

State of The Art of Anaerobic Digestion of Municipal Solid Waste in Europe

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The company

- DRANCO DRY DIGESTION TECHNOLOGY DEVELOPED IN 1983
- OWS CREATED IN 1988: MORE THAN 20 YEARS EXPERIENCE IN ANAEROBIC DIGESTION OF SOLID AND SEMISOLID ORGANICS
- SALES: ± 20 MILLION EURO
- 75 PEOPLE (OWS INC IN OHIO, USA; TWO SUBSIDIARIES IN GERMANY)



OWS REFERENCES



Brecht I & II



Hille (Pohlsche Heide)

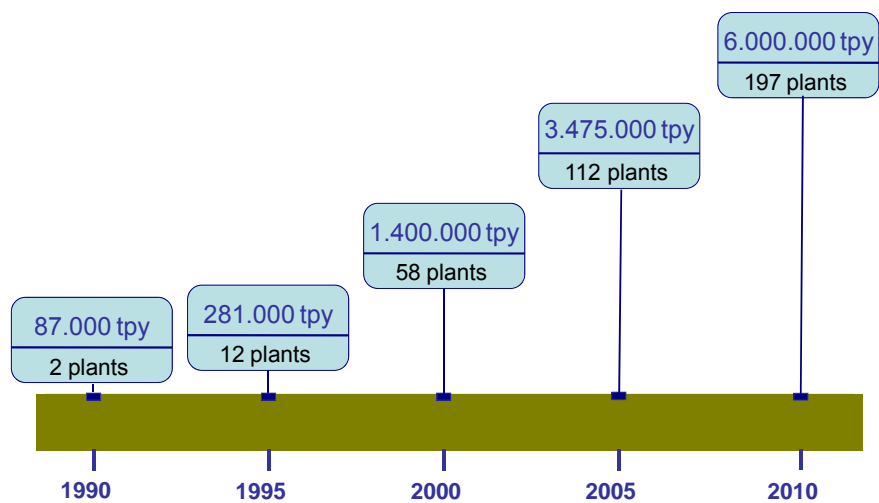
Brecht I (B)	1992	20.000 tpy	Biowaste / paper
Salzbourg (A)	1993	20.000 tpy	Biowaste
Bassum (D)	1997	105.000 tpy	Residual waste
Aarberg (CH)	1998	11.000 tpy	Biowaste
Kaiserslautern (D)	1999	25.000 tpy	Residual waste
Villeneuve (CH)	1999	10.000 tpy	Biowaste
Brecht II (B)	2000	50.000 tpy	Biowaste / paper
Rome (I)	2003	40.000 tpy	Biowaste
Leonberg (D)	2004	30.000 tpy	Biowaste
Hille (D)	2005	100.000 tpy	Residual waste + sludge
Pusan (S-K)	2005	70.000 tpy	Biowaste
Münster (D)	2005	80.000 tpy	Residual waste
Terrassa (E)	2006	25.000 tpy	Biowaste
Vitoria (E)	2007	120.000 tpy	Mixed waste
Alicante (E)	2008	180.000 tpy	Mixed waste
Hotaka (J)	2008	3.000 tpy	Biowaste
Tenneville (B)	2008	39.000 tpy	Biowaste
Kempton (D)	2008	18.000 tpy	Biowaste
Séoul (S-K)	2009	30.000 tpy	Biowaste / paper
Leszno (Pl)	2010	50.000 tpy	Mixed waste
Bourg-en-Bresse (F)	2013	90.000 tpy	Mixed waste
Hengelo (NI)	2011	50.000 tpy	Biowaste
Mirandela (P)	2011	55.000 tpy	Mixed waste
Wijster (NL)	2012	57.000 tpy	Residual waste
Chagny (FR)	2013	73.000 tpy	Residual waste
Nüstedt (D)	2006	20.000 tpy	Energy crops

**WHAT IS THE STATE-OF-THE-ART
OF ANAEROBIC DIGESTION
OF THE ORGANIC FRACTION
OF MUNICIPAL SOLID WASTE IN EUROPE
IN 2012?**

Criteria

- o > 10% biowaste & MSW (at least 3.000t)
- o Design capacity, unless specified differently
- o Biowaste: total capacity
- o MSW: capacity to digesters
- o Plants must be built, under construction or contracted

