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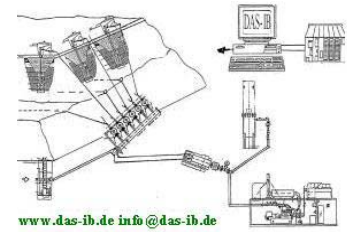
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- Training of system operators
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LFG projects in Germany due to the National Climate Initiative by the German Government

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Summary:

In 2015, the German Government has started the 2nd trial regarding the reduction of CO₂ emissions through an improved operation of LFG systems. The "50 % sponsorship" (the aid / public money) is restricted to the investment in a better gas extraction system by means of higher suction pressure and not in a better operation of CHP units.

DAS – IB GmbH and the reporter / presenter carried out gas potential analyses by means of pumping trails and gave theoretical gas prognoses in several German landfill sites, namely in Vechta, Chemnitz (two sites), Kiel, near Bautzen (two sites), Weimar, Fulda, Bochum, etc. These days, five of these projects will enter the second step of the campaign by the "50 % sponsorship" which is called the invest procedure. This means that new technical equipment will be installed from the gas wells via pipe works, aeration blowers, gas boosters to low calorific flares instead of the standard 50 vol % of methane flares.

Index words

Climate change, national climate initiative, gas extraction systems, aeration , landfill gas, LFG, optimisation, operation, gas collection system, manifold station, MSW, disposal sites, landfill, gas

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prognoses, IPCC, gas extraction system, gas wells, methane emission, return of invest, LFG, NKI (German National Climate Initiative) , PtJ , gas potential, investment in gas extraction and LFG2Energie, reduction of CO₂ emissions, MSW landfill, mobile flares, pumping trails, gas wells, methane reduction, LFG flares, LFG2money

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Summary

Within the scope of the German National Climate Initiative, DAS - IB GmbH was instructed to carry out the "potential analysis" at different sites or to practically implement engineering services for, amongst others, the inventory-taking including evaluations, tests (potential analysis) and the realization of investment measures. The PtJ (Project Management Jülich) climate initiative aims to reduce climate-relevant CO₂ emissions through a fast and sustained conversion of abandoned municipal solid waste landfills into a stable condition. The available so-called poor-gas treatment measures are briefly presented in the lecture.

General remarks

The methane emissions that are escaping from landfills (landfill gas) show high climate relevance. According to the IPCC, methane is – in a 100 year comparison – 28 times more harmful (more detrimental) than carbon dioxide (CO₂).

ptj – Projekte auf stillgelegten Siedlungsabfalldeponien
Nationale Klimaschutz Initiative (NKI)

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IPCC – 100 Jahre $\text{CH}_4 / \text{CO}_2 = 28 / 1$ (Stand 2015)

100 m³ / h Deponiegas mit 40 Vol % $\text{CH}_4 =$

100 m³ / h * 0,4 * 0,7 kg / m³ * 28 =

28 kg / h * 28 = 784 kg CO_2 eq / h =

6.162 CO_2 eq t pa

Das organische CO_2 aus HMD ist Null, da es biogene
Organik ist

#12S. 3

Bild: PtJ projects on abandoned municipal solid waste disposal sites / German National Climate Initiative

IPCC – 100 years $\text{CH}_4/\text{CO}_2 = 28/1$ (last update 2015)

100 m³/h landfill gas with 40 vol.-% $\text{CH}_4 =$

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6,162 CO_2 eq t pa

The organic CO_2 from **MSW???** is zero, as it is biogenic organic material

What are PtJ projects (climatic protection at abandoned municipal solid waste landfills)?

On the initiative of the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMU), more than 5,000 climate protection projects have been implemented since 2008, and approximately 2,500 municipalities have been supported. /1/

On 3 December 2014, the Federal Cabinet opted for the Action Program 2020 for Climate Protection. The program comprises measures for an additional reduction of CO₂ equivalents (equ). This also addresses the waste management, where landfill aeration is listed as the only measure to reduce methane emissions. The following methods are employed for the aeration of landfills: low-pressure aeration, high-pressure aeration, pressure aeration without extraction, and landfill aeration through over extraction. /2/

The project management Jülich (PtJ) advises the ministry and the municipalities regarding the aid program, from the filing of application, via the mode of payment to the final report on the expenditure of funds. /1/

The PtJ projects that are presented hereinafter for a sustained reduction of **greenhouse gas emissions** through the so-called in-situ stabilization primarily consist of two consecutive phases, namely the "potential analysis" (financial support of 50%, currently no longer an indicated max. promotion), and the "investment measure" (a promotion of 50%, gross max. 450,000 €).

