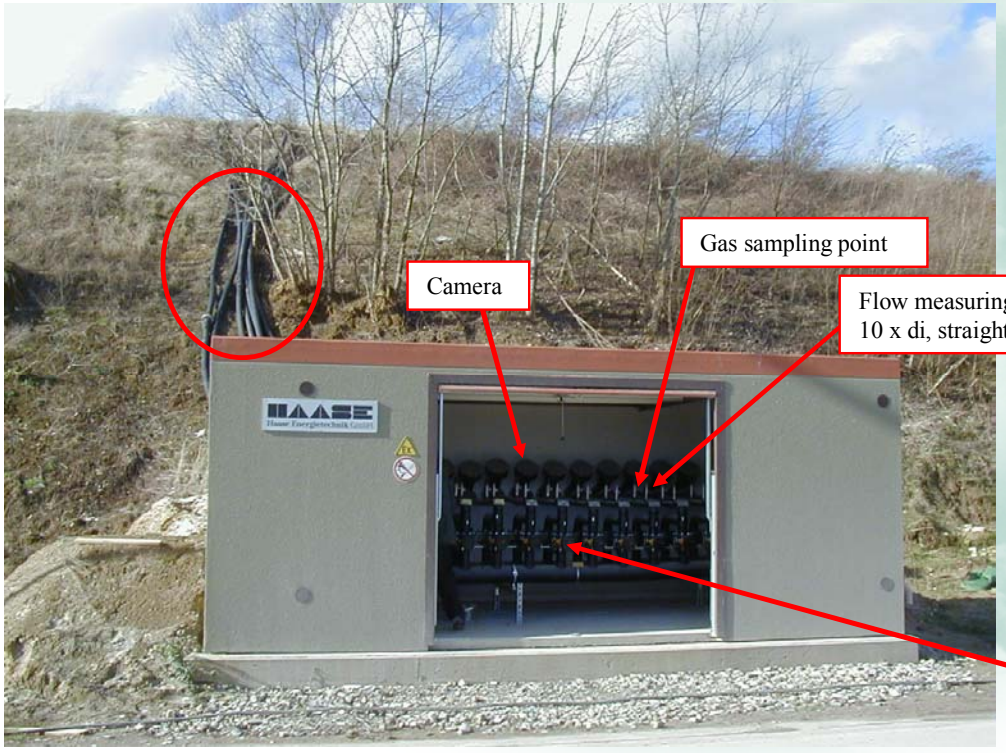
Gas wells: Good and bad examples

- Gas wells: extract gas and transfer it to the manifold station

Pipelines below ground level

- Pipe connections from the individual gas wells to the manifold station:
  - Pipes <u>below</u> ground level = no movements

Pipelines above ground level

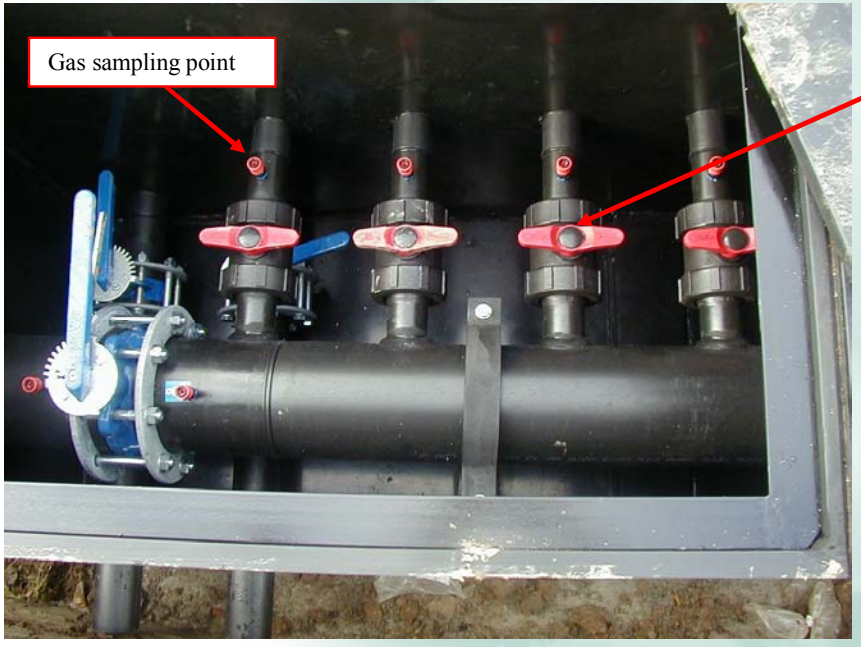


- Pipes <u>above</u> ground level:
  - cheap
  - movements, problems caused by condensate

