

**Optimisation of gas extraction / collection systems for a better climate; decrease the CO<sub>2</sub> potential by minimising the methane emissions over (via) the surface**

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**Optimisation of gas extraction / collection systems for a better climate; decrease the CO<sub>2</sub> potential by minimising the methane emissions over (via) the surface**  
**15th Intern. Waste Management and Landfill Symposium Sardinia 2015, Oct 5th - Oct. 9th**

**Wolfgang H. Stachowitz / Marcel Mattern**  
**DAS - IB GmbH**

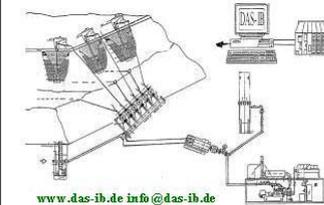
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**LFG - & Biogas - Technology**

Biogas, sludge gas and landfill gas technology:

- Consulting, planning, project management
- Training of system operators
- Expert i.a. in accordance with § 29a of the Federal Immission Control Act; and Qualified Person reg. the Ordinance on Industrial Safety and independent expert

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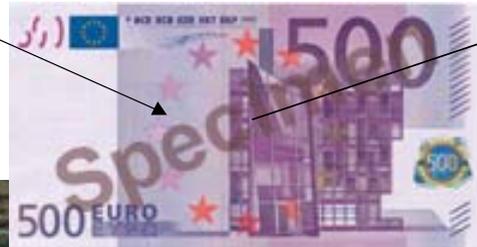
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**Emissions of methane: The story of environment and money ..**

Methane + O<sub>2</sub> =

+ CO<sub>2</sub>



**GWP: 28**

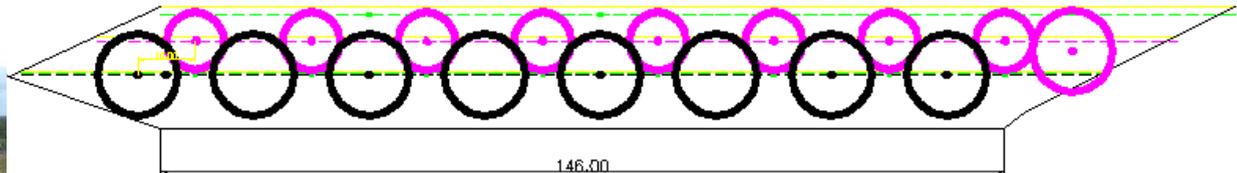
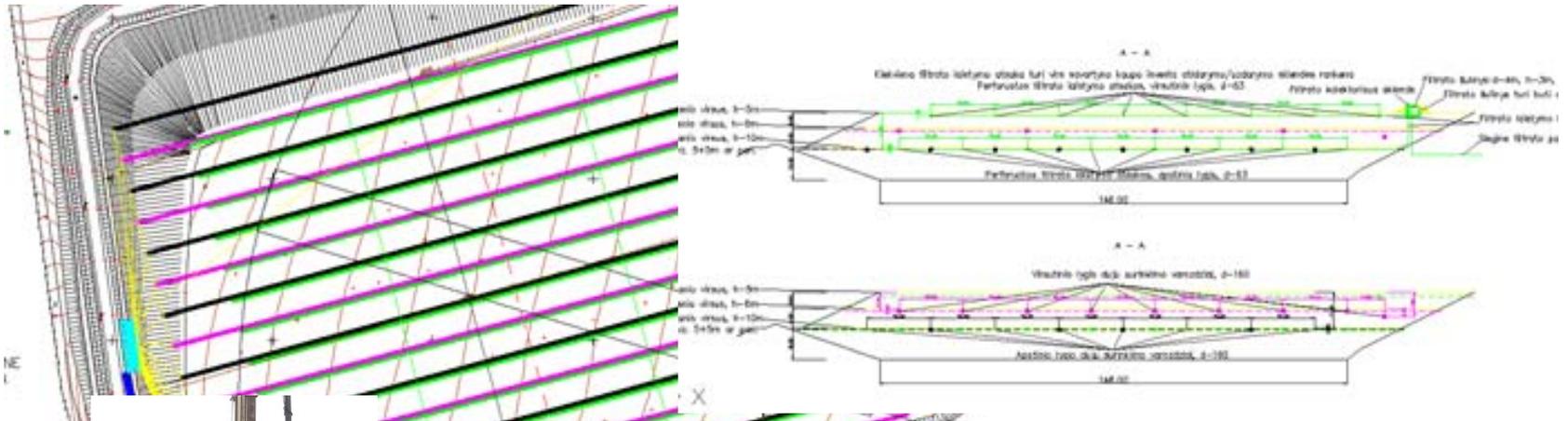


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**No efficiency - without a good gas extraction system**



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**No efficiency - without good workers and measurement devices**