The potential analysis aims to analyze the specific initial situation as well as the technically and economically implementable greenhouse gas reduction potentials, investigate suitable methods and ascertain and evaluate the emission and optimisation potential. The technical implementation of the suitable method on site takes place within the scope of the investment measure.

Information regarding the requirements (for example, at least a reduction potential of 50% CO₂ **equivalent** (CO₂ equ) compared to the existing methods), the application and the possibilities for grants (currently max. €450,000 for investment measures) can be found in the "Merkblatt Erstellung von Klimaschutzteilkonzepten" or in the "Merkblatt investive Klimaschutzmaßnahmen" at <https://www.ptj.de/klimaschutzinitiative-kommunen/klimaschutzkonzepte>. The application is submitted online.

1 Landfill degasification within the scope of PtJ projects

In cooperation with the communal operators, the application regarding the potential analysis for the first sites, namely the Petersberg-Steinau landfill (district of Fulda) and the Tonnenmoor landfill (waste management company of the Vechta district – AWW) was filed in April 2014 in close coordination with DAS-IB GmbH - and in May 2015 for the Umpferstedt landfill of Stadtwirtschaft Weimar. The implementation of the potential analysis has been effected since the turn of the year 2014/2015 for the first two projects and since April/May 2015 for the LH (state capital) Kiel-Drachensee project.

These are the current project statuses (February 2017 - extract):

- AWW, Tonnenmoor landfill – invitation to tender regarding the investment measure
- AWVC, Himmelsfürst and Wittgensdorf landfill – completion of the potential analyses
- Stadtwirtschaft Weimar – Umpferstedt landfill – application for investment measures and Ordinance for the Implementation of the Federal Immission Control Act approval
- RAVON, Kunnersdorf and Nadelwitz landfills – assignment of the investment measure
- USB, Kornharpen landfill – assignment of the investment measure
- Kiel – Drachensee landfill, Petersberg – Steinau only potential analyses, since investment measures were not economically viable.

On the Wilsum landfill (Grafschaft Bentheim district), the effective implementation of the potential analysis was realised from April 2014 onwards. At this site, the application regarding the potential analysis is filed directly by the waste management company of the Grafschaft Bentheim district, without the participation of DAS - IB GmbH. However, DAS – IB GmbH won the respective communal bids, like in Kiel – Drachensee.

1.1 Application and implementations regarding the potential analysis at the Petersberg - Steinau and Vechta – Tonnenmoor landfills

Petersberg - Steinau

The abandoned Petersberg - Steinau landfill site was operated until 1982. From 1989, the gas was extracted via gas wells and a gas booster station. As a result of low delivery rates, the energetic utilisation was stopped in 1999 and, subsequently, a poor-gas

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treatment plant (VocsiBox®) was operated until approx. 2007. In the period between 1999 and 2003, a qualified mineral surface sealing was applied.



Illustration 1, Aerial view of the Petersberg - Steinau landfill from 2013 [Google. Inc.]

Vechta - Tonnenmoor

Already in the beginning of the 1970's, the city of Vechta operated a predecessor landfill at the present-day Tonnenmoor site in which, in addition to the waste from the urban area, waste from the northern district of Vechta was also deposited. On 1 January 1975, the Vechta district took over the responsibility. From this moment, the waste from Lohne and Dinklage was also deposited there. Since 1979, the entire waste volume of the Vechta district has been deposited at this site after the Neuenwalde landfill near Damme had been closed. With the completion of a new landfill area (Tonnenmoor II), the operation was stopped in 1988 at the old Tonnenmoor I waste disposal site.

