





Climate neutral landfills due to in situ aeration

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c/o
Hamburg University of Technology – TUHH
CREM - Circular Resource Engineering and Management
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What is HiiCCE?

Hamburg Institute for Innovation Climate Protection and Circular Economy

- Cooperation between municipal company **Stadtreinigung Hamburg** (SRH) and **Hamburg University of Technology** (TUHH)
- HiiCCE is an accepted **affiliated institute** with the TUHH
- HiCCE is a **100% subsidiary** of Stadtreinigung Hamburg (SRH)
- HiiCCE is supported by a **Top-class advisory board** made up of renowned experts (science, industry and administration)
- HiiCCE offers its customers **comprehensive know-how** in the areas of waste management, resource and climate protection

What is HiiCCE ?

HiiCCE Employees

- Project Management
- Technical Consulting
- Project Development

CREM Institute at TUHH

- R&D&I for a Circular Economy
- Analytics
- roject Development

Public Company Stadtreinigung Hamburg

- Waste Management
- Waste Disposal and Recycling
- Urban Cleanlines

Advisory Board

- Interdisciplinary Competence
- Impulses for the Institute's Work
- Knowledge Pool

HiiCCE
Subsidiary of the Stadtreinigung Hamburg and affiliated institute with the TUHH

Support for transformation processes (not only) in the waste management sector

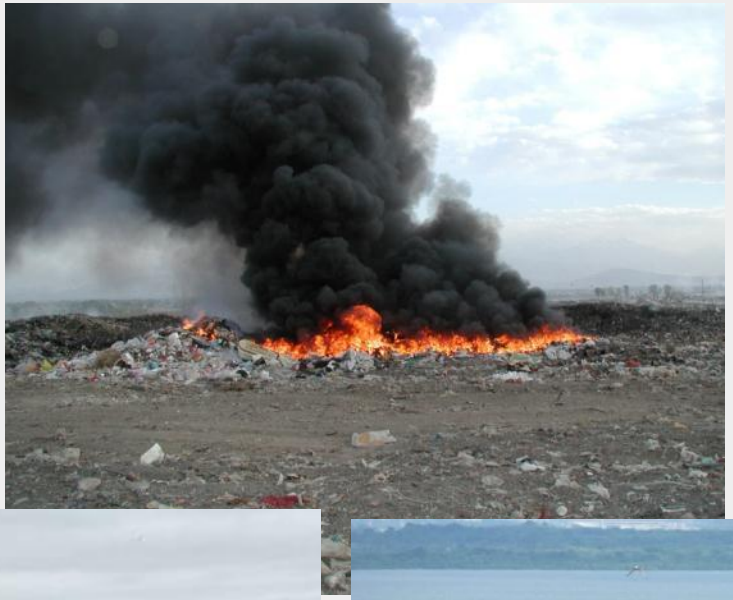
Public and private companies

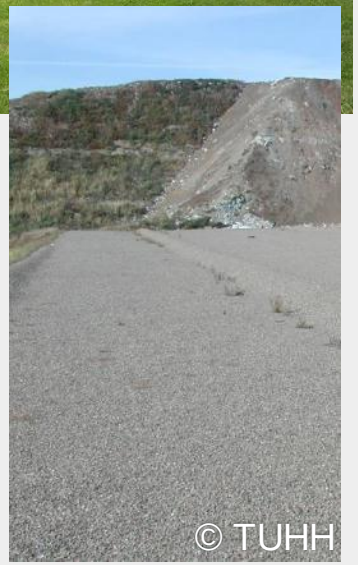
Industry

Public sector

3rd NEXUS Conference March 2024

Landfill diversity





Solid waste disposal worldwide – some facts

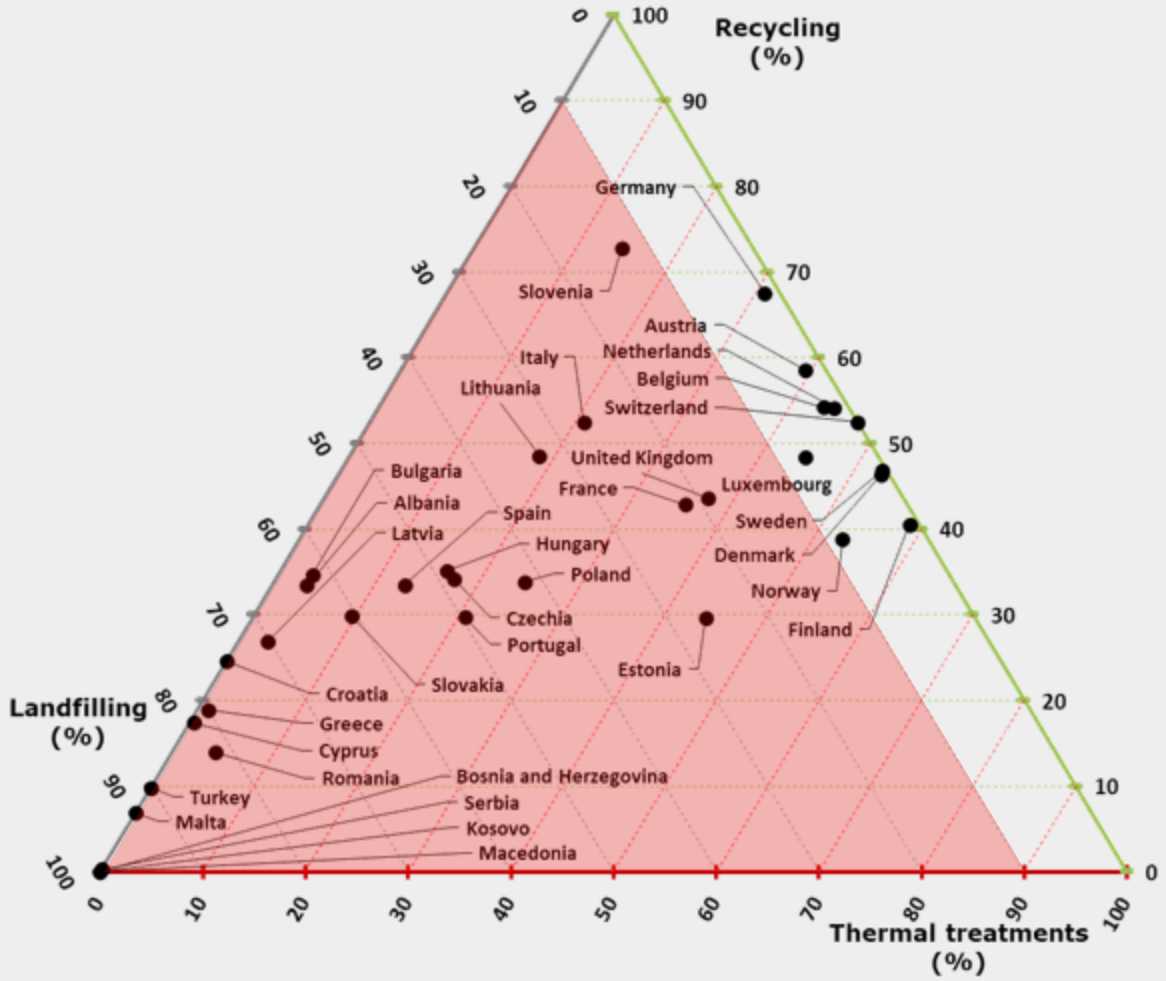
- More than **75%** of all wastes generated world wide end up at solid waste disposal sites (SWDS)[1]
- SWDS are the third largest producer of anthropogenic greenhouse gases (approx. 68 million tons methane per year)
- Polluted leachate contributes towards soil, surface water and ground water contamination