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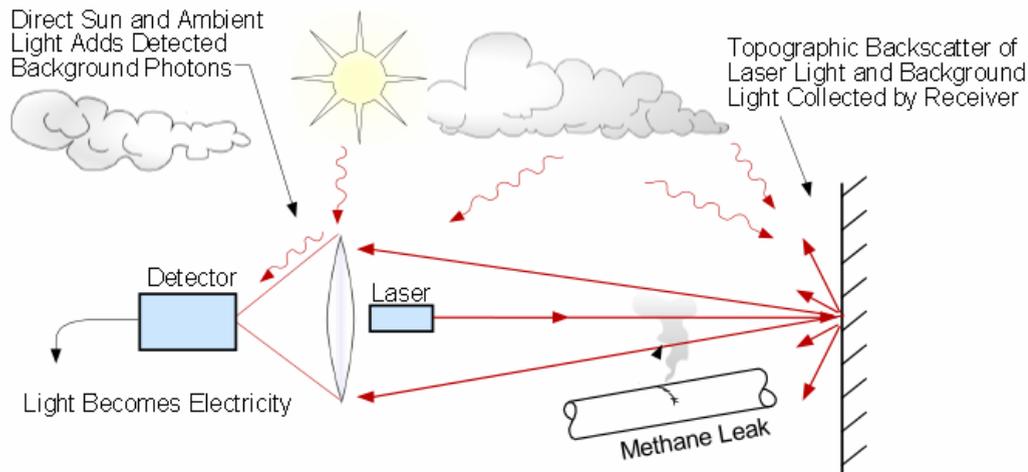
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## RMLD

**(Remote Methane Leak Detector)**  
**– Laserabsorptionsspectrometer**



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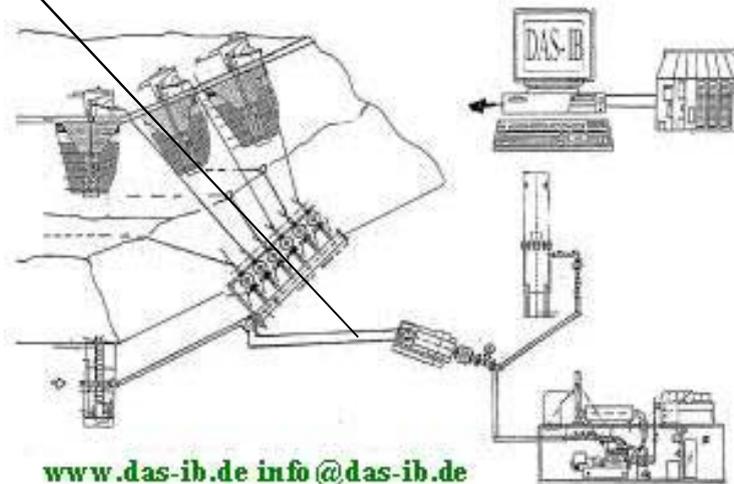
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Methane  
(méthane) + O<sub>2</sub> =



+ CO<sub>2</sub>

**GWP: 28**



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It looks easy – money from waste ... **BUT** ....

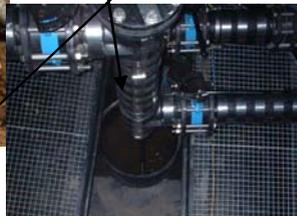
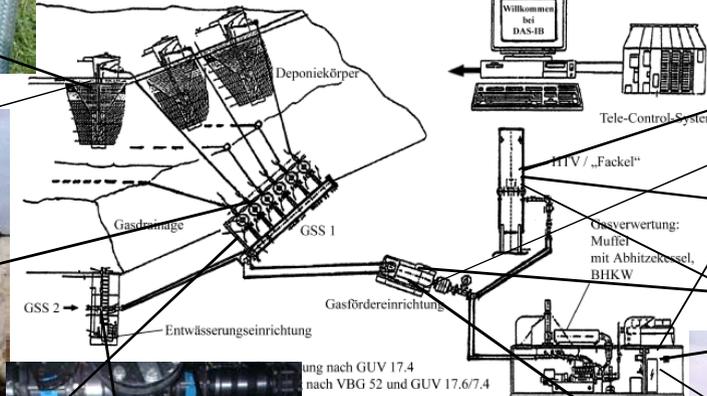
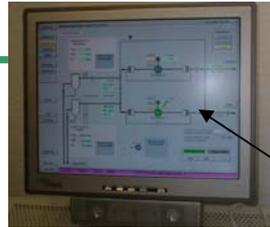
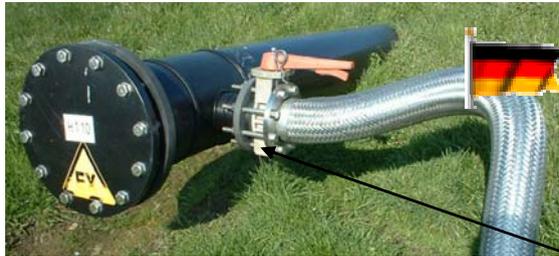
Il semble facile de faire de l'argent à partir des ordures ... **MAIS**...

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**The big EASY**

**If the gas extractions system runs**

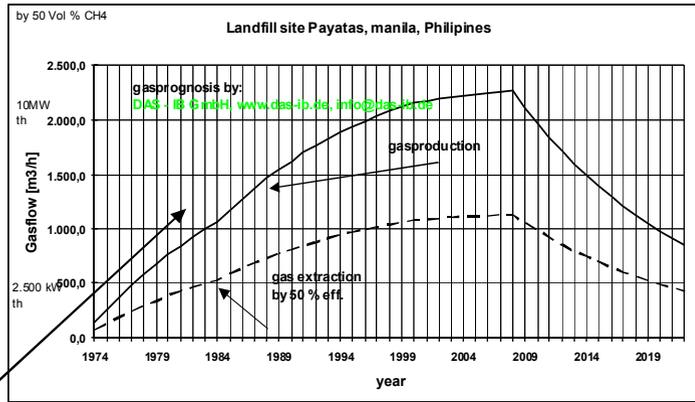


See: Author Wolfgang H. Stachowitz  
 15 Years of experience in the field of LFG disposal ..  
 Sardinia 2001, 8th International ...

