Earth Engineering Center
CITY COLLEGE of NEW YORK

GLOBAL WtERT COUNCIL

EARTH ENGINEERING CENTER
COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

SUSTAINABLE WASTE MANAGEMENT: PUSHING THE FOREFRONT OF INNOVATION



WtERT Biannual Conference 2024

October 2-4, 2024

The City College of New York

Earth Engineering Center
CITY COLLEGE of NEW YORK

GLOBAL WtERT COUNCIL

EARTH ENGINEERING CENTER
COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK

SUSTAINABLE WASTE MANAGEMENT: PUSHING THE FOREFRONT OF INNOVATION

WtERT Biannual Conference 2024

Synergies for the climate by Combining Anaerobic Digestion Plants with Waste-to-Energy

Dipl.-Ing. (TU) Werner P. Bauer
WtERT Germany



Earth Engineering Center
CITY COLLEGE of NEW YORK

GLOBAL WtERT COUNCIL

EARTH ENGINEERING CENTER
COLUMBIA UNIVERSITY
IN THE CITY OF NEW YORK

WtERT Biannual Conference 2024

Synergies for the climate by Combining Anaerobic Digestion Plants with Waste-to-Energy



Agenda:

1 Science

2 Implementation of Scientific Findings

3 Dissemination Knowledge



Material Recycling or Energy Recovery?

In this discussion, protagonists of material recycling and waste incineration are usually irreconcilably opposed.







Anaerobic Digestion Plants with Waste-to-Energy

… and in 2010 we asked for a research work to check whether it is possible to combine both?





© WtERT Germany GmbH, 2024

Anaerobic Digestion Plants with Waste-to-Energy

2 Implementation of Scientific Findings

An approach for reducing greenhouse gas emissions from bio-waste treatment facilities is the integration of these plants into the infrastructure and operation of existing municipal solid waste incineration plants (MSWIP).

The evaluation of this concept was carried out by the consortium of the consulting engineers ia GmbH, Munich and Qonversion, Bamberg (Prof. Quicker and colleagues), commissioned by the Association of the Bavarian waste incineration plants ATAB.

The project was funded by the Bavarian Ministry for Environment.

Focus of the study was the minimization of the climate unfriendly greenhouse gas emissions methane and nitrous oxide from anaerobic digestion (AD) plants for bio-waste. Other synergy effects arising by the joint usage of infrastructure and manpower in the WSWI and AD plant were also investigated.

© WtERT Germany GmbH, 2024

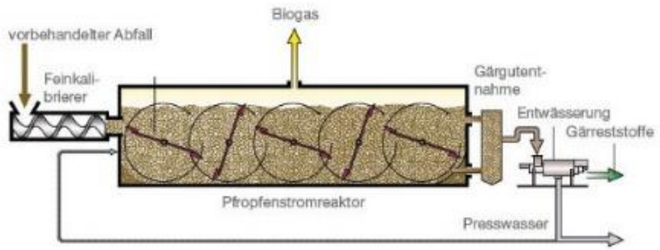
Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

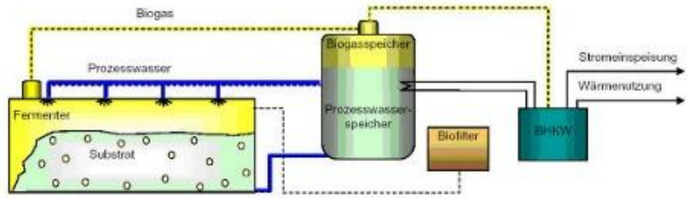
The ecological and economical effects of the integrated concept were studied exemplarily for three waste incineration sites with different capacities, each in connection with a digestion technology, specific for the different local conditions..