Important EU regulations (CE package)

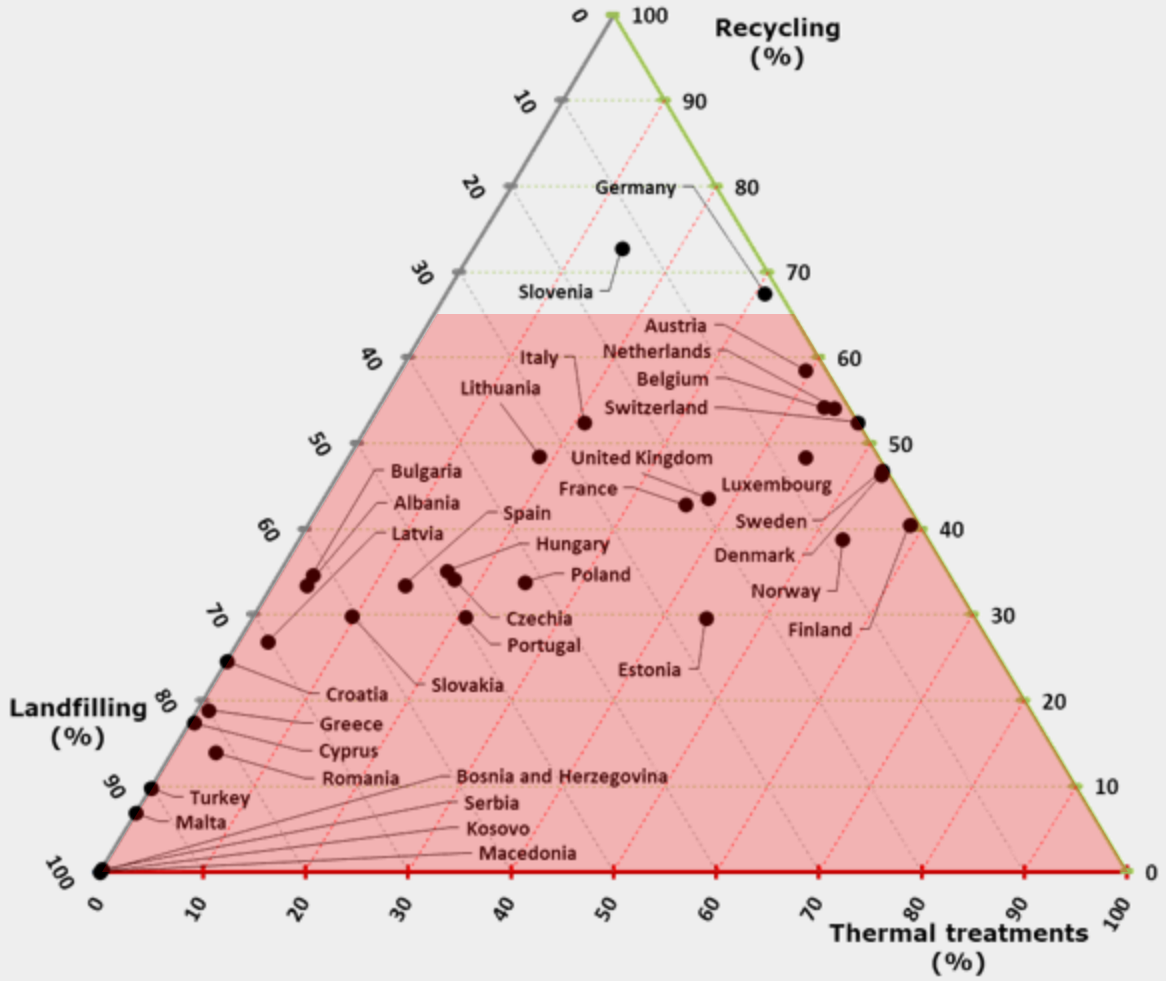
Key elements (beside others):

- A common EU target for recycling **65% of municipal waste by 2030**;
- A common EU target for recycling **75% of packaging waste by 2030**;
- A binding **landfill target** to reduce landfill to maximum of **10%** of municipal waste by **2030**.