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**No efficiency - without good gas prognoses and equipment on site**



See Author Wolfgang H. Stachowitz  
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$$Q_{a,t} \left( \frac{m^3}{a} \right) = 1,868 \cdot M \cdot TC \cdot f_{a0} \cdot f_a \cdot f_o \cdot f_s \cdot k \cdot e^{-k \cdot t}$$



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**No efficiency - without any knowing of local conditions**



Measurement over a landfill in Morocco

So you do need a good gas  
prognoses – tests on sites  
– pumping trails – etc. etc.



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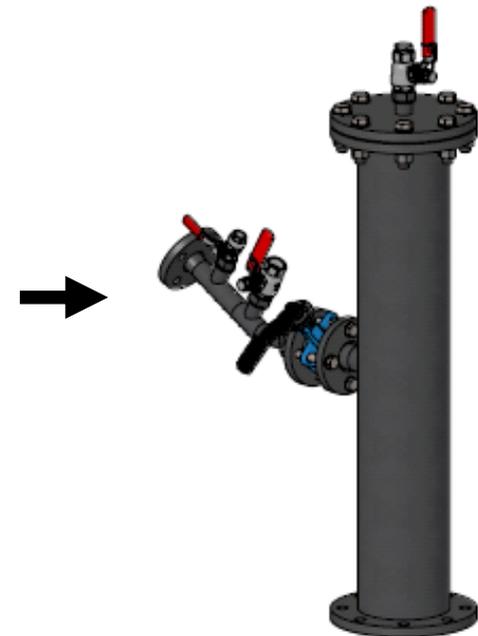
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Measurement over a landfill in Morocco

Gas well – full equipped with sample points



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Gas well – full equipped  
with sample points

Theory and in practice



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**No efficiency - without any measurement on site from gas well via surface ....**



Measurement on surface:

(Mesure en surface: )

“VOC”

Volatile organic compounds

(Les composés organiques volatils)

Landfill near Budapest, Hungary



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**No efficiency - without any measurement on site from gas well via surface ....**

Measurement at gas wells:

Level of water & free gas well pipe

To drop a perpendicular



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**No efficiency - without any measurement on site from ... via manifold station ..**



Measurement at manifold station:  
p, F, T, Q: CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>S, ...  
Plus samples for a laboratory:  
F, Cl, S, Si, CO, NH<sub>3</sub>, H<sub>2</sub>S etc.



Manifold station on top of a landfill –   
Dewatering back in landfill



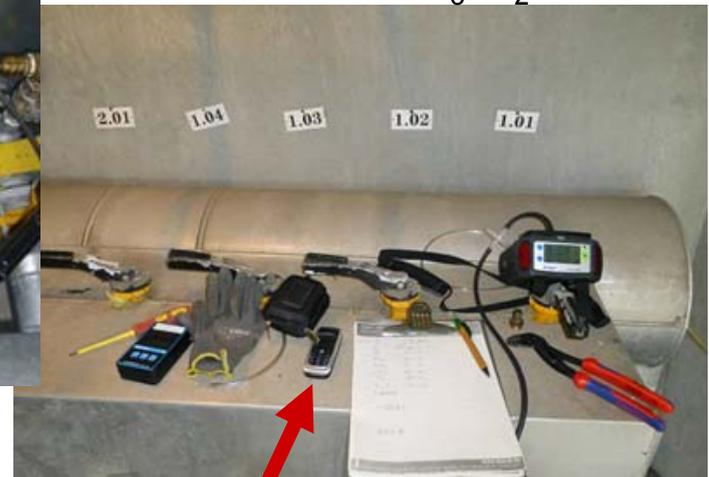
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Plus samples for a laboratory:  
F, Cl, S, Si, CO, NH<sub>3</sub>, H<sub>2</sub>S etc.



Manifold station on the brink of the landfill –

Dewatering back in landfill is possible via condensate shaft



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**No efficiency - without any measurement on site from ... via manifold station ..**



Landfill in Lithuania, near Vilnius – old manifold station vs. new manifold station.

Ring – pipe around the site with bypass instead of “good” & “poor” gas system

Landfill in Lithuania, near Vilnius



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**No efficiency - without the right local solutions**



Manifold station on the brink of the landfill  
with dewatering (to the condensate shaft) and purge connections

Landfill in Lithuania, near Vilnius



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### No efficiency - without the right local solutions



Measurement at manifold station:

p, F, T, Q: CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub>, H<sub>2</sub>S, ...