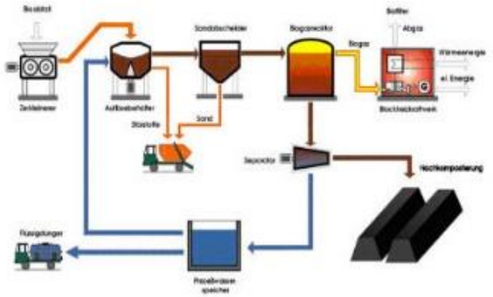












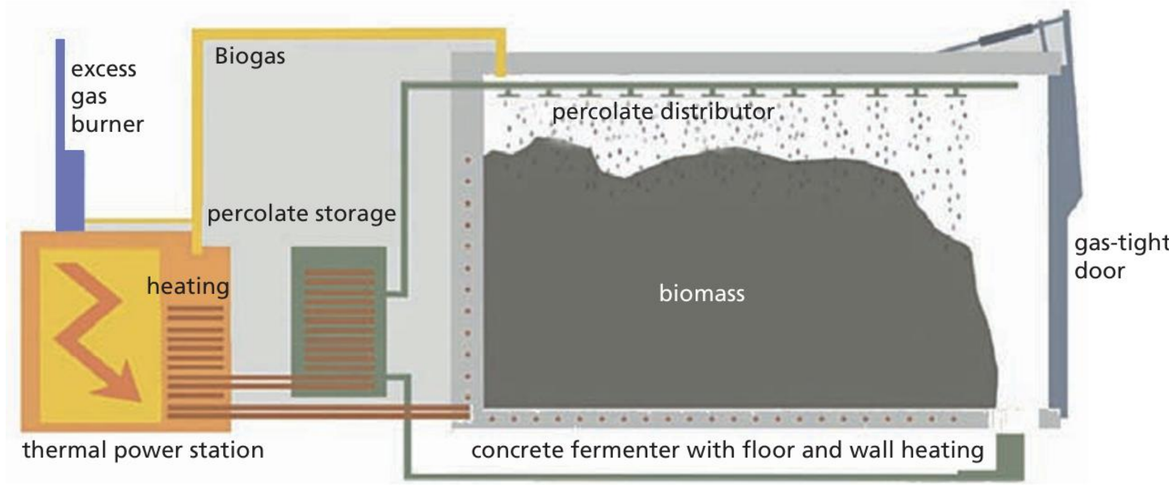
© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites



On the basis of the insight gained and in consideration of the basic framework of the individual waste-to-energy power stations recorded by questionnaires, the choice of the optimal fermentation technology for each respective waste incineration plant participating in the pilot project was made. With regard to optimizing the eco-efficiency by using existing buildings, the following combinations were chosen for the study:

- GfA Geiselbullach: discontinuous dry fermentation
- ZAS Burgkirchen: wet fermentation
- AVA Augsburg: continuous dry fermentation



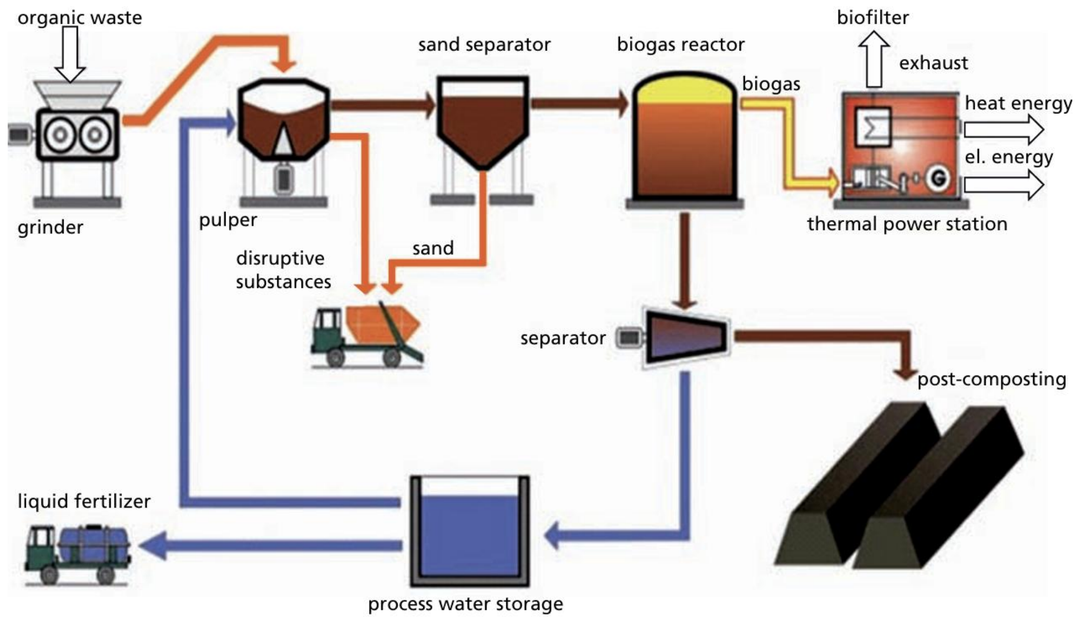
© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

On the basis of the insight gained and in consideration of the basic framework of the individual waste-to-energy power stations recorded by questionnaires, the choice of the optimal fermentation technology for each respective waste incineration plant participating in the pilot project was made. With regard to optimizing the eco-efficiency by using existing buildings, the following combinations were chosen for the study:

- GfA Geiselbullach: discontinuous dry fermentation
- ZAS Burgkirchen: wet fermentation
- AVA Augsburg: continuous dry fermentation