Digestion capacity development in Europe (1)

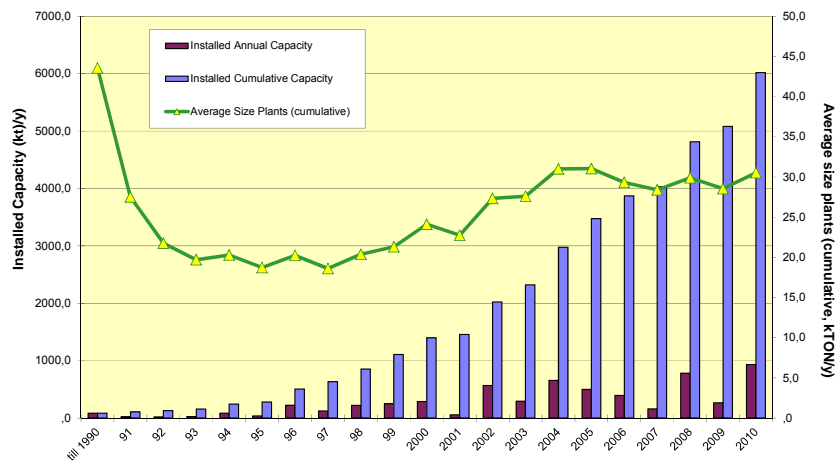


Digestion capacity development in Europe (2)

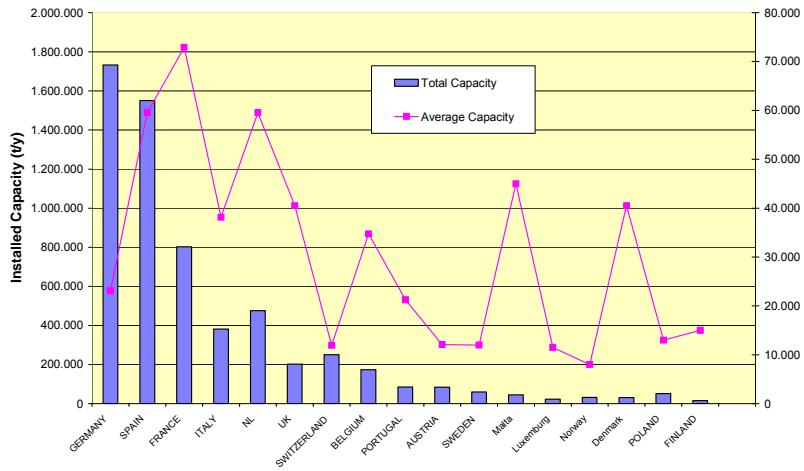
- Capacity and size increase

5 Year Development	1991-1995	1996-2000	2001-2005	2006-2010
# of plants installed	13	43	54	85
plants/y	2,6	8,6	10,8	17
capacity installed	194.000	1.117.500	2.077.950	2.479.450
capacity installed/y	38.800	223.500	415.590	495.890
average size of plant	14.923	25.988	38.481	29.170