The landfill gas of the old waste disposal site was utilised energetically as derived fuels in adjacent brickworks until the beginning of 2013. The Tonnenmoor I landfill is a former domestic waste landfill with a surface sealing that complies with the Technical Guidelines for the Disposal of Municipal Solid Waste (TASi).

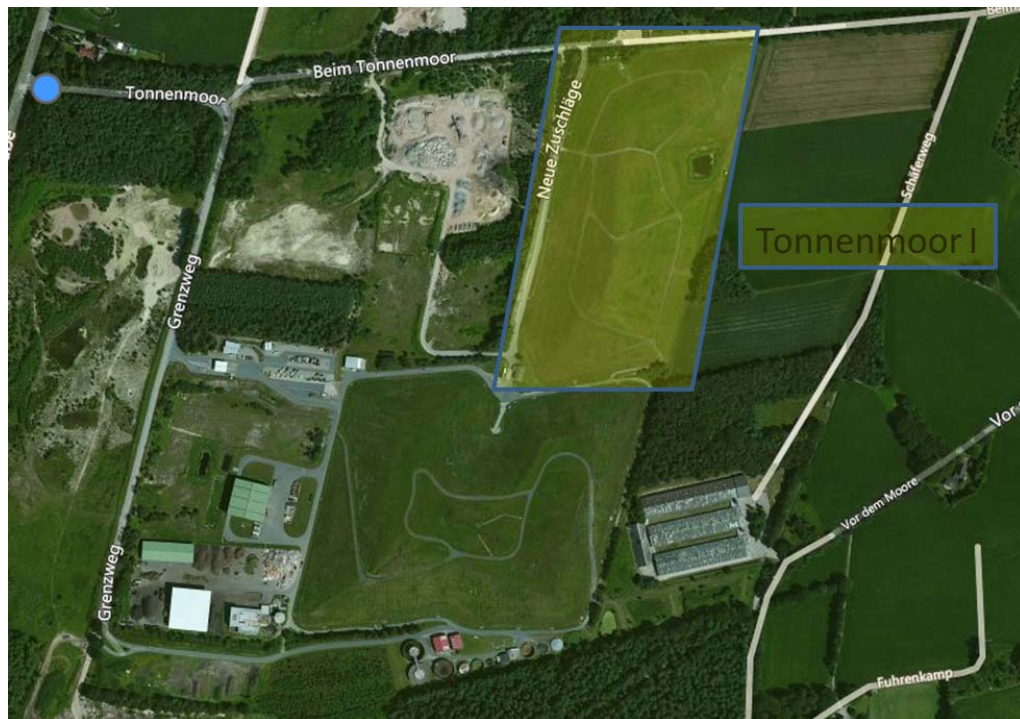


Illustration 2, Aerial view of the Tonnenmoor I landfill from 2013 [Google Inc.]

Due to a lack of information / documentation from the "old times" on the current state of the landfill, further investigations of the existing gas collection systems are planned. Subsequent to having received the two positive aid-granting decisions in August 2014, we conducted qualified extraction tests at individual gas wells or for the entire gas collection system starting from November 2014, in addition to the compilation of inventory records in 2015.

As a first step, the so-called inventory audit, the existing documents for the landfill sections are collected and evaluated. In this respect, the following points were worked out in particular:

- Compilation of the inventory documents and of the plant and site documentation including information regarding the landfill surface area, form, volume, disposal volume and periods, and the waste consistency
- Verification and evaluation of the already effectuated extraction tests
- Logging of the (technical) state of the available process equipment with the gas collection system and the drainages (condensate separation)
- Preliminary assessment of the existing gas collection system, amongst others (selection) via camera inspection or light plummet measurement for the verification of the condition (filter condition, accumulation of leachate, mechanical impairment) of gas well pipes and gas pipes

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- Comparison between the gas prognosis models with the actual state on site.

Subsequent to the completion of the inventory check, qualified and representative extraction tests were carried out by means of a mobile flare/extraction system, first on selected gas wells and afterwards on the entire gas collection system. The mobile small-scale flare from DAS – IB GmbH that was employed for this purpose is equipped with a gas compressor and a combustion chamber for up to three burners (approx. 10 kW_{therm} to 100 kW_{therm}). This flare can be directly connected to the gas wells or the gas manifold via a flexible pipe and adapted measurement sections for, amongst others, the landfill raw-gas flow-through.