Plus samples for a laboratory:

F, Cl, S, Si, CO, NH<sub>3</sub>, H<sub>2</sub>S etc.



dewatering

Landfill in Lithuania, near Vilnius

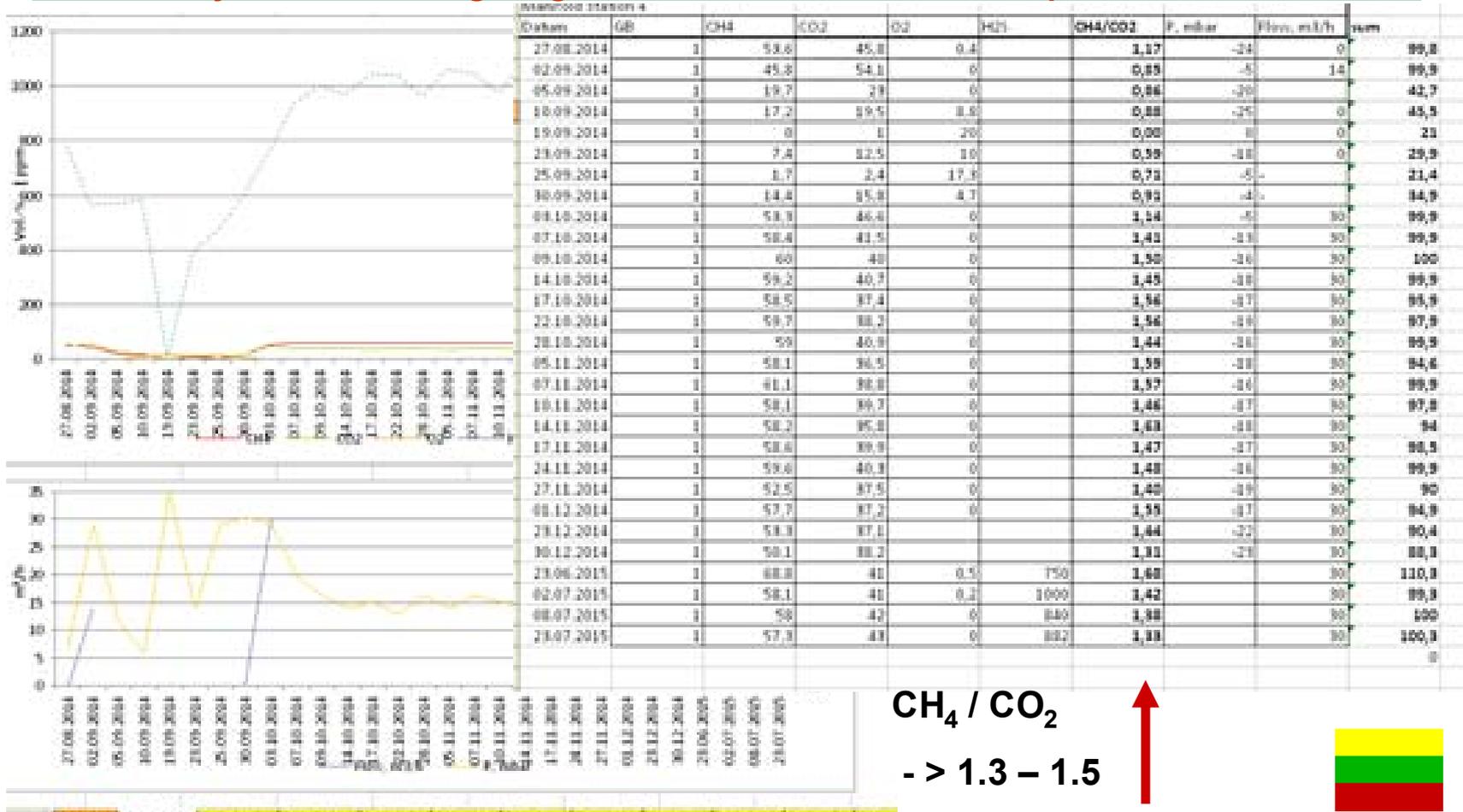


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**No efficiency - without the right figures of measurement and interpretation**



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**No efficiency - without knowing of the raw gas**

## Raw gas analyses / inspections



Methan	Vol-%	27,6	DIN 51872-5*;KI
Kohlendioxid	Vol-%	5,6	DIN 51872-5*;KI
Sauerstoff	Vol-%	26,1	DIN 51872-5*;KI
Stickstoff	Vol-%	< 0,5	DIN 51872-5*;KI
Wasserstoff	Vol-%	< 0,5	DIN 51872-5*;KI
Kohlenmonoxid	Vol-%	< 0,5	DIN 51872-5*;KI
<b>Nebenkompontenten</b>			
X Schwefelwasserstoff	mg/m <sup>3</sup>	2190	Sewern;KI
Ammoniak (NH3)	mg/m <sup>3</sup>	> 76,0	Sewern;KI
<b>Siliciumkomponenten</b>			
Hexamethyldisiloxan	mg/m <sup>3</sup>	0,7	E VDI 3860 Bl. 2;KI
Hexamethylcyclotrisiloxan	mg/m <sup>3</sup>	< 0,4	E VDI 3860 Bl. 2;KI
Octamethyltrisiloxan	mg/m <sup>3</sup>	< 0,1	E VDI 3860 Bl. 2;KI
Octamethylcyclotetra- siloxan	mg/m <sup>3</sup>	1,5	E VDI 3860 Bl. 2;KI
Decamethyltetrasiloxan	mg/m <sup>3</sup>	< 0,1	E VDI 3860 Bl. 2;KI
Decamethylcyclopenta- siloxan	mg/m <sup>3</sup>	0,5	E VDI 3860 Bl. 2;KI
Summe Siloxane	mg/m <sup>3</sup>	2,7	E VDI 3860 Bl. 2;KI
Summe Siloxane als Si	mg/m <sup>3</sup>	1,0	E VDI 3860 Bl. 2;KI
<b>Summenparameter</b>			
Chlor gesamt	mg/m <sup>3</sup>	< 1	E VDI 3860-2;KI
Fluor gesamt	mg/m <sup>3</sup>	< 1	E VDI 3860-2;KI
Schwefel gesamt	mg/m <sup>3</sup>	1600	E VDI 3860-2;KI