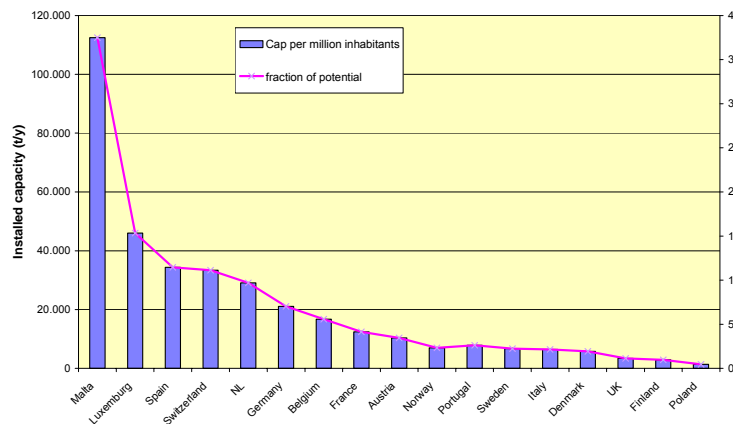
Cumulative capacity



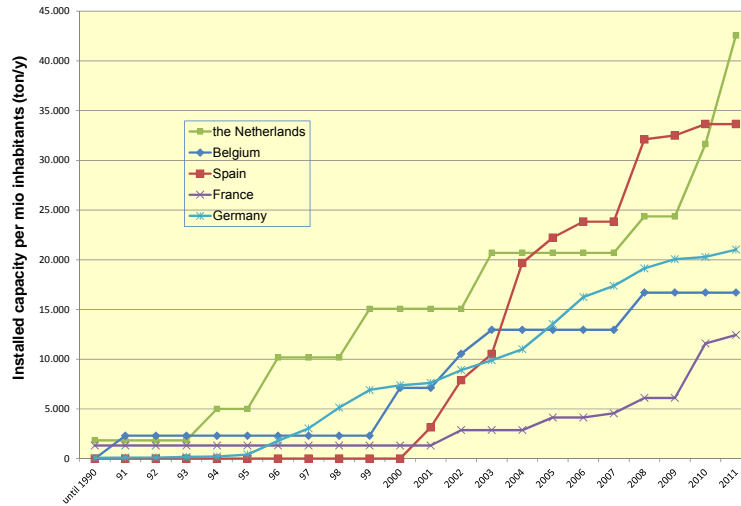
Capacity per country



Capacity per million inhabitants and percentage of potential theoretical capacity



Evolution of the installed capacity



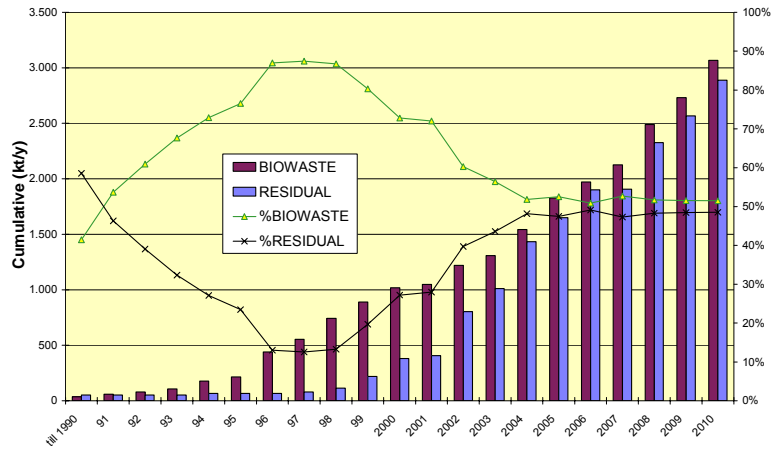
OWSI
Organic Waste Systems

Analysis of installed capacity

- mesophilic (35-40°C) vs. thermophilic (50-55°C)
- dry (> 15% ds) vs. wet (< 15% ds)
- two phase (acidification & methanisation) vs. single phase (combined)
- codigestion (solid waste + other substrates) vs. single feedstock digestion (only waste)
- mixed or residual waste (no separate collection) vs. biowaste (separate collection of organics)

OWSI
Organic Waste Systems

Biowaste versus residual waste



OWS
Organic Waste Systems

Biowaste versus residual waste

5 Year Development	1991-1995	1996-2000	2001-2005	2006-2010
Biowaste installed/ 5 year	179.000	803.000	808.250	1.240.450
Residual installed/ 5 year	15.000	314.500	1.269.700	1.239.000
%biowaste	92%	72%	39%	50%
%residual	8%	28%	61%	50%

OWS
Organic Waste Systems

DRIVING FORCES BEHIND THE GROWTH OF ANAEROBIC DIGESTION OF ORGANIC WASTE

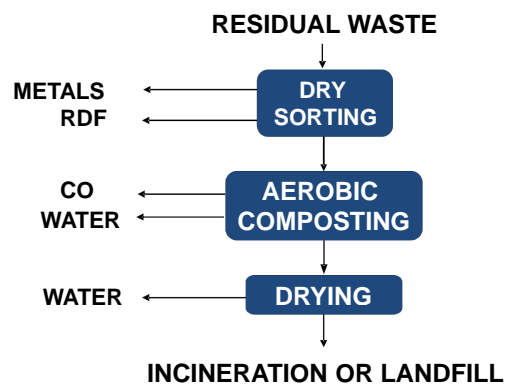
Driving forces for AD in Europe

- Introduction of biowaste collection (EU Landfill regulation)
- Incentives for production of renewable energy
- Sustainable plants 'win' more municipal waste procurements
- Upgrading and extension of older biowaste plants
- Advantages of AD
 - Economically very attractive
 - No excess wastewater for dry systems: *partial stream digestion*
 - More waste can be treated on the same surface area
 - Reduction of odors
 - Hygienization: important for food waste
 - High flexibility