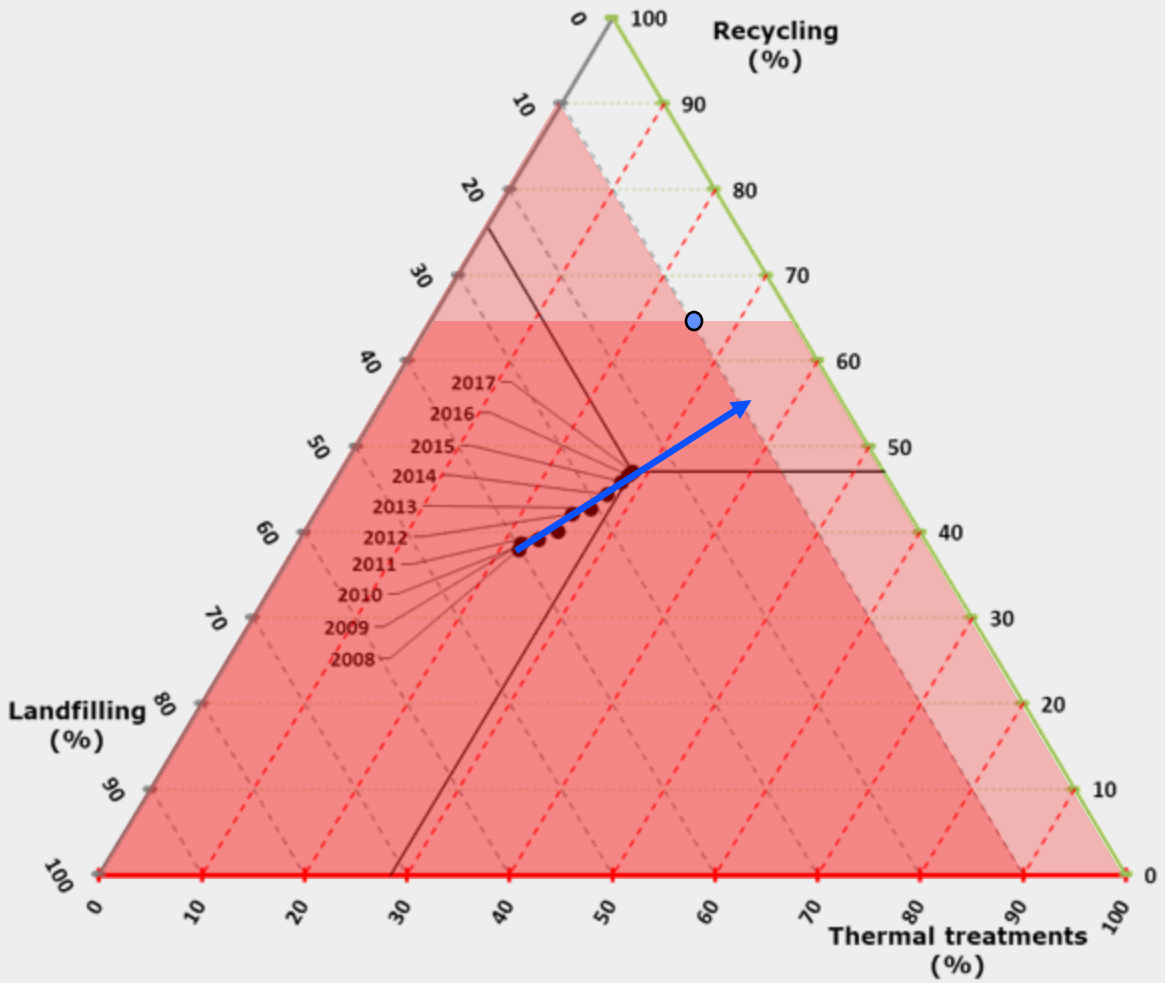
EU target for landfilling: 10%



EU target for recycling: 65%



EU: Landfilling/Incineration/Recycling (2017)



Situation:

- Recycling: 47%
- Landfilling: 24%
- Therm. Treatm.: 28%

Tendency (2008-2017):

- Recycling: +9%
- Landfilling: -16%
- Therm. Treatm.: +7%

Landfill concepts

Bioreactor LF

Operation Phase

Low gas production

Post operation phase

In situ Aeration
(+ Water Addition?)

MBT

Incineration

MBT landfills

Bottom ash landfills

Surface capping
passive Aerobisation

Aftercare Phase

Sustainable Landfill

Landfilling of RDF ashes and bottom ash

- Ashes need a 3 month curing phase before landfilling;
- In the initial phase hydrogen may be produced and high temperatures may occur;
- Leachate treatment in most cases necessary

Landfilling of MBT material

- Reduction in landfill volume;
- Improvement of landfill operation by reducing dust emissions, paper flow and odour emission;
- Significant reduction in deposit formation (clogging) in the leachate collection system;
- Minor settlings (favourable for the early installation of the final surface cover).

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Question:

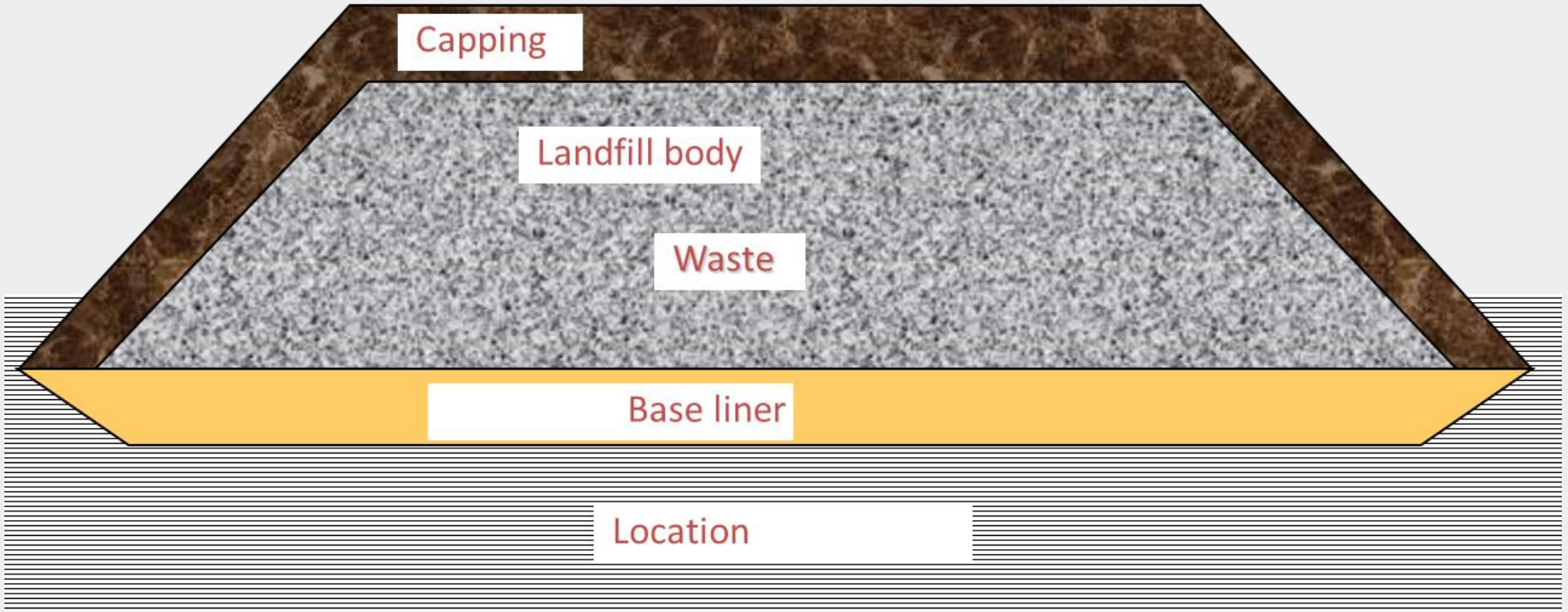
What about the great number of already existing old MSW landfills?

The bad old times…

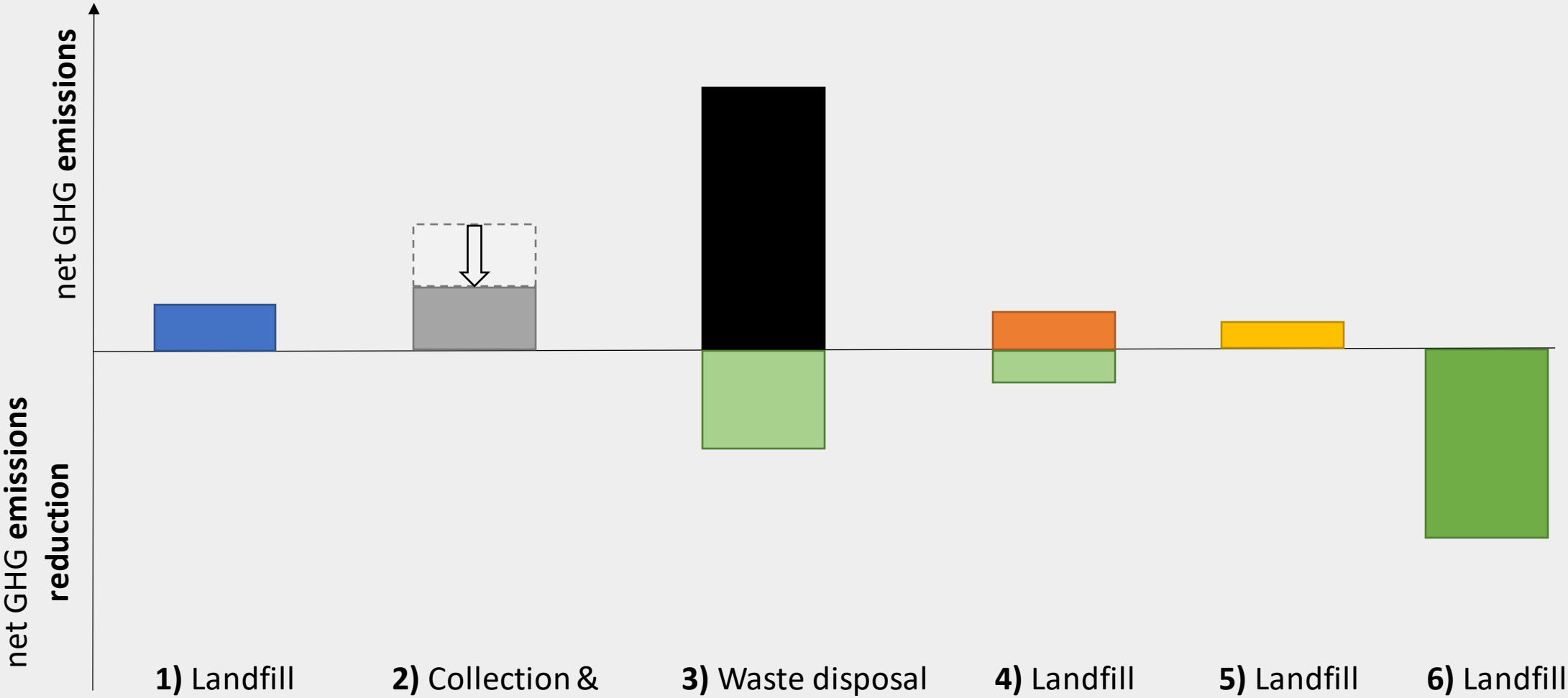
MSW disposal in the 1970ies

Landfilling practice in Germany (1970ies)

1970ies & 1980ies: Multi Barrier Concept - the solution?