Handwritten notes on the table:  
 - Next to 'Schwefelwasserstoff': **X**  
 - Next to 'Ammoniak (NH3)': **2 end of measurement div.**  
 - Next to 'Summe Siloxane': **2,44**  
 - Next to 'Summe Siloxane als Si': **3512**  
 - Next to 'Schwefel gesamt': **3512**  
 - Next to 'Sewern;KI' (row 2): **> 5,355**  
 - Next to 'Sewern;KI' (row 3): **> 186**

Legend:  
 \* = nicht akkreditiert  
 KI = Fremdgegabe  
 n.b. = nicht bestimmbar  
 - = nicht bestimmt



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**No efficiency - without knowing of the right gas flow – so make realistic pumping trails – normally 3 until 6 months**

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## Die mobile Kleinst-Fackel – the small scale mobile flare



DMF V:  
Feuerungswärmeleistung /  
firing capacity:  
0 - 150 kW<sub>th</sub>



Grasbrunnen und  
ung  
erleichter und  
der Fackeln:  
- Luft (29.X.2007),  
ten Vordruck von  
entstehler  
ung  
gen, Druckmessungen  
1/2" saug- und  
Stahlreifen Kontakte bei  
AUG"  
Is Bullerer Blitzschutz  
gleich / Beiliftung  
ng:  
nab: 1:15  
2 ngaswärmleistung  
= 250 mbar  
CO<sub>2</sub>, O<sub>2</sub> zur  
Durchfuß-, Druck- und



- FIELDS OF APPLICATION:**
- \* Barbecue – only with Natural gas!
  - \* LFG- & Biogas Pumping trails
  - \* Protective LFG degassing
  - \* Optimization of individual gas wells and gas manifold stations
  - \* Training / schooling / instructions
  - \* Training at the flare, booster and measuring devices
- BASIC CONFIGURATION OF THE FLARES:**
- \* Design according to TA air (2007), Control range for a pressure of 5 to 99 mbar (g) to flare
  - \* Operation with an own LFG- booster
  - \* H – 0 – A Start
  - \* Supervision of the combustion chamber - burner control unit (BCU)
  - \* Temperature measurements, pressure measurements
  - \* Analysis connection: 1/4" 1/2" on the suction and on the pressure side
  - \* slam shut valve
  - \* Output of a potential-free contact via GMD on mobiles "ON" and "OFF"
- TECHNICAL DESIGN:**
- \* Control range: 1:100 (manual), 1:15 (automaticaly)
  - \* 0 - 150 kW<sub>th</sub> firing capacity
  - \* 0 - 200 m3/h at a p = 250 mbar
- OPTION'S:**
- \* Raw gas analysis: CH<sub>4</sub>, CO<sub>2</sub>, O<sub>2</sub> for the permanent measurement
  - \* Electrical: manual flow, pressure, and temperature measurement
  - \* INDIU - operation

**Time >> 6 month on site !! For a stable LFG flow  
DAS IB – mobile flares on trailers until 1,6 MW<sub>th</sub>  
Or small scale flares less than 100 kW<sub>th</sub> on a trolley**

We helfen Ihnen gerne.

- Biogas-, Klärgas- und Deponiegastechnologie:**
- \* Beratung, Planung, Projektierung und Ausführung
  - \* Schulung von Betriebspersonal
  - \* Sachverständigtätigkeiten (u.a. nach § 20a BImSchG und befristigte Person (id BetriebsV))
  - \* CO<sub>2</sub>-Zertifizierungshandel
  - \* Erstellen von Explosionsschutzdokumenten



We are able to assist & help you:

- Biogas, sewerage gas and landfill gas (LFG) technology:**
- \* Consulting, planning & designing, projecting
  - \* Special schooling and training of system operators
  - \* Independent expert & specialist
  - \* Expert in ATEX-Zoning
  - \* CO<sub>2</sub> trading with methane (carbon trading / LFG-projects)
  - \* Creating of explosion protection documents
  - \* Bigger mobile flares DMF I (1 MW<sub>th</sub>) until DMF II (1,6 MW<sub>th</sub>)