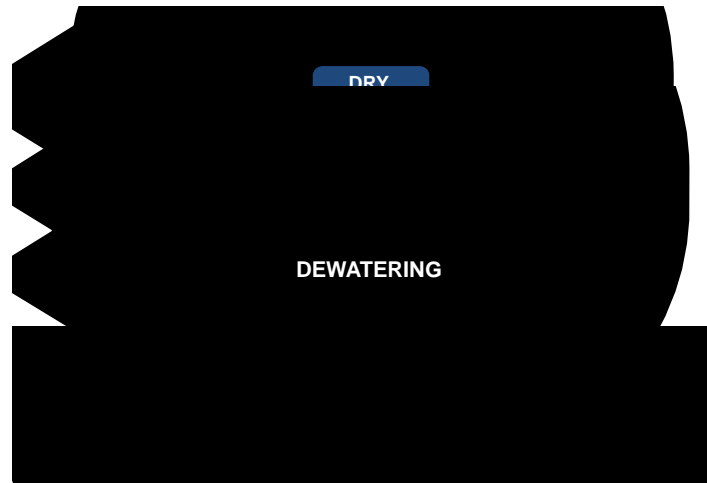
Partial stream digestion (I)

- Only part of the organics is digested (up to 70%)
- Other 30% or more of organic fraction is bypassed and is not subjected to digestion
- Digestate is directly mixed with bypassed organic fraction **without dewatering**
- Non-digested organics provide exothermic energy and needed structure for aerobic posttreatment and drying

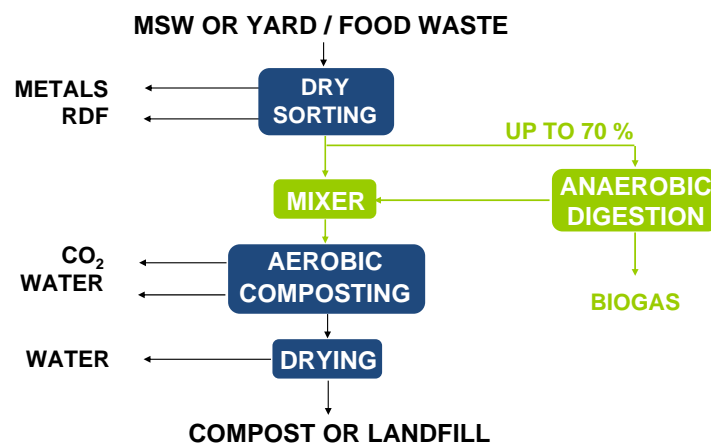
Aerobic MBT-plant



Full stream digestion



Partial stream digestion (II)



Advantages DRANCO partial stream digestion

- Production of renewable energy (~ only composting)
- > TS in digestate: ideal for mixing prior to composting
=> avoids costly dewatering step & water treatment
- Reduction of odour: amount of VOC's ↓
- Shorter composting time for digested waste
 - ⇒ Additional capacity becomes available
 - ⇒ Increased capacity on the same site
- Ecological benefits of the compost are similar
- Economically very interesting

Disadvantages DRANCO partial stream digestion

- Less energy recovery (↔ full stream digestion)
- Longer aerobic treatment required (↔ full stream digestion)

STATE-OF-THE-ART EXAMPLES

State-of-the-art example

- Partial stream digestion: Tenneville (BE)



State-of-the-art example

- Partial stream digestion: Tenneville (BE)




Organic Waste Systems

Biowaste treatment plant Tenneville (BE)

- Capacity = 37.700 tpa biowaste & green waste + 1.300 tpy liquid organic waste
- Digester volume = 3.150m³
- Start-up: 2009
- Energy production
 - 9.750.000 kWh electricity per year
 - 10.000.000 kWh heat per year
- Digestate mixed with (bypassed) fresh yard waste before aerobic composting