Landfill gas management



Collection and delivery of waste

- **Separation at source and reduction of indirect GHG emissions (transport)**
  - **Application of e-trucks and H_2-powered trucks for waste collection**
  - **Waste transport by railway rather than on roads**

E-Truck for waste collection

Fuel-cell Truck

Railway waste transport

Waste disposal phase – LFG control

Installation of **horizontal gas drainages** during waste disposal or after completion

Collection

Disposal

Upgrading to natural gas quality → enhanced efficiency

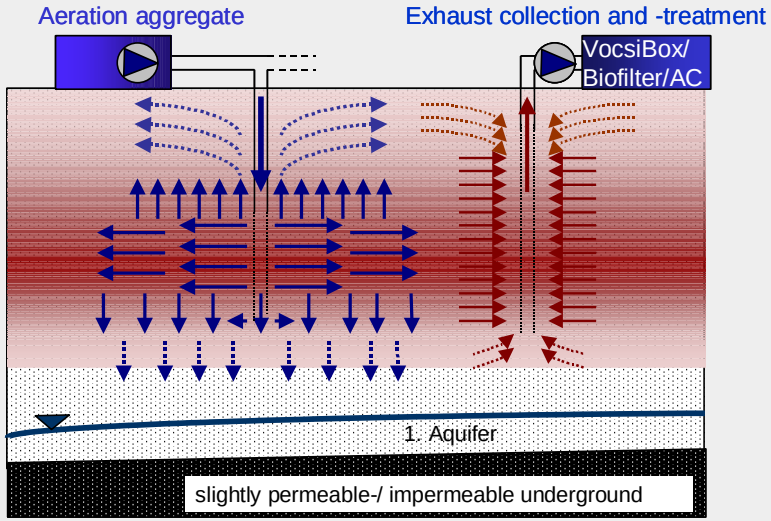
Utilization

Landfill aftercare

Aeration

Aeration + Water Infiltration

Water **Infiltration**



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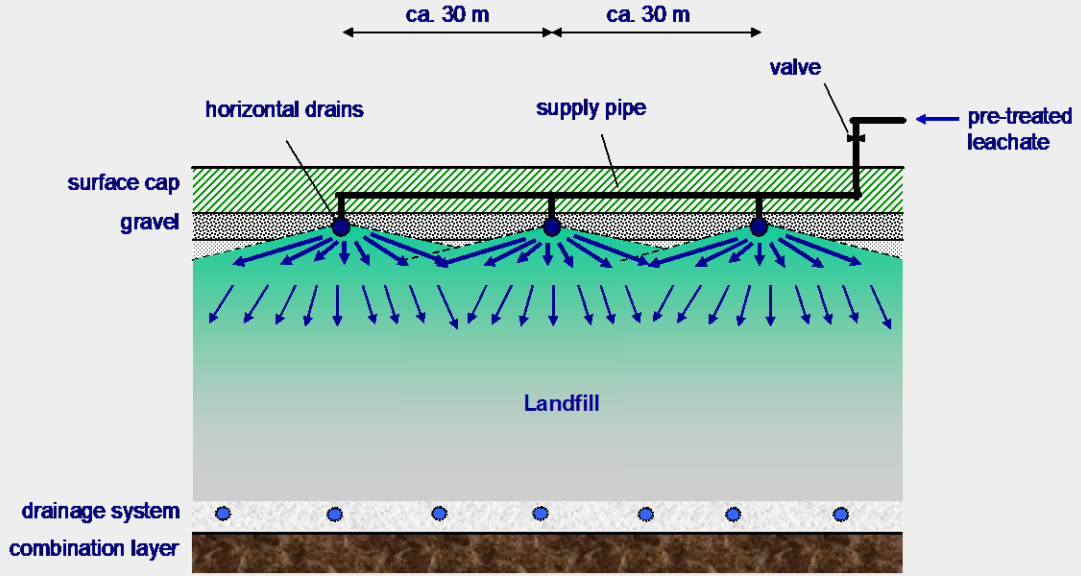