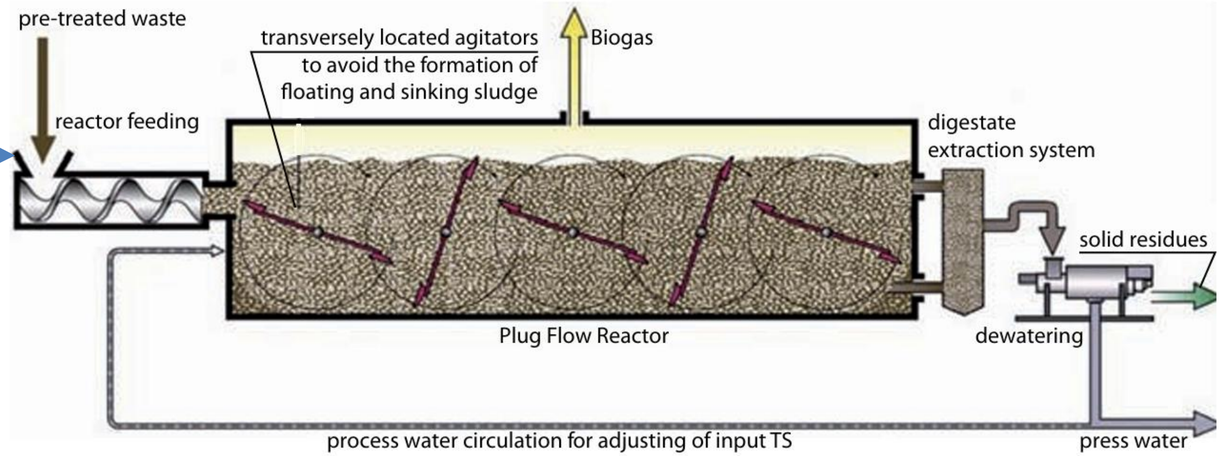
© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

On the basis of the insight gained and in consideration of the basic framework of the individual waste-to-energy power stations recorded by questionnaires, the choice of the optimal fermentation technology for each respective waste incineration plant participating in the pilot project was made. With regard to optimizing the eco-efficiency by using existing buildings, the following combinations were chosen for the study:

- GfA Geiselbullach: discontinuous dry fermentation
- ZAS Burgkirchen: wet fermentation
- AVA Augsburg: continuous dry fermentation





© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

Table 1: Short Overview Waste-to-Energy and Power Station

	unit	GfA Geiselbullach	ZAS Burgkirchen	AVA Augsburg
Waste input	Mg/a	100,745	228,000	~ 200,000
Number of furnace lines		2 (+1)	2	3
Energy output to third parties				
• Electricity	MWh/a	48,143	75,000	78,085
• Heat	MWh/a	13,511	–	38,008
• Process steam	MWh/a	–	73,000	–
Type of flue gas cleaning (FGC)		Dry FGC with bicarbonate and fibrous filter, SCR with natural gas furnaces	Electrostatic filter, three-stage scrubber, SCR with steam heating, fibrous filter with active coke	Electrostatic filter, two-stage scrubber, SCR with steam heating, fibrous filter with active carbon
Liquid which can be used additionally in the waste-to-energy power station	m³/a	~4,500	~15,000	7,000 – 15,000

Table 2: Overview of the essential parameters of the chosen fermentation technologies

Site	unit	Geiselbullach	Burgkirchen	Augsburg
Chosen procedure		Closed dry fermentation	One-stage wet fermentation	Dry fermentation plug-flow process
Organic waste flowrate	Mg/a	15,000	25,000	45,000
Space available on plant grounds		yes	yes	yes
Fluid fermentation residue/Surplus water from BGA	m³/a	800	9,500	13,800
Solid fermentation residue from BGA	Mg/a	12,300	10,300	18,300
Producible volume of (raw) biogas	m^3_N/a	1,337,000	2,550,000	4,208,000
Biogas utilisation		CHP, longdistance heating	Treatment for feed into natural gas grid	CHP, longdistance heating

For details see on the WtERT Decision Support System (DSS):