Organic Waste Systems

State-of-the-art example

- Partial stream digestion: Twence (NL)




Organic Waste Systems

State-of-the-art example

- Partial stream digestion: Twence (NL)




Organic Waste Systems

Biowaste treatment plant Twence (NL)

- Capacity = 50.000 tpa
 - 40.000t biowaste
 - 5.000t overdue products
 - 5.000t liquid products
- Digestate is mixed with fraction 60-160mm
- No dewatering
- Gas engines: 2 x 1,2MW
- Heat of engines for industrial purposes >5km
- Start-up: 2011

Biowaste treatment plant Twence (NL)

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State-of-the-art example

- MBT Plant Hille (DE)




Organic Waste Systems

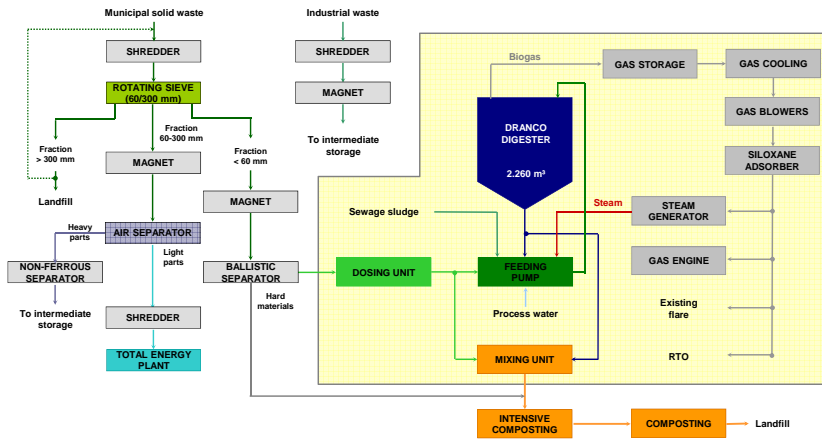
MBT Plant Hille (DE)

- Capacity = 100.000 tpa
 - 40.000t residual waste
 - 40.000t bulky waste
 - 20.000t dewatered sludge

=> 38.000t to AD
- Digestate is mixed with hard particles <60mm
- No dewatering
- Start-up: 2005


Organic Waste Systems

MBT Plant Hille



SORDISEP

SORTing - DIgestion - SEPARation

Integration of AD into MBT-plants



Separation opportunity

- Organics have been removed to a large extent: no sticky odorous components
- Wet separation of digested residue is possible using intensive washing/screening techniques
- Production of high quality compost without source separate collection

Potential for recycling & landfill diversion

	AEROBIC	PARTIAL STREAM DIGESTION	FULL STREAM ANAEROBIC	ANAEROBIC (WITH MAX. RECYCLING)
RECYCLING				
- METALS	6%	6%	6%	6%
- SAND	-	-	0-6%	8%
- BIOGAS	-	5 – 10%	15%	15%
- FIBERS	-	-	-	12%
	6%	11 – 16%	21-27%	41%
LANDFILL DIVERSION				
- RECYCLING	6%	11 – 16%	21-27%	41%
- LOSS OF WATER	35%	35%	35%	35%
- LOSS OF MASS	6%	3%	1%	-
	47%	49 – 54%	57-63%	76%

- BIOGAS = RECYCLING
- RDF OR MIXED WASTE COMPOST = DISPOSAL

Conclusions

- Strong growth:
2 (1990) < 58 (2000) < 197 (2010)
- > 6.000.000t installed in 2010 = about 5% OFMSW in Europe
- ± 20% of biological treatment capacity for organics derived from household waste

Conclusions

- Factors hampering growth:
 - Investment and operating cost
 - Politic situation / decisions (lack of)
 - Negative references

Conclusions

- Factors stimulating growth:
 - Revamping existing biowaste composting plants
 - Extending treatment capacity of existing biowaste composting plants => *partial stream digestion*
 - Treatment of food waste, agro-industrial organic residues, harvest residues, is strongly on the rise

**AD OF SOLID WASTE ORGANICS
IS HERE TO STAY**

THANK YOU !!!



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