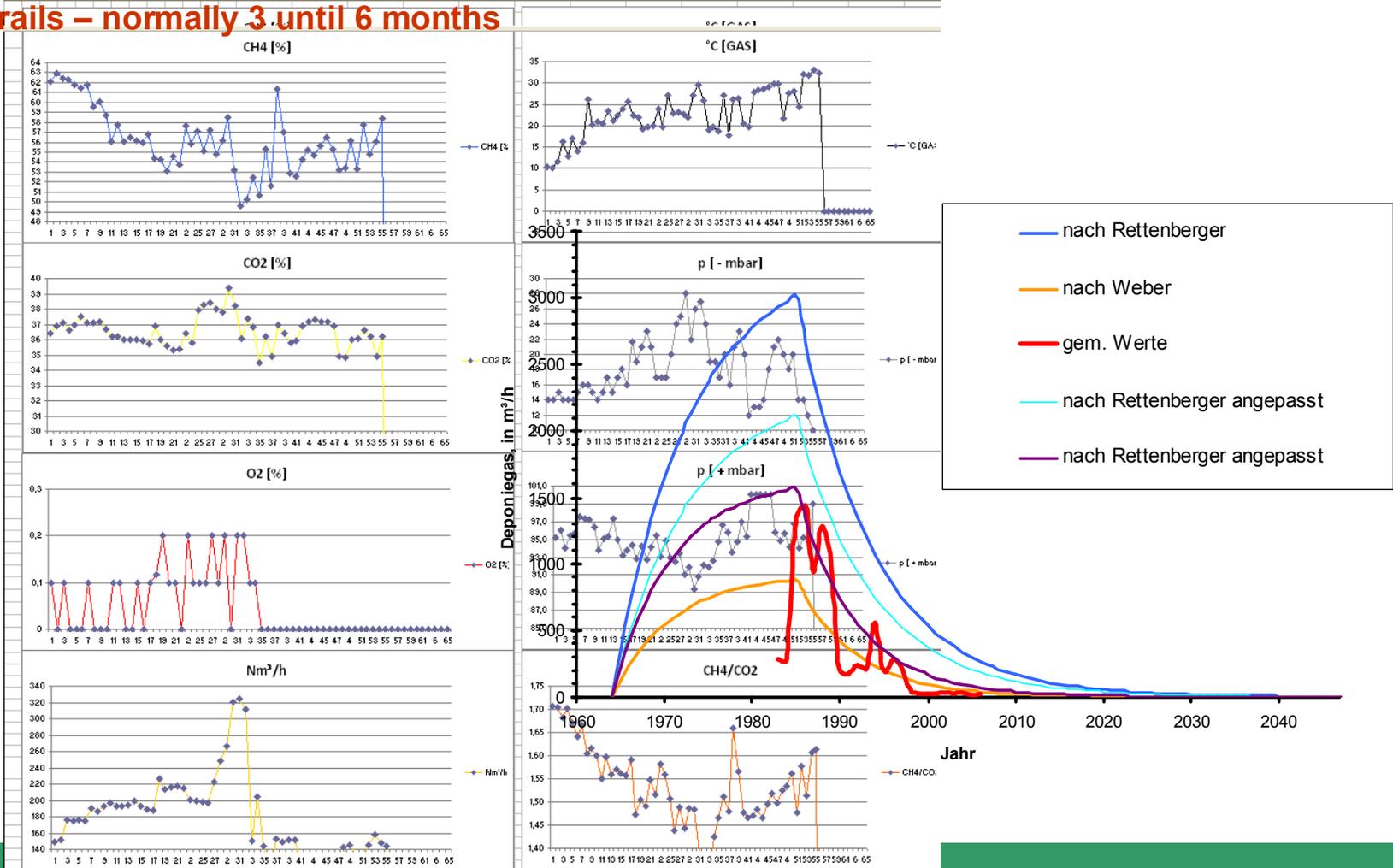


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Or active air in the landfill – here in central gas well

