››› Role and potentials of CDM, sectoral approaches and NAMAs in solid waste management

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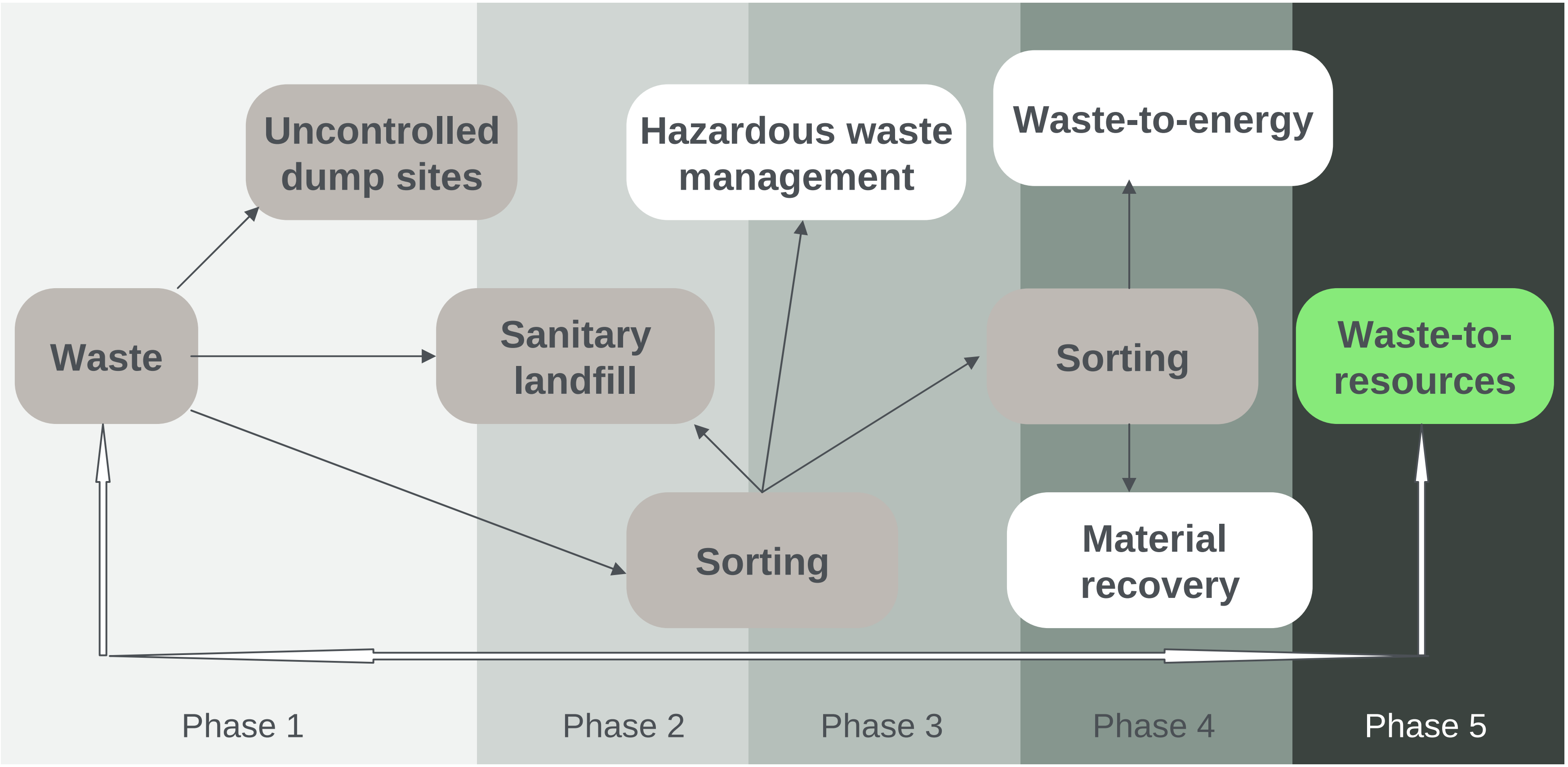
Bank aus Verantwortung