Illustrations 3, Employment of the mobile DMF V small-scale flare with a mobile gas analysis and flow measurement at the Vechta - Tonnenmoor [DAS - IB GmbH] site as a substitute for the initial gas disposal in the brickworks, and a theoretical and practical air injection (picture on the top right and below)

These extraction tests were completed by air introduction via the central gas well in the middle of the landfill by means of our mobile gas booster "board"/station.

The potential analysis is effectuated by means of the inventory check and the representative and qualified extraction tests. In the latter, it is checked via the creation of a gas prognosis or assessment of the gas formation potential according to the first order decay method (IPCC Guidelines 1996) or similar as to how far the presentation of the measuring result from the preliminary investigations and the actual state, the analysis and indications regarding the optimisation of the gas collection system, as well as the employment of poor gas systems a possible anaerobic and aerobic in-situ stabilisation can be implemented.

In June 2017 the call for bids of the invest action started. The results will be presented in the presentation at Sardinia conference.

1.2 Implementation of the potential analysis at the Kiel-Drachensee landfill

The abandoned "Drachensee" waste disposal site is a former clay and gravel mining area, whose pits, according to the documents that were handed over to us, were filled with household and bulky refuse, commercial waste, construction waste, excavation material, and vegetable waste from 1950 to 1964/65. The eastern part of the abandoned waste disposal site area is currently commercially used (approximately 47%), while the area in the west of it is used mainly for allotments. It also serves as a local recreation area. In 1996, a landfill gas collection system was installed, comprising a total of nine gas wells. Subsequent to the termination of the degasification facilities, the gas composition of the respective wells was analysed. The gas analyses showed that the methane concentration of the individual gas wells strongly differed from each other. As a consequence, some sections of the abandoned waste disposal site were over extracted during the operation of the degasification system. This resulted in a differentiated adjustment of the extraction quantities per gas well for the operation of the landfill degasification system, in order to avoid the over extraction of the individual wells. Therefore, the Hamburg University of Technology (TUHH), Department of Waste Management, was tasked in 1997 by the environmental agency of the state's capital Kiel to make recommendations for the further operation of the degasification plant and the optimisation of the gas collection system within the scope of an investigation programme. The resulting degasification with

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machines (gas booster station with a VocsiBox®) was projected and implemented at that time by HAASE Energietechnik GmbH, represented by the currently speaking person.