Gas manifold station (open)

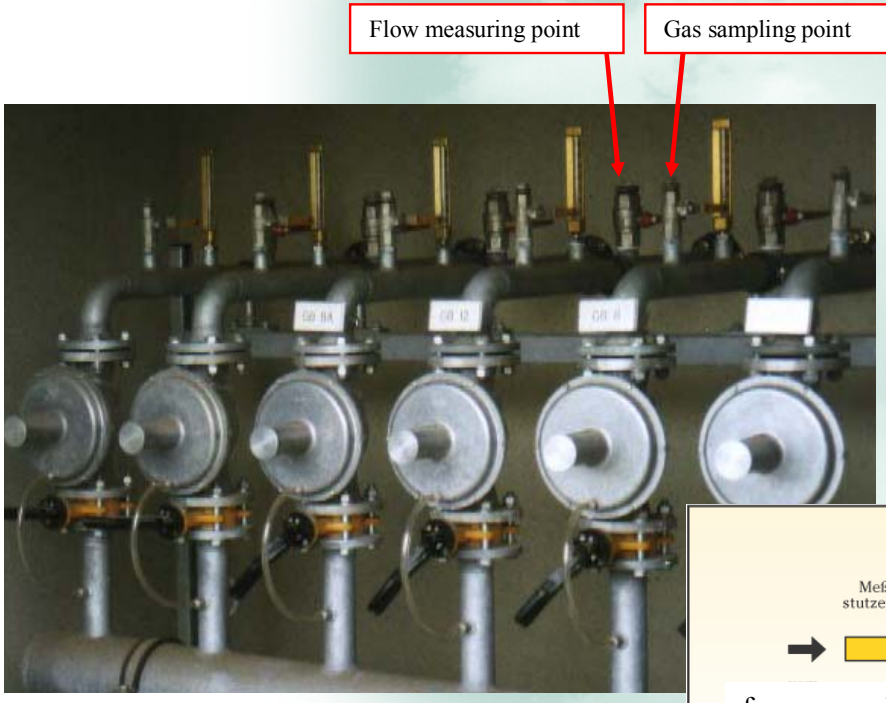
- cheap
- no weather protection: frost, rain ...

Gas manifold station (underground)

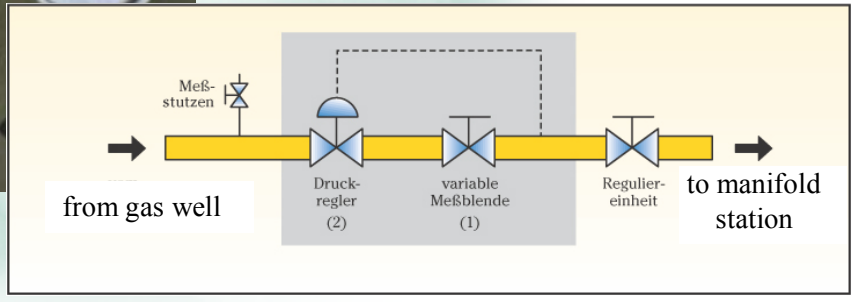


- Manual butterfly valves:
  - axes are not vertical = corrosion and other problems caused by condensate and frost
- No flow measuring points
- No bellows
- Monitoring and optimizing of the gas flow is impossible

Dewatering of gas pipelines (Haase patent)