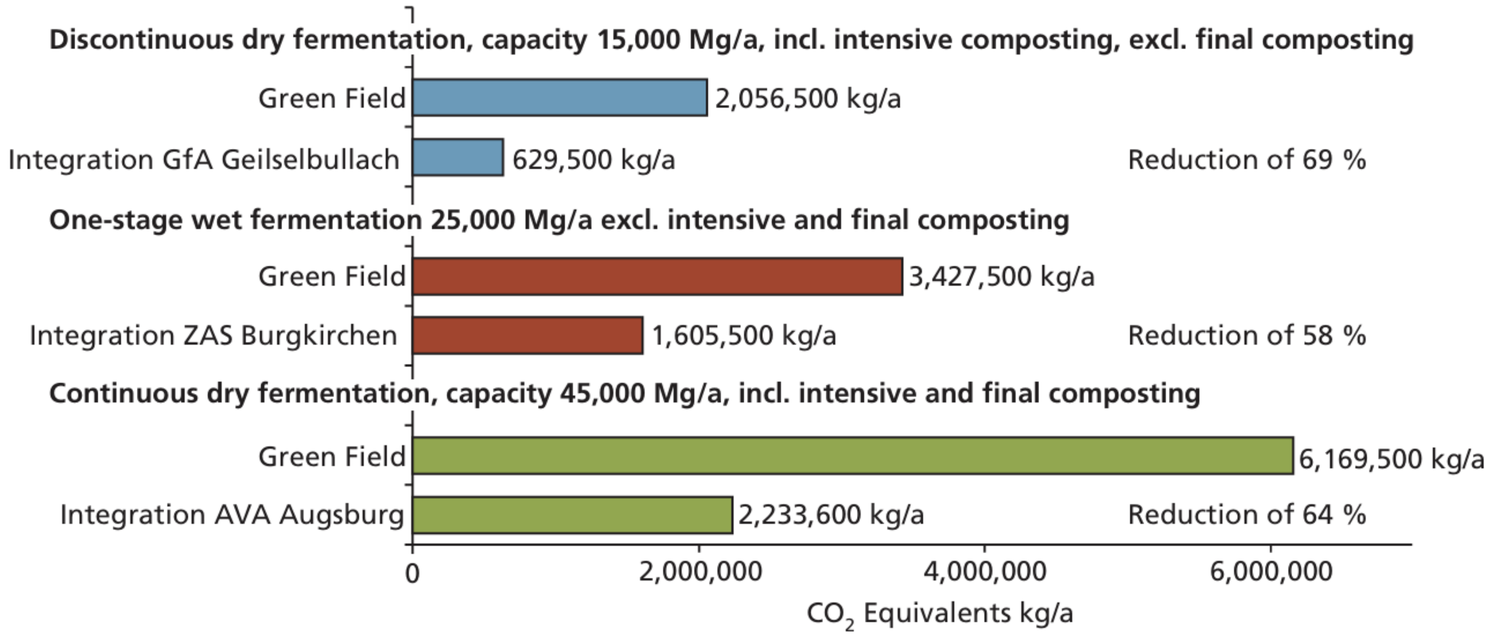
https://www.wtert.net/paper/4049/The-Waste-to-Energy-Power-Station-The-Perfect-Location-to-Build-a-Fermentation-Plant.html

© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

The study clearly demonstrates that the integrated concept has a significant higher ecological efficiency:

- Treatment costs cof AD plants an be reduced by 25 % in average.
- Greenhouse gas emissions from AD plants can be reduced between 53 % and 69 %,
- For all three examples could be proven that the integrated operation of an anaerobic digestion plant for bio-waste on the site of a municipal solid waste incinerator has advantages compared with a green field plant for anaerobic digestion.



© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

The study clearly demonstrates that …

- The realization of such concept is advised – **also for reasons of public acceptance**

Over and above the savings and low emissions, there are no new affected persons.

As far as official approvals are concerned, the waste-to-energy power stations are higher ranking.

In every examined case in this study, the fermentation can be setup within the boundaries of the existing plant and also partly within existing buildings.

Land does not have to be purchased, nor new access routes mapped out and pushed through.

The construction of a fermentation plant for organic waste at the location of an incineration plant can also positively affect the acceptance of the existing plant, as the attempted polarization between incineration and recycling will be dissolved.

In this sense, the fermentation plant can be an important step toward upgrading the entire location of the waste-to-energy power stations into a resource-oriented supply center with better acceptance by the general public.

© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites

3 Disseminate Knowledge



Let's go to the WtERT DSS and see what AVA Augsburg did since 2010 :

https://www.wtert.net/bestpractice/265/Material-AND-Energy-Recovery-at-its-best-the-Example-of-AVA-Augsburg-Germany.html

© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites at AVA Augsburg



Key Data of AVA
Area: 235,000 m²,
> 350,000 tons of waste /a.
Residual waste from households, commercial and hospital waste and 90,000 tons biowaste / a.
The core elements are the **WtE plant** and the **fermentation plant** for organic.
AVA takes over the tasks: treatment of hospital waste, slag processing, mobile heat transport, power generation through PV and much more..

