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Separate collection, composting, anaerobic digestion, MBT

Drivers in environmental policy and trends for biological treatment

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Contextual remarks: More than just waste management

- Biodegradables represent the vast majority of MSW arisings
- Proper management often linked by strategies to reduced impacts of disposal
  - Landfill diversion targets (EU Landfill Directive)
- Extended benefits: soils, farmlands, the environment
  - Climate Change (UNFCCC)
  - Biodiversity, fertility, resilience, prevention of floods, erosion (EU Soil Thematic Strategy)
- Also, treatment of residuals developing (MBT)
  - Recover energy/materials (e.g. low-grade "compost" for restricted applications)
  - Improve conditions for landfilling and energy recovery

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MSW composition (EC, 2001)

	AU	BE	DK	FIN	FRA	GER	GRE	IRL	ITA	LUX	NL	POR	SPA	SWE	UK	EST
YEAR (quantities)	1998	1997	1998	1997	1998	1998	1997	1998	1998	1997	1998	1999	1997	1998	1998/ 99	1996
Total MSW (million tonnes)	4.85	4.69	2.93	2.51	44.4 (38)	49.1	3.9	2.06	26.9	0.30	8.22	3.8	17.2	3.81	31.5	0.56
Total (OECD) (1997 data, or latest year)	4.1	4.85	2.95	2.1	28.8	40.0	3.9	2.03	26.6	0.19	8.72	3.8	15.3	3.2	28.0	
Kitchen and Yard Waste	**29.2**	**34.9**	**37**	**40**	**29**	**29.9**	**47**	**27**	**33.6**	**43.8**	**42.0**	**37**	**44.1**	**40**	**38.1**	**53.0**
Yard Waste		*13.4*							*5.0*							
Kitchen Waste		*21.6*							*28.5*							
Paper and card	24	18.9		36.8		16	20	32.5	22.8	19.2	34.4	26	22.2	37	26.1	8.1
Paper																
Cardboard																
Timber	1.4	1.9											1	1.3		
Textiles	2.8	2.6		0.8		2		2.1	5.1	2.3	2.0	3	4.8	1	3.3	
Nappies						2.8			2.0	4.0						
Plastics	8.2	6.8		4.5		5.4	4.5	11.4	10.3	7.9	5.8	10	10.6	7	8.3	3.0
Glass	9.4	5.1		2.3		9.2	4.5	4.8	7.2	6.7	10.0	6	6.9	2.6	8.7	7.4
Metals	7.2	3.7		3.2		3.2	4.5	2.6	3.0	2.7	2.6	2	4.1	3.5	3.4	4.3
Ferrous metals								*1.7*			*2.1*		*3.4*		*2.9*	
Non-ferrous metals								*0.9*			*0.5*		*0.7*		*0.5*	
Other	17.8	26.0		12.4	37.3	31.5	15.5	19.2	15.9	12.9	4.2	16	6.6	6.6	12.1	24.2
YEAR (Composition)		1998		Early 90s		1993	1997	1998	1998	1994	1996		1997		Early '90s	1996

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The EU approach to Landfilling:

- Dir 99/31 (Landfills) mandates *reduction of biodegradable municipal waste* to be landfilled
- Also, it mandates *pretreatment* of the waste to be landfilled

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Assessment of diversion of biodeg waste

	% in MSW	% in restwaste	% of MSW
Fines < 20 [1]	10,39	3,84	1,54
Food waste	29,65	5,73	2,29
Paper and board	23,46	33,83	13,53
Yard waste	2,48	1,11	0,44
TOTAL	63,90	43,36	17,50

[1] we assume 80% of fines is food waste

X 0.4

Source sep. = 60% → **Residual waste = 40%**

Diversion biodeg waste = 72,62%

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Drivers for composting in the EU

- Landfill Directive 99/31
- European Climate Change Programme
  - C sequestration
  - Reduced production / application of pesticides and mineral fertilisers
  - Improved water retention
  - Improved workability
- TS on Soil Protection
  - "Depletion of Organic Matter" is considered as one of the "Soil threats"
  - Regions in Italy giving subsidies to farmers to use organic fertilisers

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Revision of the WFD
An important update !!