- Pressure-controlled dewatering system in between manifold station and gas well

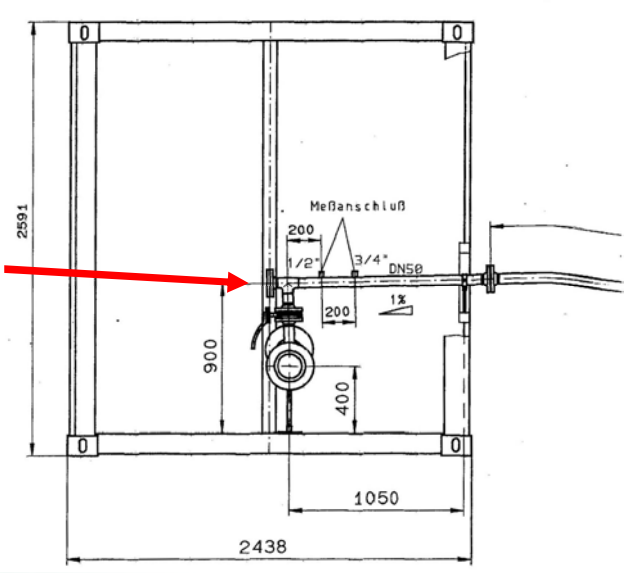


Monitoring of gas pipelines

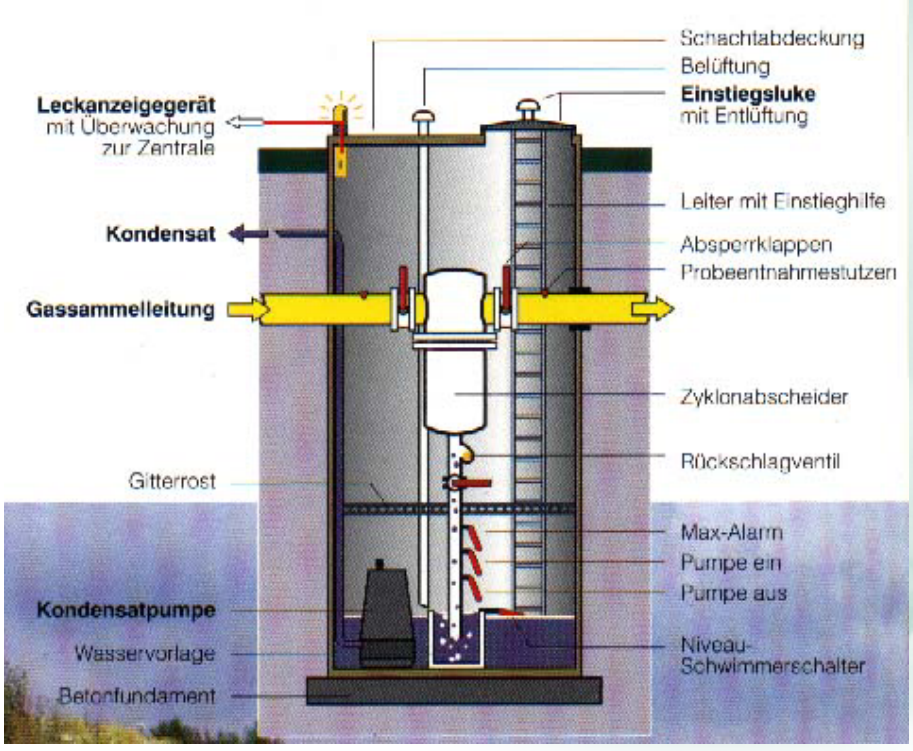
- Manifold station:
  Automatic device
  for pressure-controlled
  dewatering of gas pipelines