© WtERT Germany GmbH, 2024

Synergistic Effects by Thermal and Biological Waste Treatment Facilities at Integrated Sites at AVA Augsburg

The local proximity to the WtE plant and the technical interaction of individual process steps generate ideal synergies. For example, waste water as well as sorted out impurities (e.g. plastic foils) can be fed directly to the WtE plant for incineration.

Exhaust air streams from the area of the presses, the settling and storage basins, as well as the intensive rotting, can be fed to the WtE plant where they can be co-incinerated. As these are loaded with ammonia and contain traces of methane, this significantly reduces greenhouse gases and potential odors after the biofilter. The existing biofilter is thus relieved.

In return, the biowaste fermentation plant can be supplied with electricity and, if necessary, with heat (to heat the fermenters) by the waste-to-energy plant. In this way, the **biogas produced can be completely converted into biomethane and used as a complementary and storable form of energy to PV and wind power**.

Best Practice



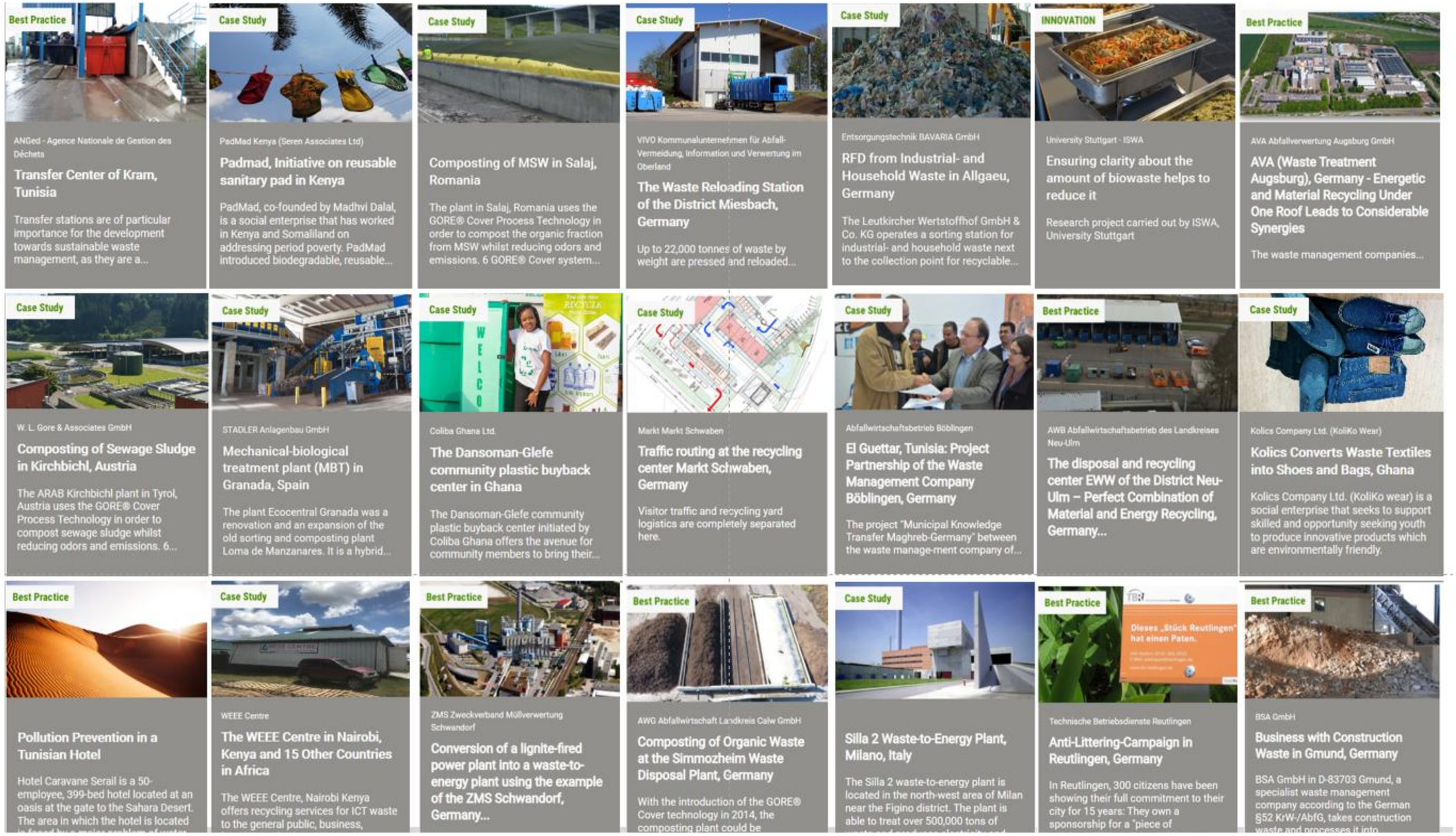
AVA Abfallverwertung Augsburg GmbH

Material AND Energy Recovery at it's best, the Example of AVA Augsburg, Germany

The waste management companies of the city of Augsburg, the district of Augsburg and the district of...