››› Outline of presentation

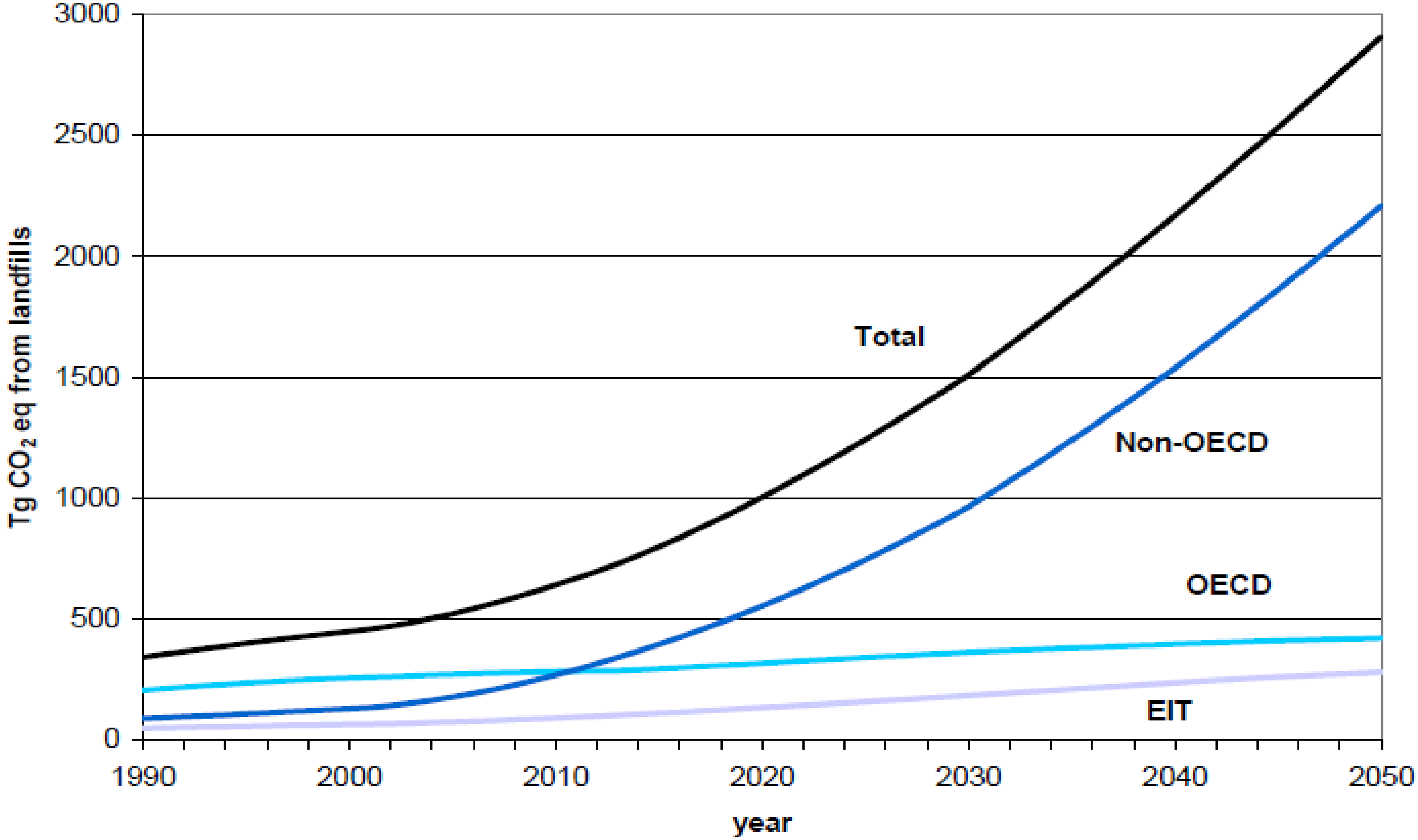
1	Introduction
2	Methodology
3	Cost and cost coverage
4	Conclusions

››› Development stages in solid waste management



Source: BMZ Strategiepapier ‚Ressource Abfall', Bonn 2012

›››
Forecast of GHG emissions from landfills



Source: Monni et al.

››› GHG reduction potential by SWM in selected countries

ifeu Öko-Institut e.V.