## **AERATATION**

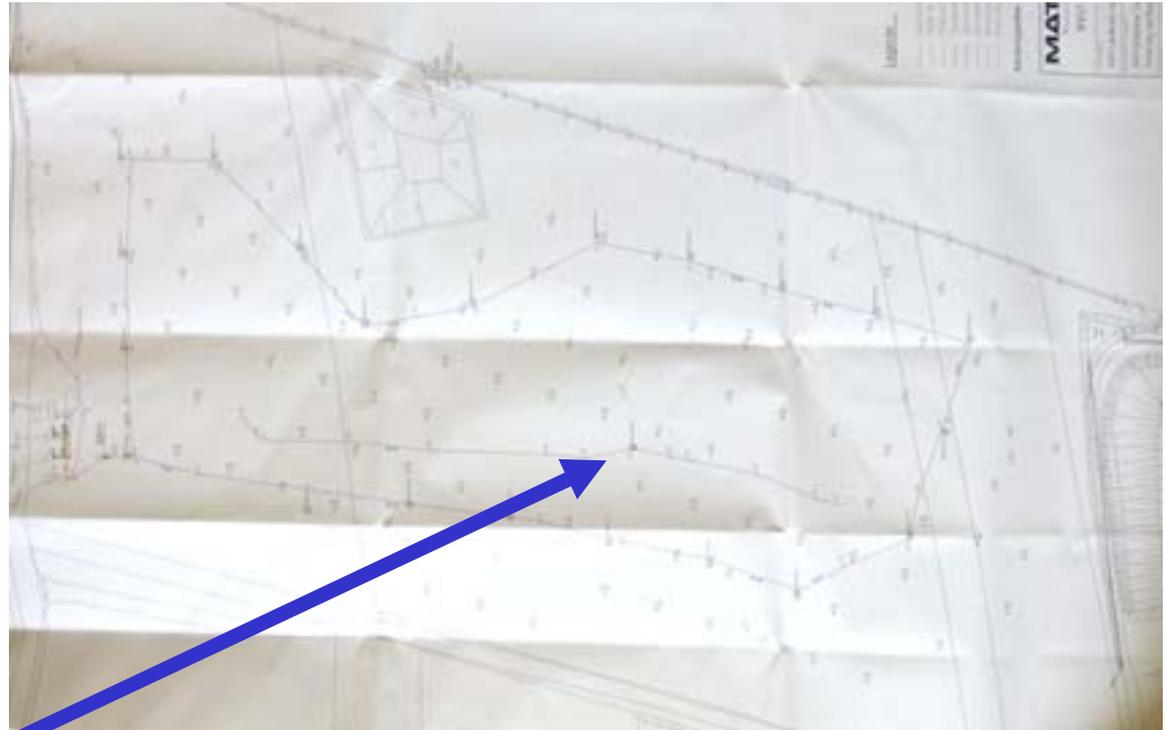
Vent air in side

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**AERATATION**



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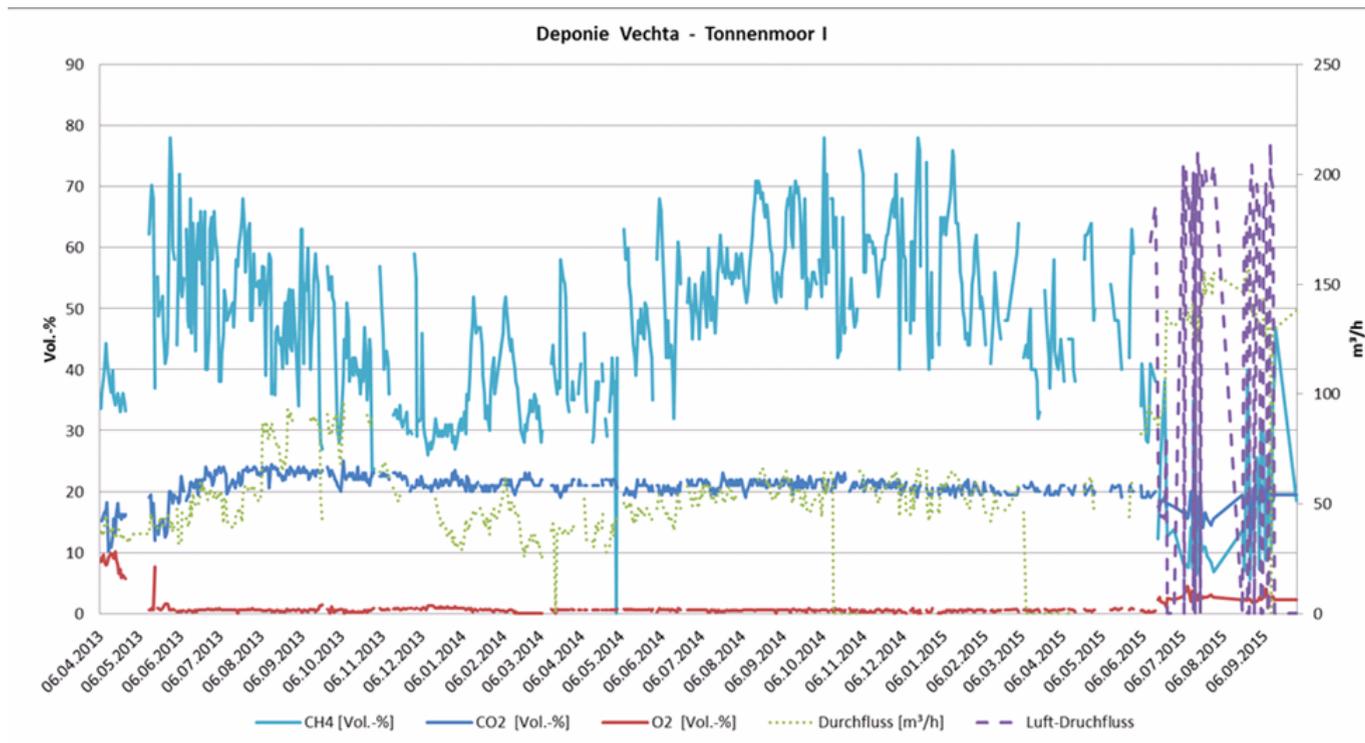
Or active air in the landfill - **AERATATION**



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Or active air in the landfill:  $\text{CH}_4 + 2 * \text{O}_2 = \text{CO}_2 + 2 * \text{H}_2\text{O}$  **AERATATION**



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Please note all landfill sites are different

- Weather conditions
- size, high, input,
- etc.

Chaque décharge est un cas particulier

- Conditions climatiques
- Dimension, hauteur, input
- etc.

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**No efficiency - without any knowing of local conditions**

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Typical wheatear in .....



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Typical wheatear in .....