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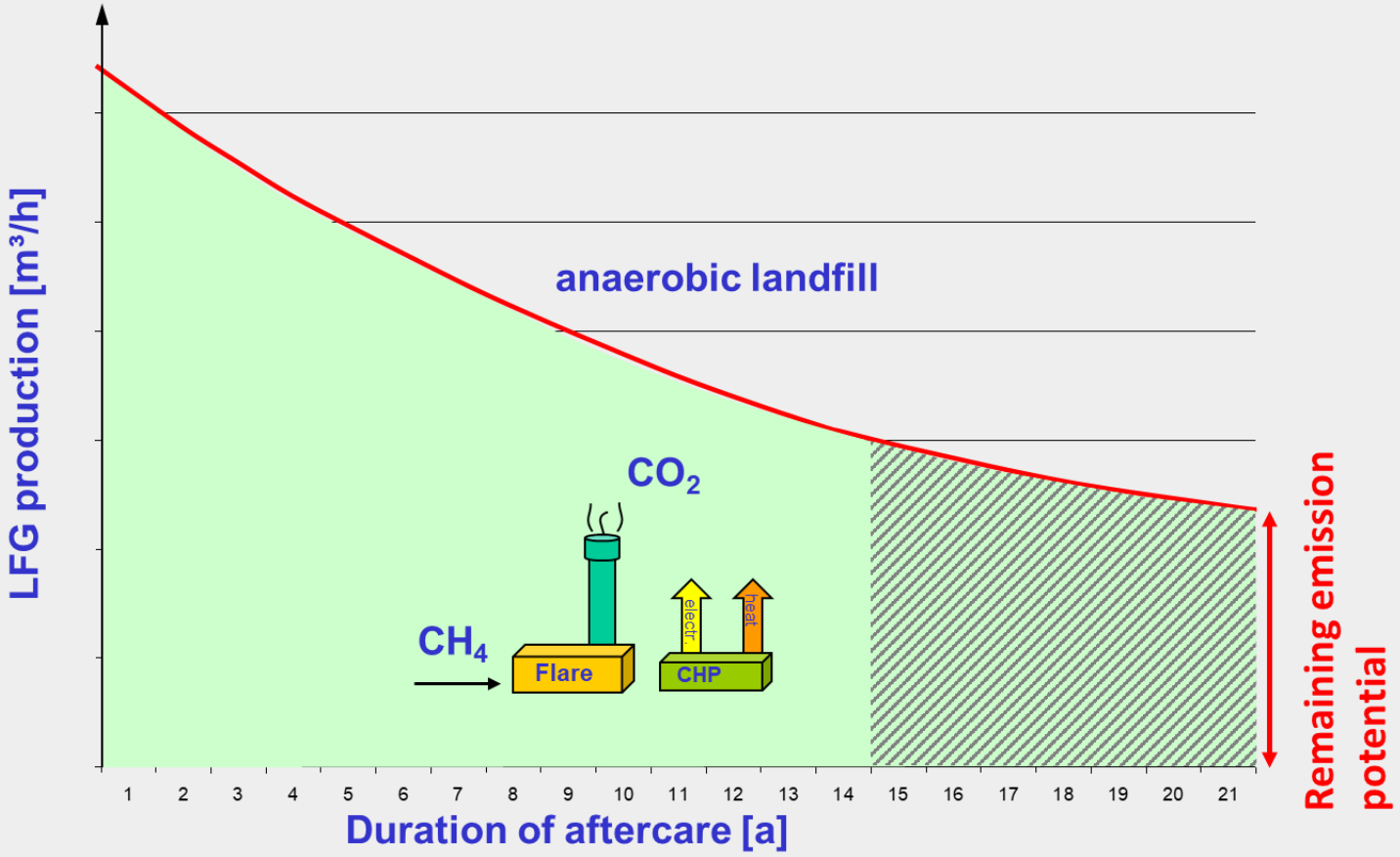
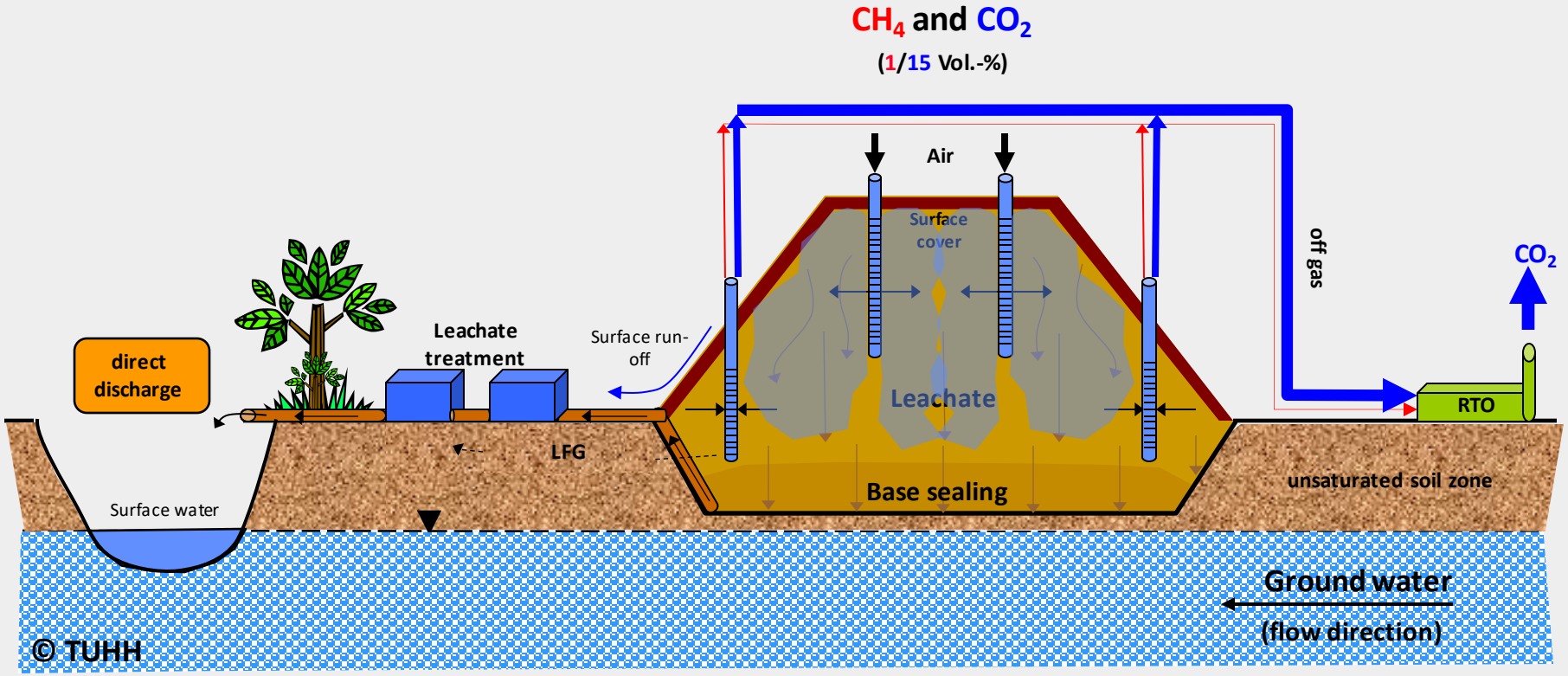
Landfill aeration – Why?



Fast and controlled reduction of the residual emission potential.