- Nov 2008 - Revision of the WFD
- Waste hierarchy kept and made stronger
  - 5-step waste hierarchy, "Recycling" now defined separately from "Recovery", and put at a higher level
  - To be subverted only if substantial evidence of better LC performance (the "unequivocally guilty" approach)
- Recycling targets: 50% reuse and material recovery on MSW *"promoting at least sep collection of paper, plastics, glass, metals"*

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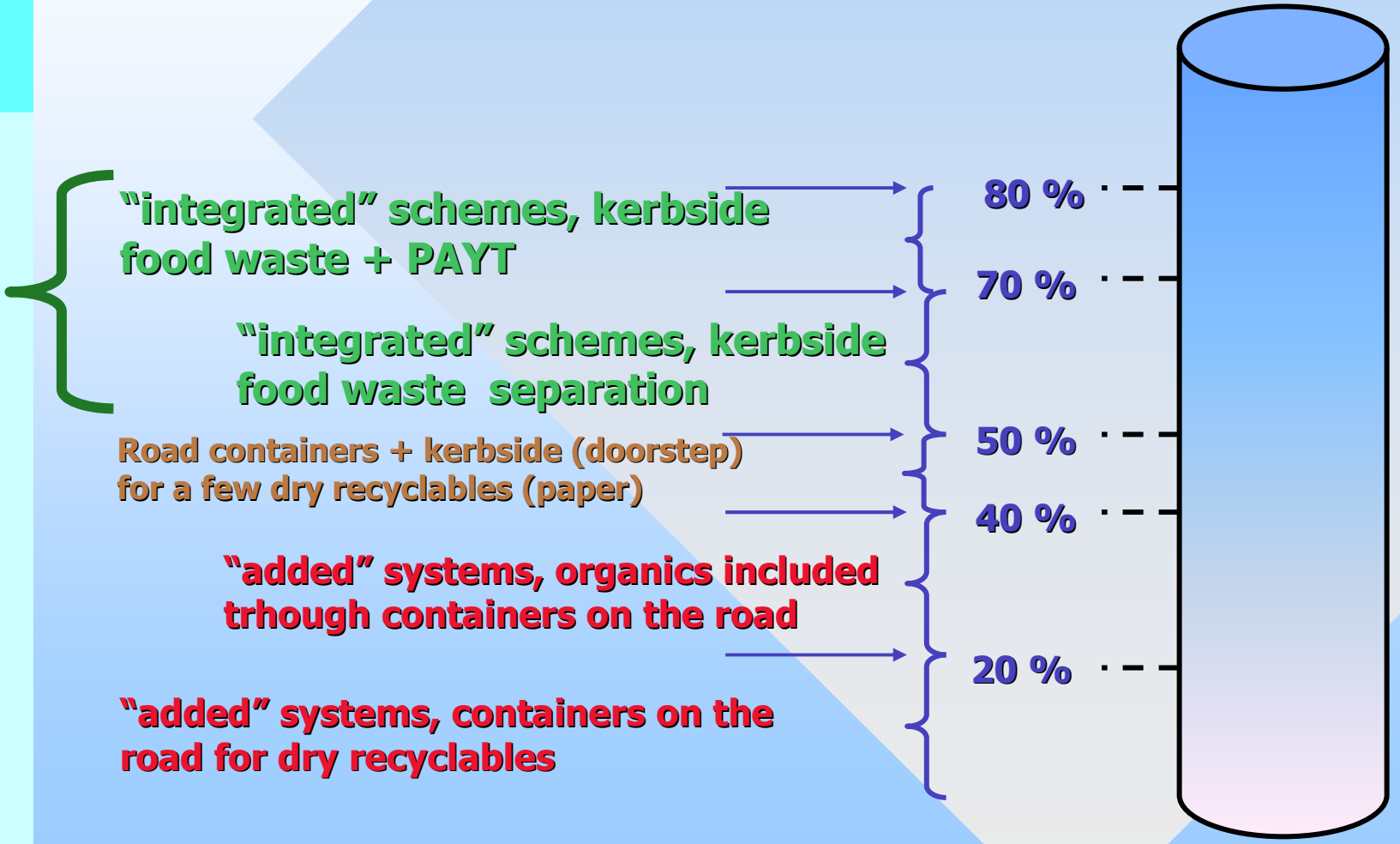
What does it take to get there ?