© WtERT Germany GmbH, 2024

WtERT aims to merge the essence of SWM with Case Studies



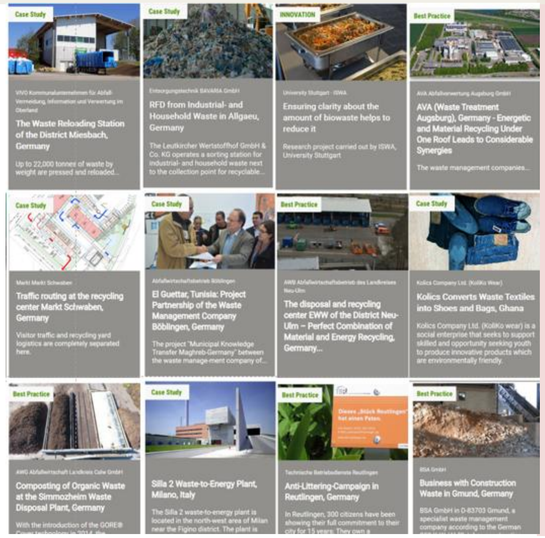
© WtERT Germany GmbH, 2024

Recommendations from Experts and Best Practises to Material Recovery

Recommendations from Experts and Best Practises to Energetic Recovery

Recommendations Reduce and ReUse

Access to proved Knowledge



Knowledge how to design Taxes and Laws

Knowledge about Landfill Gas flushing

© WtERT Germany GmbH, 2024

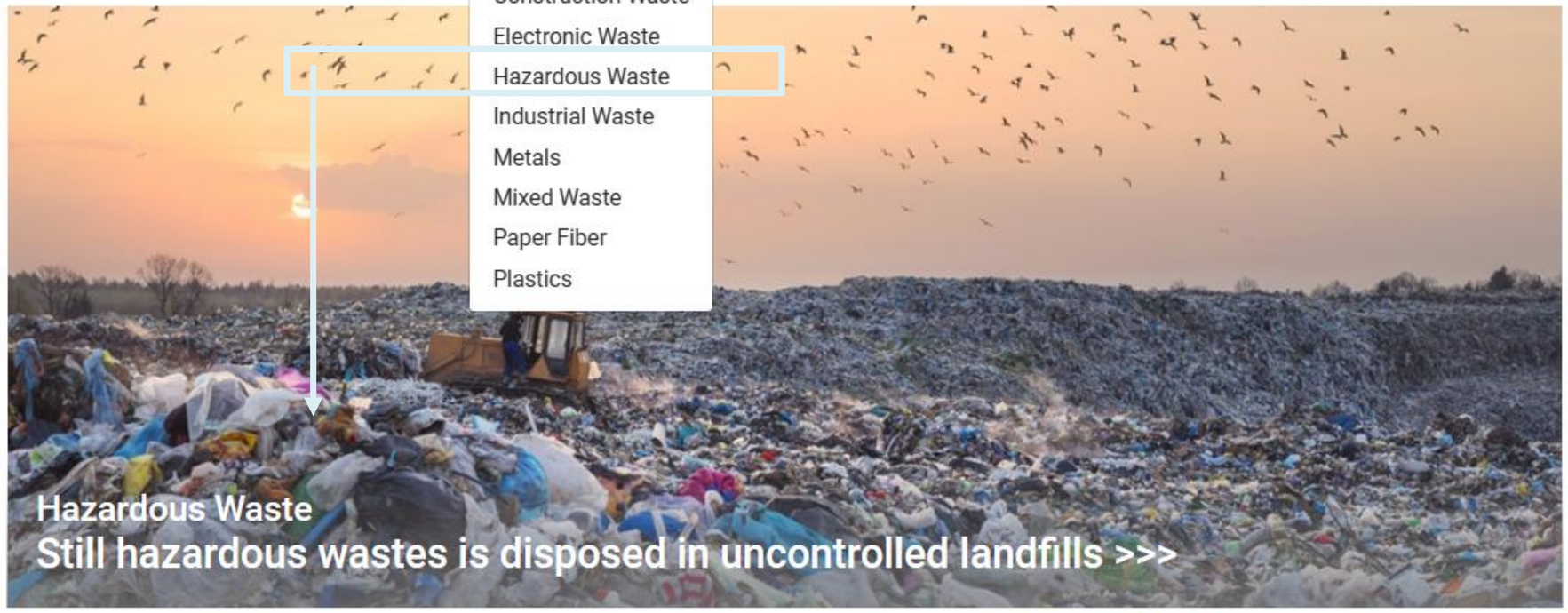
www.wtert.net

WtERT Support for Decisions — Material AND Energy Recovery

COUNTRIES | Materials | Technologies | Strategies | Network | News & Events | Log-in