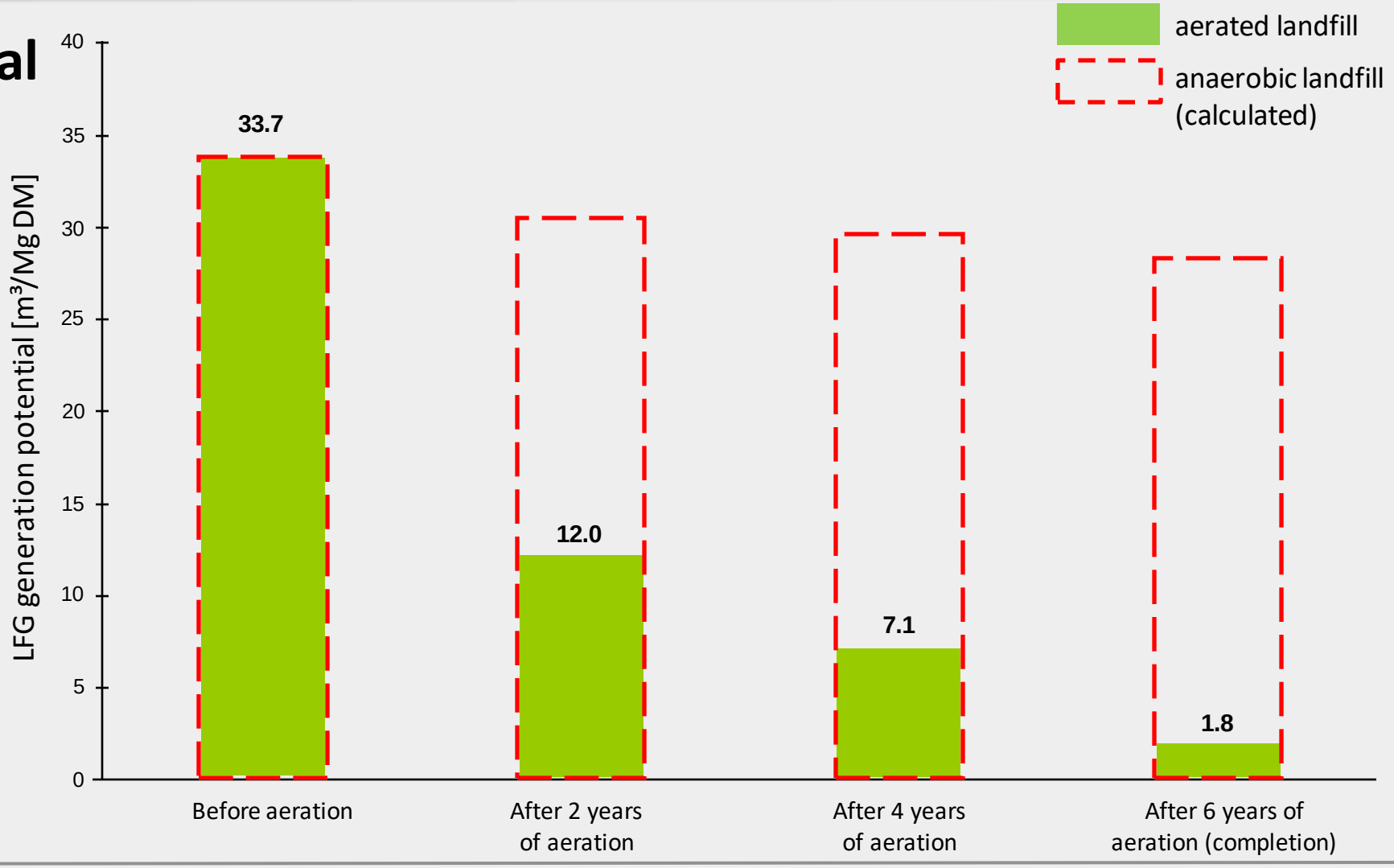
Landfill aeration – How?