Video inspection of gas pipelines

- Camera system for remote controlled video inspection of gas pipelines

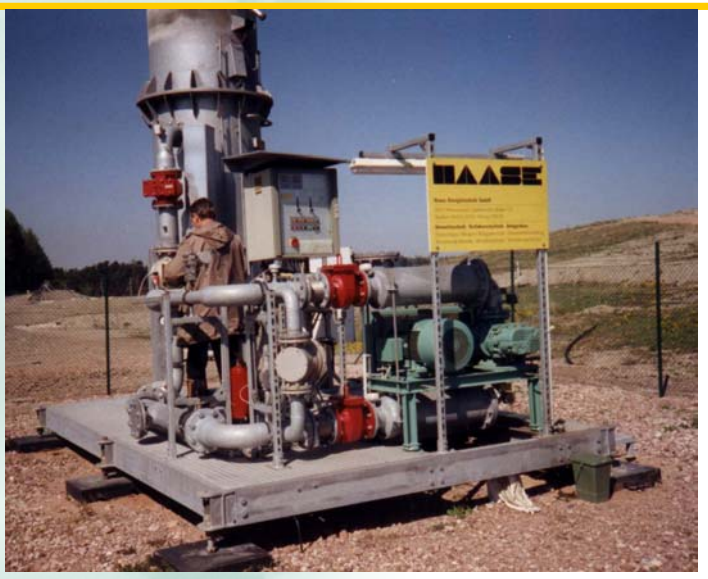


Condensate shaft



- Condensate shaft with cyclone

Open booster units (England)

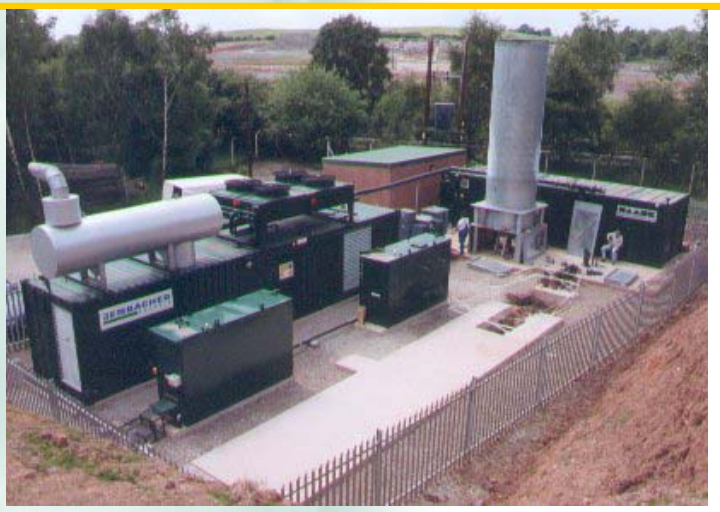


- Cheap, easy to handle
- Centrifugal booster

- Skid-mounted booster system
- Roots booster
- Higher efficiency on power request

Landfill gas plants

- Llandullas, Wales:
  Booster in ISO container and prefabricated concrete buildings

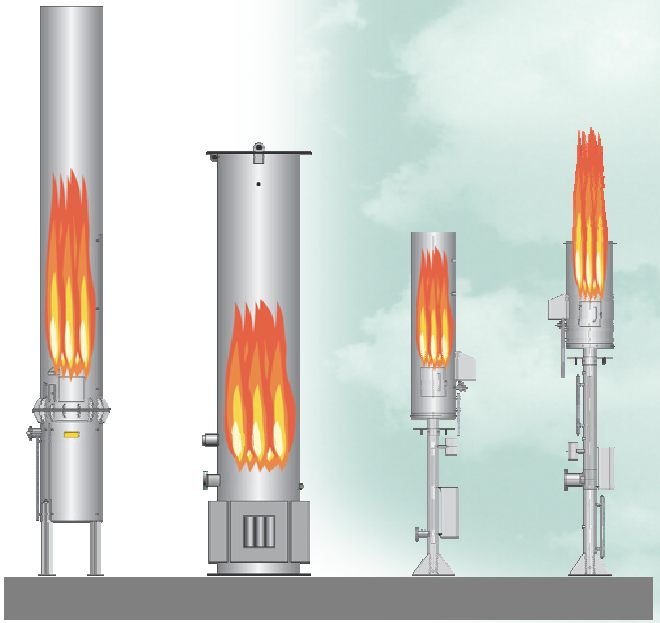


- Wilnecote, England:
  Booster in ISO Container and CHP system

Flares: Simple solution versus state-of-the-art

- Left: Simple solution
  - open combustion, low temperature, does not meet emission standards
- Right: State-of-the-art
  - closed combustion, high temperature, TA-Luft standard
  - A: 1.000 m^3/h
    B: 350 m^3/h
  - According to the manufacturers, both flares have the same retention time. **(???)**