Search

- Biomass
- Construction Waste
- Electronic Waste
- Hazardous Waste
- Industrial Waste
- Metals
- Mixed Waste
- Paper Fiber
- Plastics





Prof. Dr.-Ing. Gerhard Rettenberger
Ingenieurgruppe RUK GmbH



IAEA

IAEA Mission Says Belgium Committed to the Safe Management of Radioactive Waste and Spent Fuel, Encourages Further Development of National...



Dutch Waste Management Association

Dutch waste associations NVRD and DWMA want government support to combat laughing gas canisters

'The safety of workers is compromised, the damage to plant...



WhiteLabel-TandemProjects e.U.

Pre-Treating of non-hazardous Commingled Solid Waste in Mexico

Five steps to produce reliable Alternative Fuels

Experts / Involved Parties



Prof. Hani Ahmad Abu Qdais
Jordan University of Science and Technology (JUST)

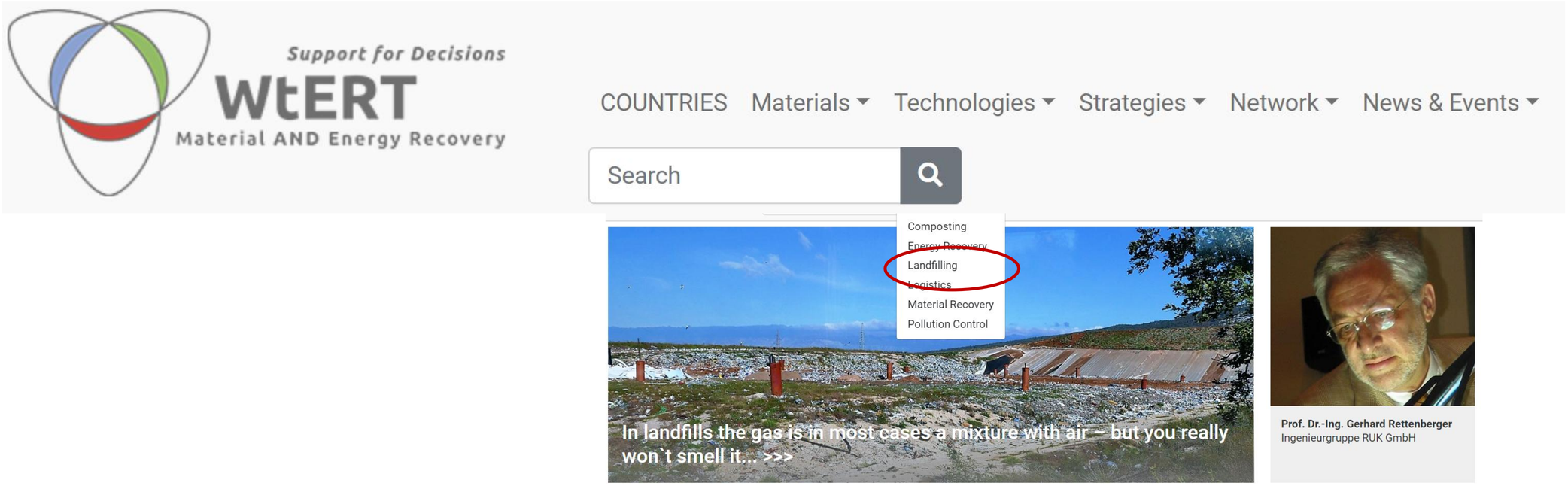


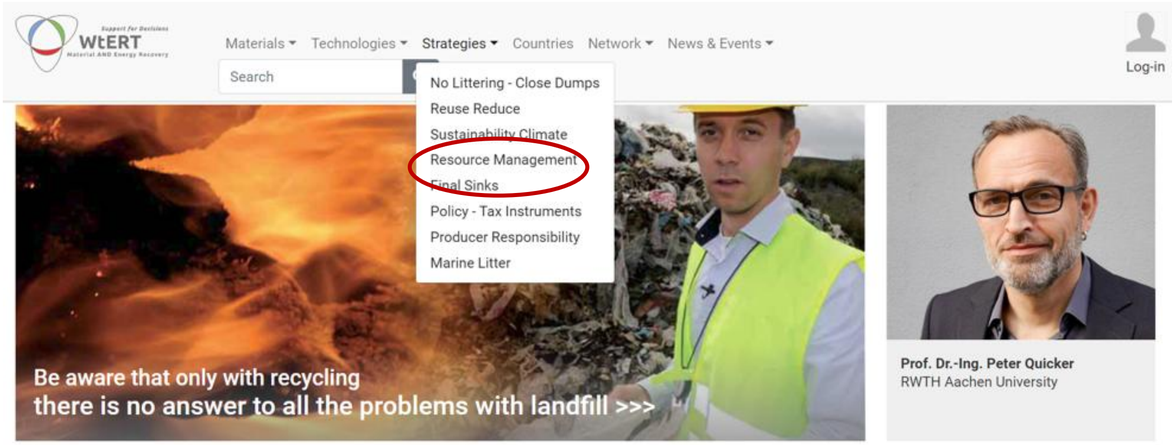
Robert Meisner
Zweckverband Müllverwertungsanlage Ingolstadt

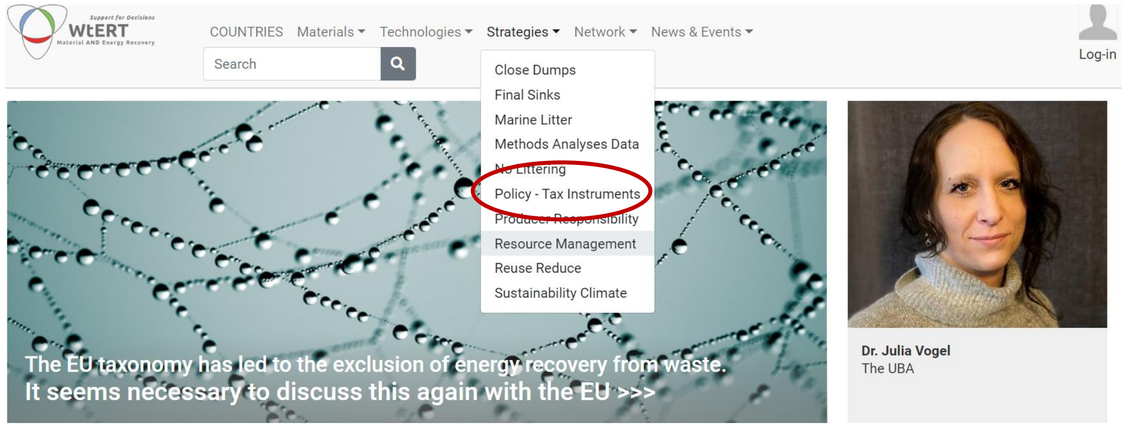


Professor, D.Sc.(Tech.) Mika Horttanainen
Lappeenranta-Lahti University of Technology - LUT University

WtERT aims to merge the essence of SWM with Recommendations







© WtERT Germany GmbH, 2024



WtERT pools Knowledge about Sustainable Waste Management



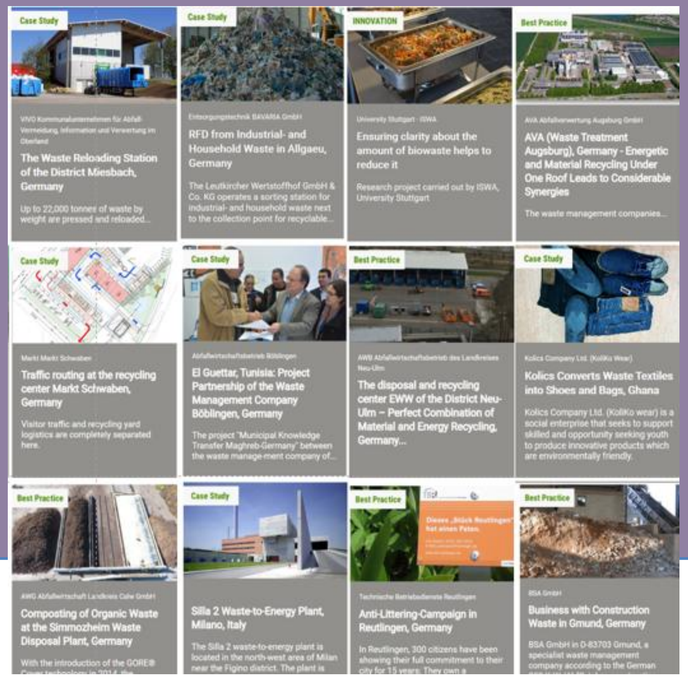
Werner Bauer

Vice President Global WtERT Council

baue@wtert.net

ia 1,5 grad innovative abfallwirtschaft

Be inspired and join www.wtert.net



© WtERT Germany GmbH, 2024