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Development of source separation of biowaste in the EU

- Obligations for biowaste management
  - NL: compulsory schemes for separate collection
  - AUT: obligation upon households to either take part in separate collection or to compost in the backyard
  - GER: KrW-AbfG → separate collection widely diffused
  - Catalunya (Spain): ley 6/95 → compulsory for all Municipalities with a pop. > 5000 (recently extended to cover all Municipalities)
  - SK (Act 24/04): Garden Waste to be separately colelcted by 2006; biowaste by 2010
- Targets
  - SWE: 35% composting target
  - ITA, UK: recycling targets acting as drivers

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Biowaste and climate change

- Biowaste emits CO2 – short-term (biogenic) carbon → C neutral
- THEREFORE, biowaste as "renewable replacement for fossil fuels" a popular argument (e.g. Directive 2001/77)
- Use of compost replaces fertilisers – avoidance of CO2 and other GHG's ought to be considered
- Use of compost may lock-up carbon in the soil – "sequestration" ought to be considered
- AD turns carbon into a substitute fuel (biogas: 100-150 m^3/tonne d.m.) – this replaces fossil fuels

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Total possible GHG savings from biowaste treatment

GHG saving by	kg CO_2 eq.
Anaerobic digestion with CHP option	135
C-sink in the soil by added humus	80
Peat substitution and avoided transport	200 - 300[1]
Replaced mineral fertiliser	30
Total	**400 - 500**

[1] 94 to 188 (substitution) + 120 to 180 (transport)

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GHG-balance for a modelled scenario

(100 ktpa MSW; 60% recycling, including AD + composting; 40% incineration)

	Quanti-ties	CO_2 emitted	CO_2 saved	CO_2 net
collection	100000	741		741
recycling	40000	28580	36220	-10650
biological treatment	20000	2210	7959	-5749
incineration	40000	16427	18403	-1976
total	**100000**	**47951**	**62581**	**-17640**

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What are the GHG-savings related to?

use of biogas as a fuel (diesel trucks)	2792
displacing mineral fertiliser	723
displacing organic matter: peat (1/3)	2401
displacing organic matter: straw (2/3)	400
TOTAL SAVINGS	7959

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Importance of locking-up C

545.000	Gg CO2	Source: "National Communications from Parties included in Annex 1 to the Convention: Greenhouse Gas Inventory Data from 1990 to 1998"
148.636.364	ton C	
16.000.000	hectares	Arable Land Area
3600	ton/ha	unit weight of the soil
57.600.000.000,00	ton soil	
0,258%	% of Carbon to be locked up in the soil in order to balance the overall national emissions of carbon dioxide in 1 year	

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Decline of Soil OM – the evidence

NATURE (Vol. 437) of 8 September 2005

- ***CARBON CONTENT OF SOIL in England and Wales fell steadily in the period 1978-2003, with some 13 million tonnes of carbon released from British soil each year. On average, British soils have lost 15% of their carbon.***
- ***much of the carbon may be entering the atmosphere in the form of greenhouse gases (eg CO2 and CH4), thus exacerbating global warming***
- ***losses of soil carbon in the UK, and in other temperate regions, are likely to have been offsetting absorption by terrestrial sinks***

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Emerging issues

- Importance of stability – forced aeration required to improve process management
- Odour nuisance increasingly raising concerns among hosting population
  - Need to fit facilities with odour treatment technologies, unless siting/materials are favourable
  - Odour standards are often adopted – approaches tend to be uniform throughout Europe
- *CAP.EX. and running costs are being driven up*
- *Possible exemptions need to be properly considered*