Flare types



HTV type **HTN type** **MTN type** **MTU type** **LTO type**

- **HTV type**
  - High temperature combustion with air ventilator
- **HTN type**
  - High temperature combustion with natural ventilation
- **MTN type**
  - Medium temperature combustion with natural ventilation
- **MTU type**
  - Medium temperature combustion, uninsulated
- **LTO type**
  - Low temperature combustion with open combustion

High temperature flares in England

- These flares meet the new stringent UK emission standards

	TA-Luft	UK Guidelines
NO_X	200 mg/m³	150 mg/m³
CO	100 mg/m³	50 mg/m³
Temp.	1,200°C	1,000°C

(Reference 3% O_2 by vol. in exhaust gas)

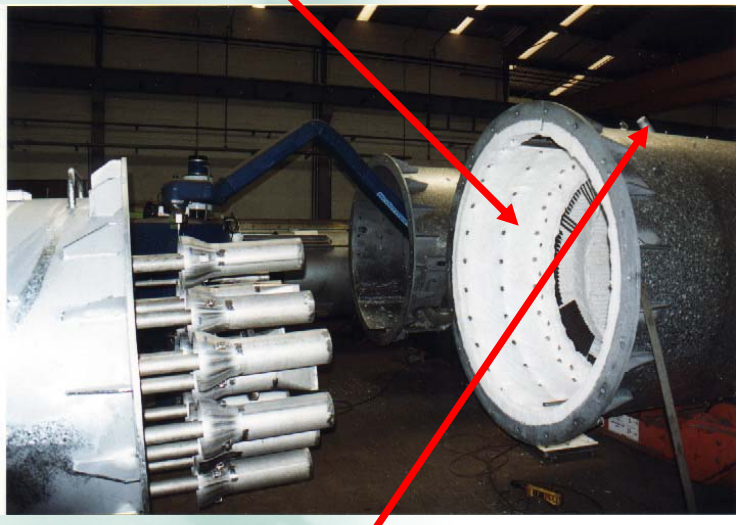
What's wrong?

- Left:
  Happe-Chappois,
  Belgium
- Right:
  Italy

Heat exchanger

Sophisticated burner system

cheap



- Burner system
- Special insulation

Stationary CHP unit

- City of Luebeck, Germany:

  Gas engines with heat exchanger

Gas utilization

- CHP unit, skid-mounted
  at Withnell, UK

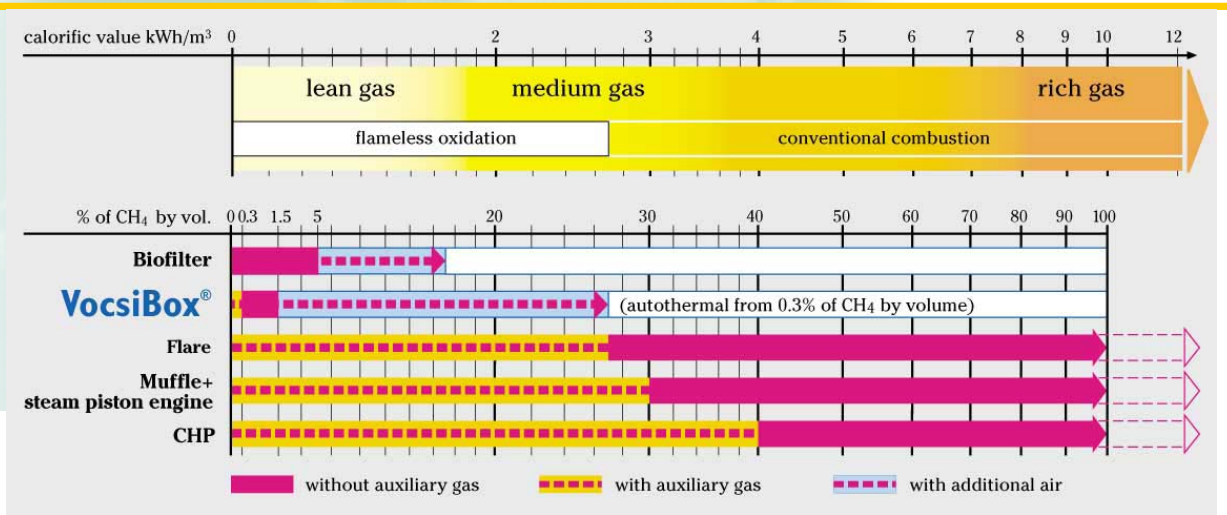
- Muffle
  at Alsdorf, Germany

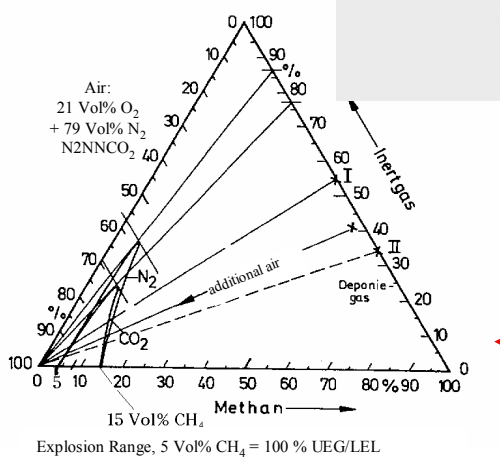
CHP container unit

- Brescia, Italy

  ISO container,
  width 250/300cm

Operation range of gas utilization facilities





Explosion Range, 5 Vol% CH_4 = 100 % UEG/LEL

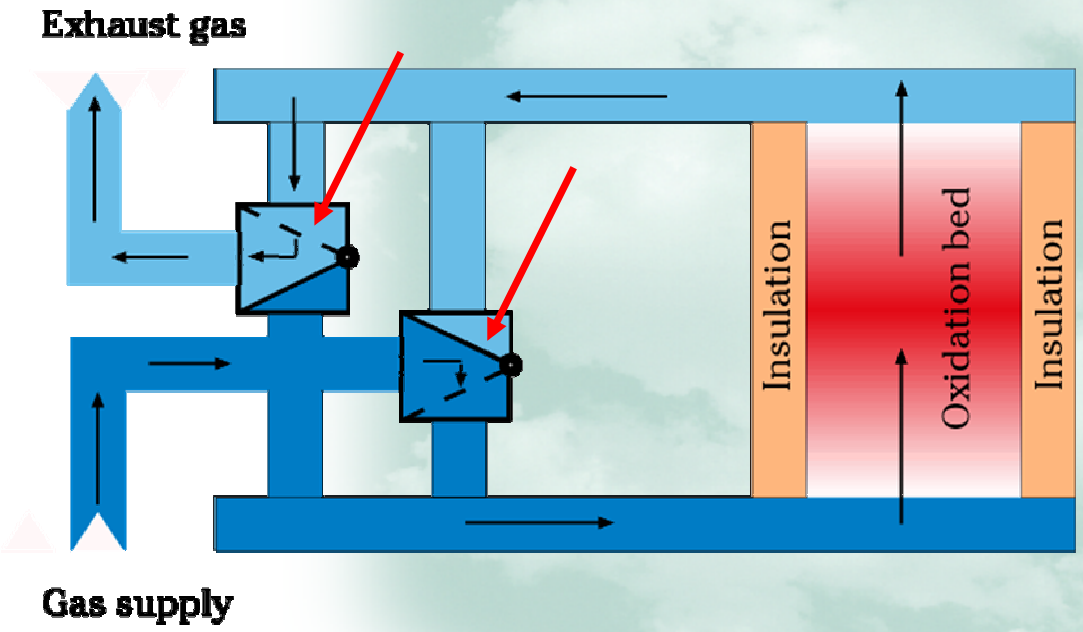
Explosion limit of gas mixtures

Haase VocsiBox®

- Utilization of low calorific gas
- Left: Cruxton, UK
- Right: Hanover, Germany
- Costs per Mg (t) CO2-reduction approx. 5 – 7 Euros
  based on 10 years operation and CH4/CO2 Globol warming potential: 25

based on Bouwmann, A.F.