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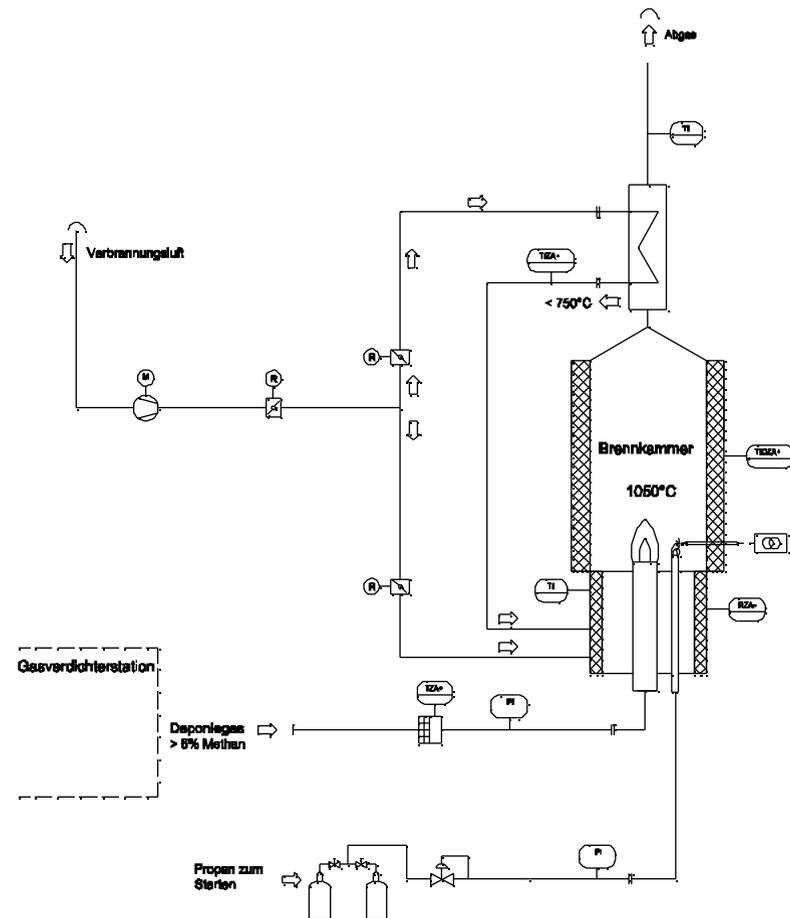
New technology's which could be useful for a better efficiency

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**Low calorific flares - heat exchanger for the necessary energy**



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**Tandem mixer in the main gas pipe of older engines to operate with lower methane content less than 30 Vol. %**

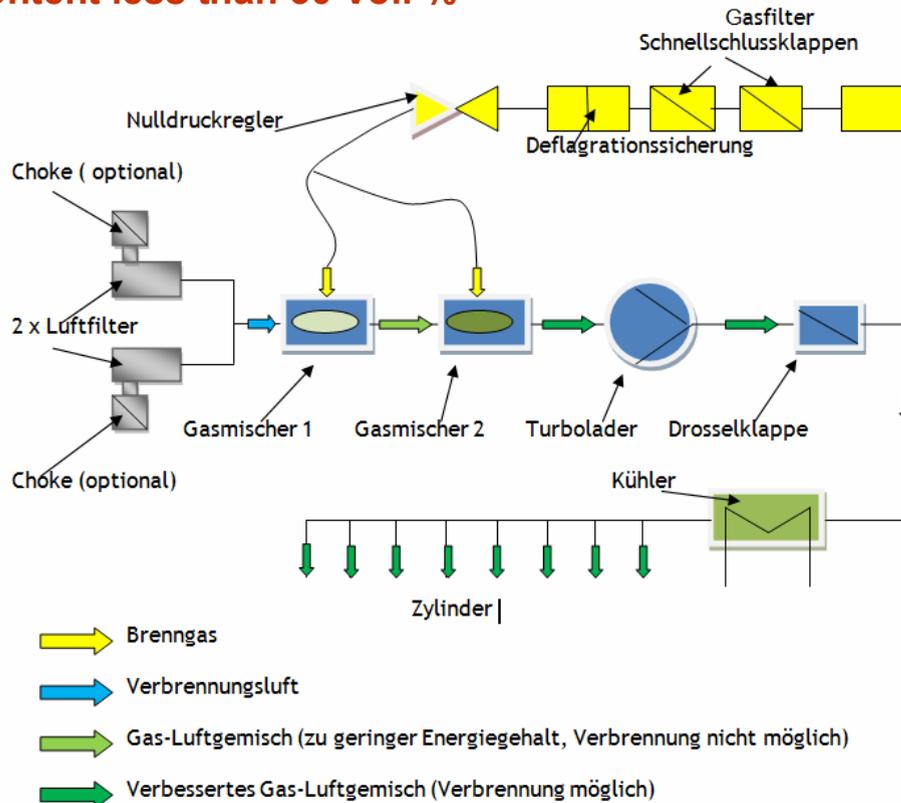


Bild 1: Prinzipdarstellung des Tandemmixers

 **GreenGas**  
 capture the energy

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Conclusions:

**No efficiency - without a good gas extraction system**

**No efficiency - without good workers and measurement devices**

**No efficiency - without good gas prognoses and equipment on site**

**No efficiency - without any knowing of local conditions**

**No efficiency - without any measurement on site from gas well via surface ....**

**No efficiency - without any measurement on site from ... via manifold station ..**

**No efficiency - without the right local solutions**

**No efficiency - without the right figures of measurement and interpretation**

**No efficiency - without knowing of the raw gas**

**No efficiency - without knowing of the right gas flow – so make realistic pumping trails – normally 3 until 6 months**

**Optimisation of gas extraction / collection systems for a better climate; decrease the CO<sub>2</sub> potential by minimising the methane emissions over (via) the surface**

**DAS - IB GmbH**  
**LFG- & Biogas - Technology**  
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At the end of a day ... we have the same results on side, bureau, PC and Laptop  
... we use special chips ...  
... and own software ....



**Das Auto.**

Photos by bahlsen and volkswagen

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# Any questions left?



Knowledge is key and is available when you know where to find it:

[www.das-ib.de](http://www.das-ib.de)

Or we see us at your site or here e.g. next break