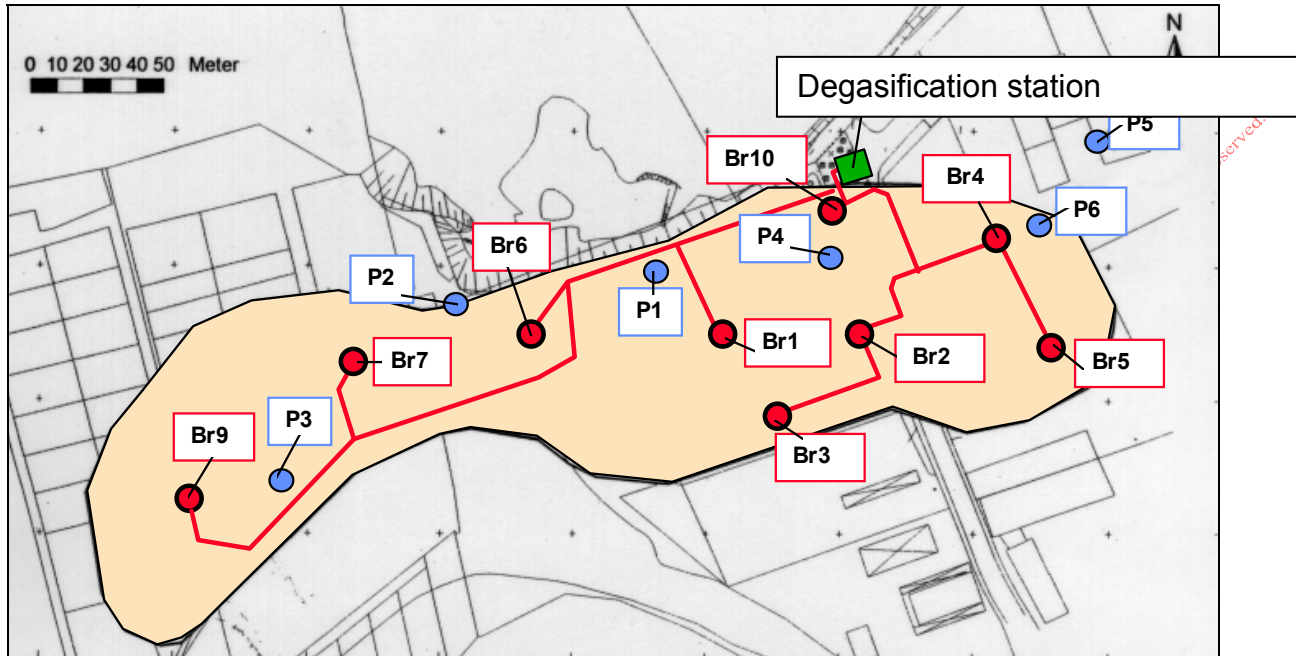


Illustration 5: Gas collection system of the abandoned "Kiel - Drachensee" waste disposal site, Br = Gas well, P = monitoring level (source: state's capital Kiel)

DAS – IB received the order on the basis of the invitation to tender from the environmental agency of state's capital Kiel in January 2015 and completed it at the end of 2015. Further measurements beyond the PtJ project were still carried out until February 2016 in order to further verify or evaluate the possible tendencies and develop further recommendations for action.



Illustration 6: TOP: Machine systems of the abandoned "Kiel – Drachensee" waste disposal site (on the left) and the implementation of drilling operations in the industrial area of the abandoned waste disposal site (in the middle) and on the right: new aeration well
 At the BOTTOM: Overview of the measures at the abandoned waste disposal site with aeration wells, gas wells and gas levels.

2 Summary and status of the projects

Within the framework of the national climate protection initiative, a potentiality study regarding the employment of suitable technologies for the reduction of greenhouse gas emissions within the scope of a PTJ project was or still is implemented at different abandoned municipal solid waste landfills. The aim is to achieve a sustained reduction of emissions of at least 50% compared to the conventional landfill gas collection and treatment via in situ stabilisation, for example through overextraction and/or air injection.

The first investment measures were allocated in the turn of the year 2016/2017 and are currently in the invitation to tender or assignment status.

DAS - IB GmbH supported the operators with regard to the application and has carried out qualified extraction tests for the assessment of the residual gas potential since 2015. Plant and operator-specific methods are elaborated on the basis of the measurements and the findings from the inventory analysis, and then again promoted with the support of PtJ, and finally implemented in 2017 within the scope of the investment measure.

On the whole, the implementation of these measures is a win-win situation. The Federal Republic of Germany receives the missing CO₂ reductions in advance and the landfill operators receive financial recognition for the advanced building measures.

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Oct 2015



"Optimizing of landfill gas extraction / collection systems for a better climate" by Wolfgang H. Stachowitz

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[pdf.-file of the one page overview 114 kB](#)

[pdf.-file of the ppt presentation 2.498 kB](#)

Oct 2013



"Methane detection on the surface of landfill sites and at biogas plants" by Wolfgang H. Stachowitz

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[pdf.-file of the presentation 964 kB](#)



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10. / 11. XII. 2014



Deponieentgasung im Rahmen von PtJ – Projekten zur vorzeitigen CO₂ – Klimabilanzverbesserung an den konkreten Beispielen: LK Grafschaft Bentheim (Deponie Wilsum), LK Fulda (Deponie Steinau – Petersberg), AW Vechta (Deponie Tonnenmoor).

Praxistagung Deponie 2014
- wasteconsult

Hannover



21. April 2015

„PtJ - Projekte auf stillgelegten

Internationale Biogas und Deponiegas Fachtagung

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Oct 05

Carbon trading and
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and CDM- projects

10th Intern. Waste
Management and
Landfill
Symposium Sardinia
2005, October 3rd - 7th

[complete as pdf - file \(488 kB\)](#)

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Wolfgang Horst

2004

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