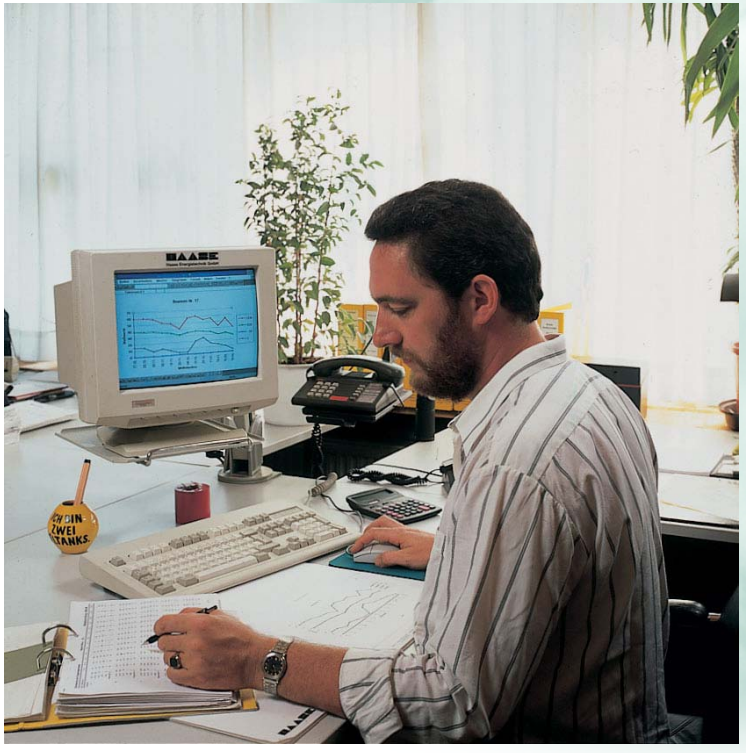
Reversing the direction of the flow

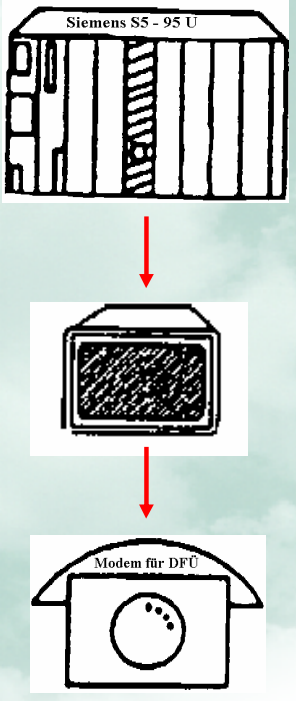


- When the direction of flow ist reversed

  the reaction bed will act as a heat exchanger.

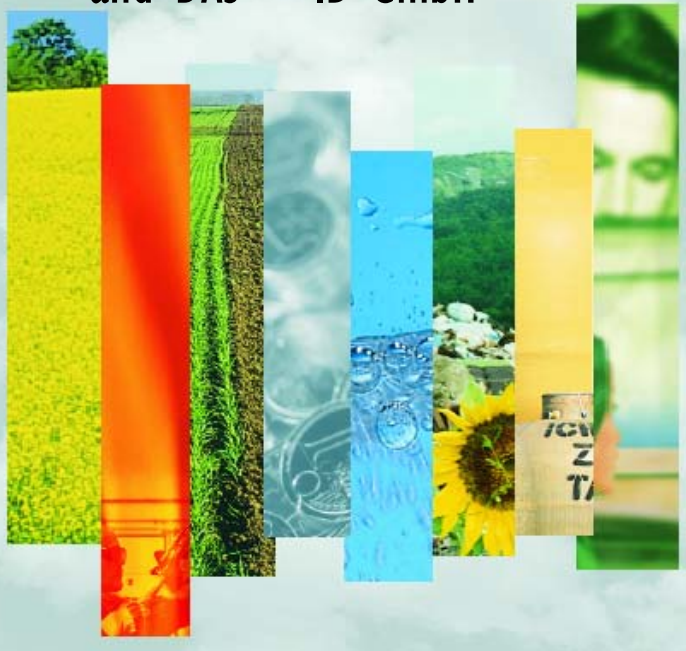
Relax: Remote control makes it easy





- Haase Telecontrol System

Haase Energietechnik GmbH
and DAS – IB GmbH



Thank you for your attention !