Landfill aeration – Examples

Landfill aeration – Results

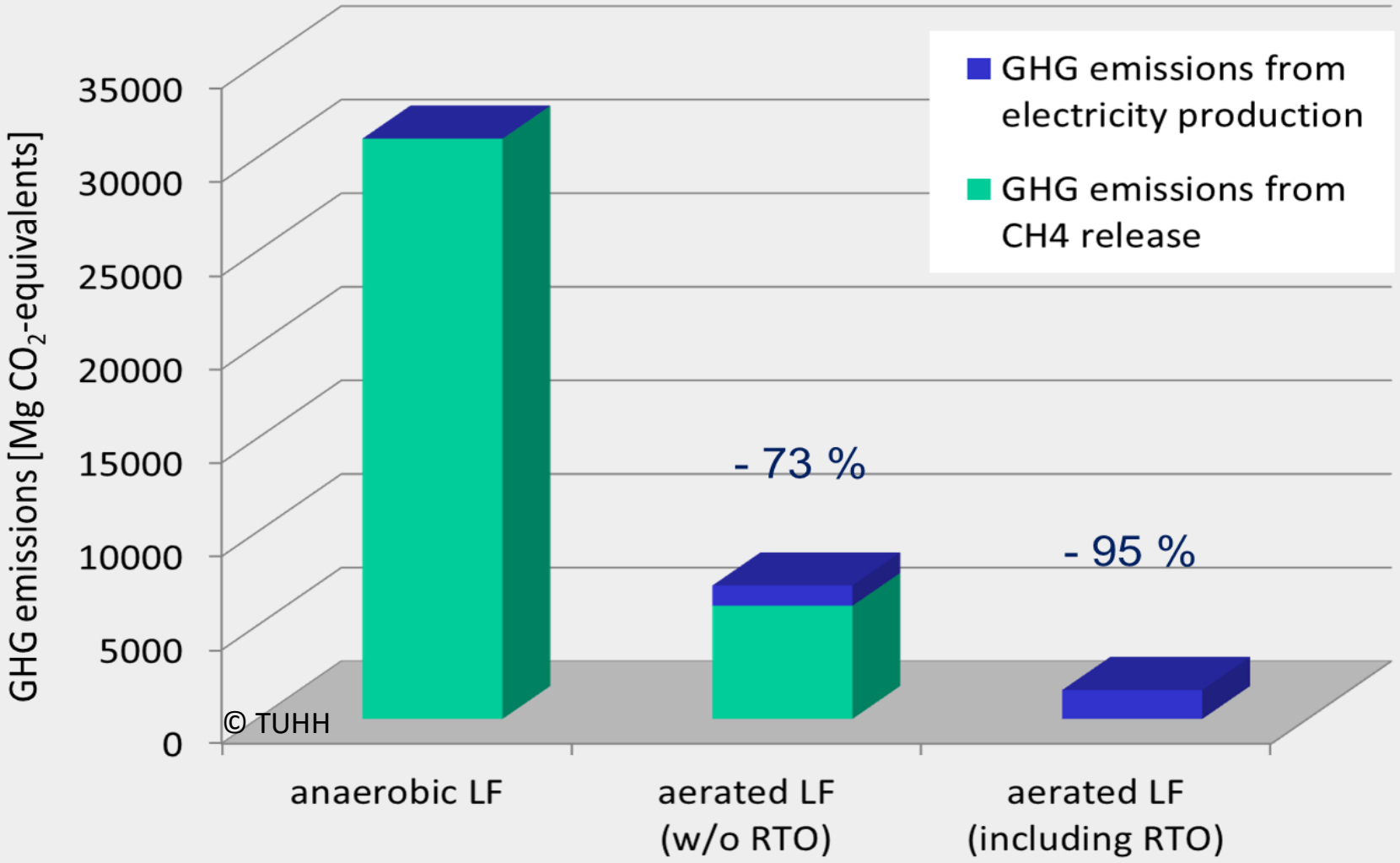
LFG potential



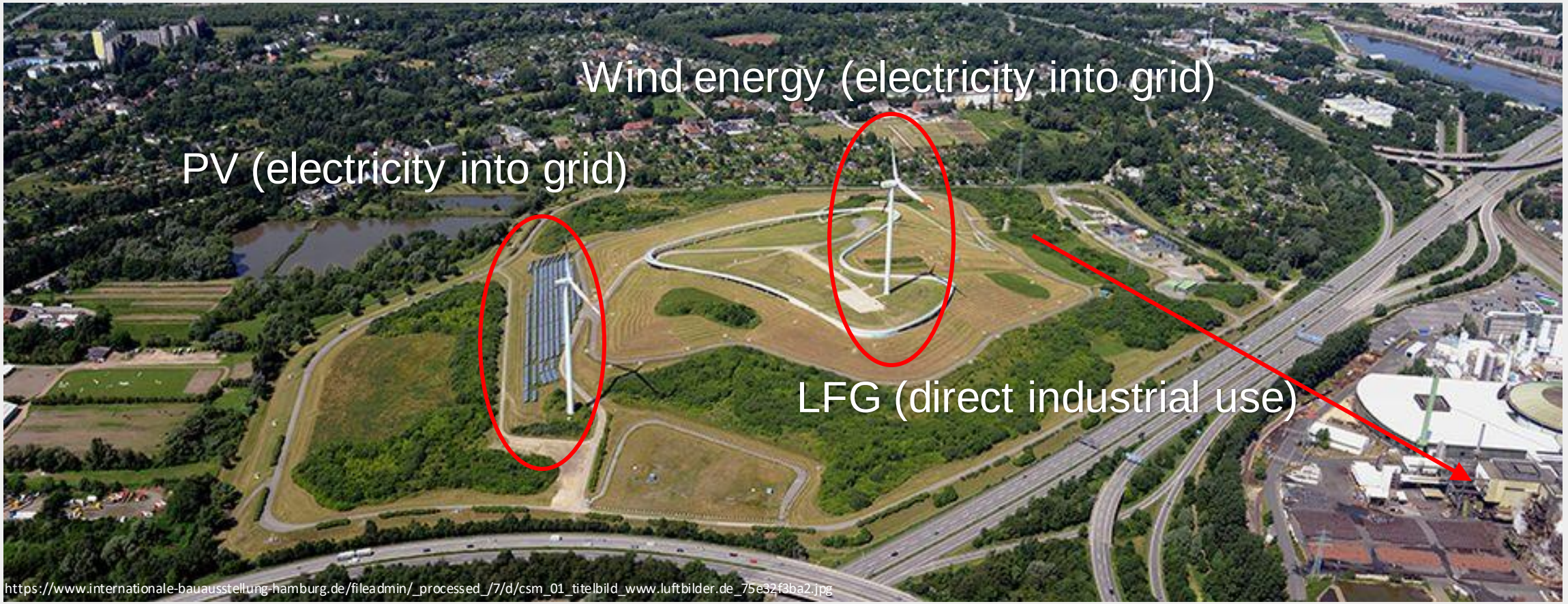
Data: Kuhstedt landfill (M. Ritzkowski)

Landfill aeration – Results

Reduction in GHG emissions



Landfill after-use



Landfill after-use – recreation and information

https://www.regionale2010.de/fileadmin/_processed_/9/7/csm_Projekt43-70_Metabolon-Luftbild_Metabolon_hil_32_3f1e59f06f.jpg

https://www.vrs-ausflugsziele.de/sites/default/files/styles/gallery_350x260/public/2016-06/Luftbild_Metabolon_hil_223_thumb_0.jpg?itok=OX84qL84

Summary

- **Long lasting biodegradation processes** in MSW landfills are causing long term emissions;
- Emission control by means of **artificial barriers** is feasible, but would demand **infinite maintenance**;
- Nowadays, MSW is **pre-treated** before landfilling (MBT, Incineration);
- Existing landfills might be **in-situ stabilized** to achieve a sustainable state in reasonable time frames;
- Bio-stabilization is a pre-requisite for a **high-quality after-use**;
- **Climate neutral landfills** may be realized over the entire landfill lifetime.

Thank you very much for your attention!

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