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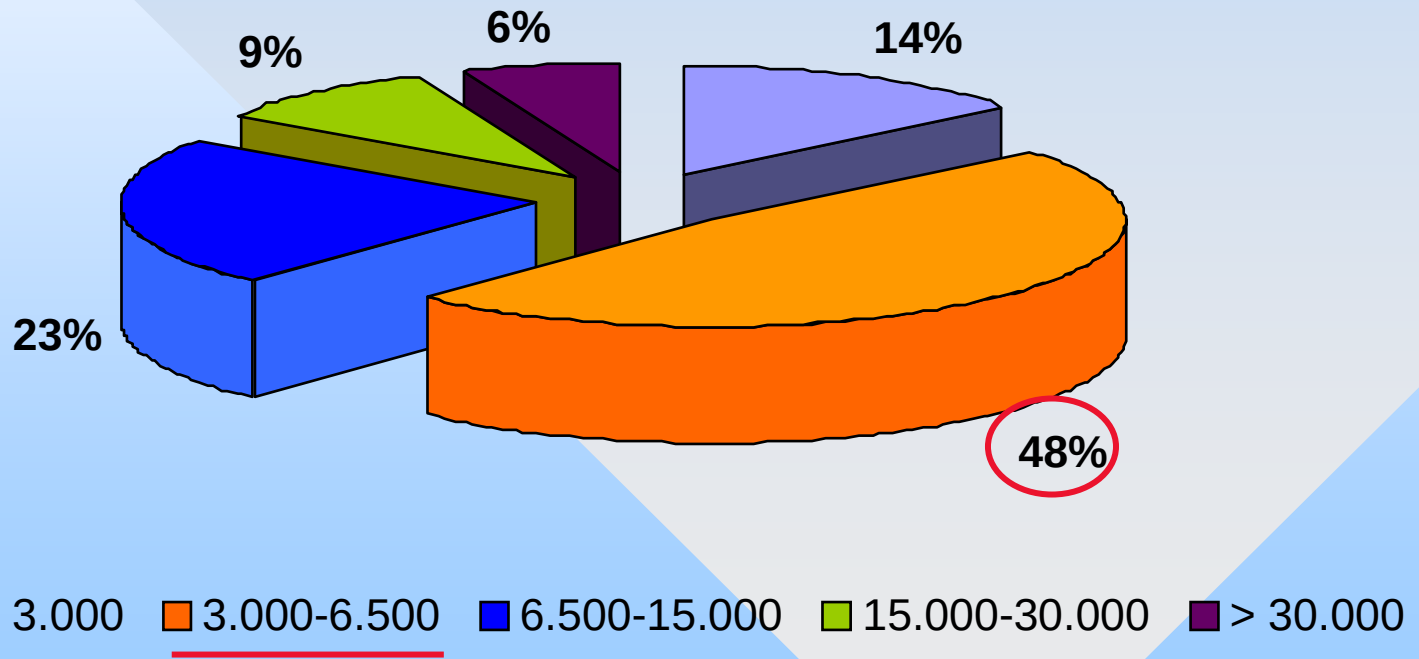
Germany

Permitted capacities



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Composting a versatile process

- Small-scale, low-tech possible
- In line with the "proximity" principle
- No common approach possible for management of disamenities
  - Widely dependant on:
  - Throughput
  - Type of materials
  - Siting
  - Type of process (eg static/dynamic)
- BATs hard to be defined !!

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Trends in process optimisation

- Increasing focus on stability
- Implications on product quality
  - Suitability for versatile applications (including peat replacement)
- Implications on odour minimisation
  - Higher stability of materials during maturation outdoor
  - Higher stability of products
- Primacy of good management of air supply
  - Needed to:
  - Supply oxygen
  - Remove heat
  - Implies good design of specific air supplies and piping
  - One key factor for proper management based on appropriate on/off times

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Anaerobic Digestion

- Turns biogenic C into a substitute fuel – wider benefits (renewable energy AND soil improvers)
- Not dependent on availability of bulking materials (e.g. metropolitan areas, lack of gardens)
- Unit investment and operational cost usually higher than composting (in spite of revenues from energy production, even if Renewable Energy is subsidised)
- Less independent from economies of scale
- Cost for the management of wastewaters – requires good integration of waste management and management of wastewater

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Mechanical-Biological Treatment

- Fast development in EU (GER, AUT, ITA, UK…)
  - Intended for treatment of residuals
  - Reduces biodegradability by 80-90% (landfilling)
  - Increases LHV of materials intended for energy recovery
- Passive aeration, low-tech on site MBT may produce prompt improvement of landfill conditions in developing countries / developing WM systems
- Integration with landfilling and energy recovery may provide for a flexibility of MSW systems
  - Decreasing amounts of residuals

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Thank you !

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