Klimaschutzpotenziale der Abfallwirtschaft

Am Beispiel von Siedlungsabfällen und Altholz

FKZ 3708 31 302

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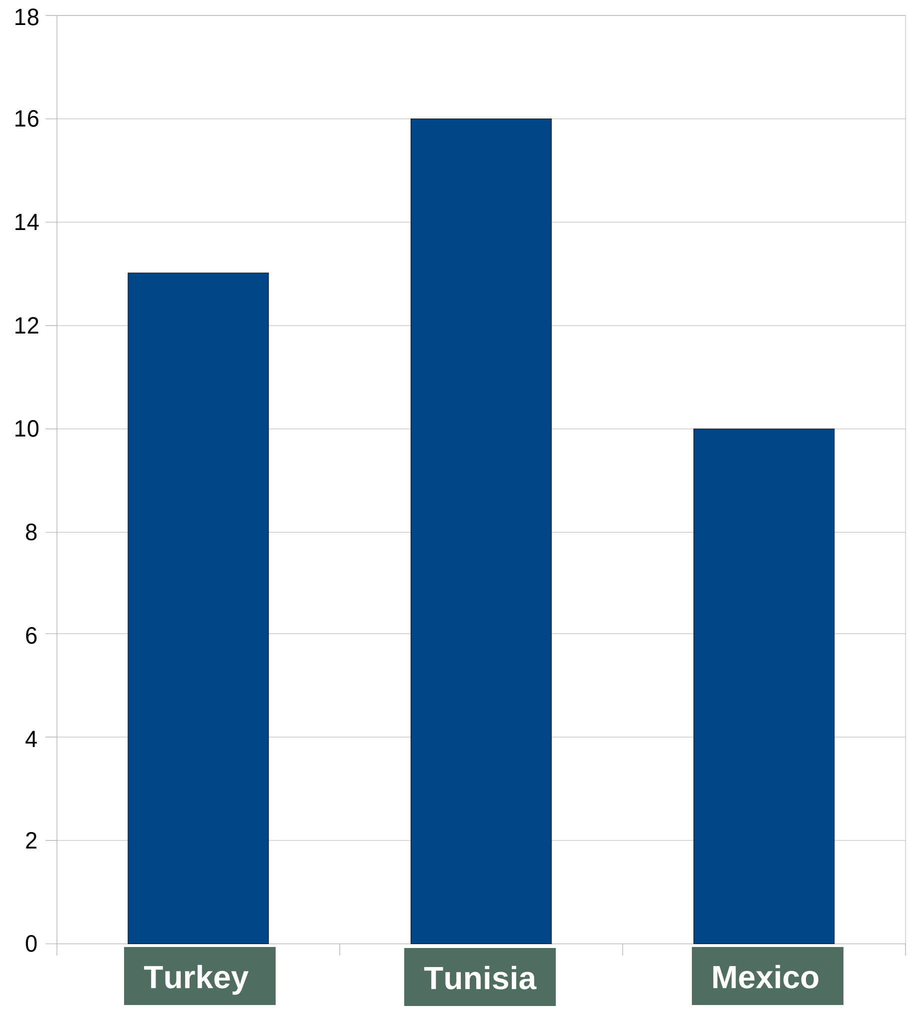
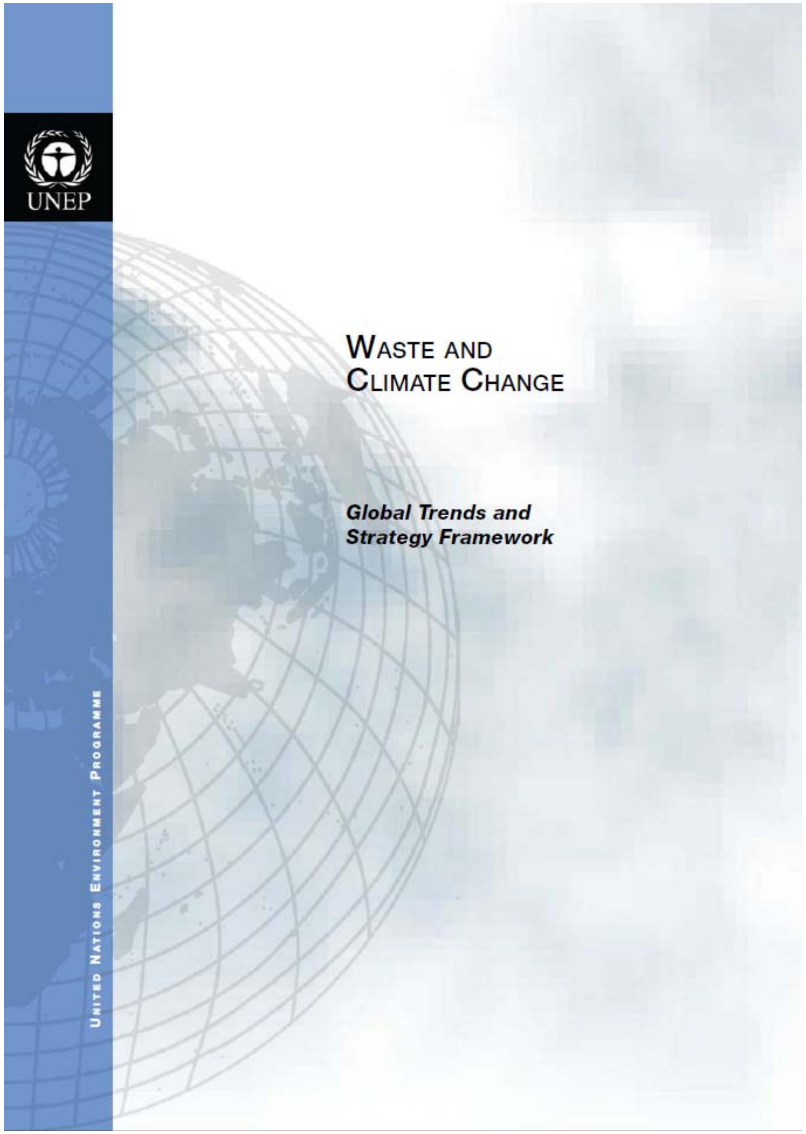
BDE
BUNDESVERBAND DER DEUTSCHEN ENTSORGUNGS-, WASSER- UND ROHSTOFFWIRTSCHAFT E.V.
WIRTSCHAFTS- UND ARBEITGEBERVERBAND

Darmstadt/Heidelberg/Berlin, Januar 2010

% of total GHG emissions



Waste and Climate Change



„At a global scale, the waste management sector makes a relatively minor contribution to greenhouse gas (GHG) emissions, estimated at approximately 3 - 5% of total anthropogenic emissions in 2005.

However, the waste sector is in a unique position to move from being a minor source of global emissions to becoming a major saver of emissions.

Although minor levels of emissions are re-leased through waste treatment and disposal, the prevention and recovery of wastes (i.e. as secondary materials or energy) avoids emissions in all other sectors of the economy.

A holistic approach to waste management has positive consequences for GHG emissions from the energy, forestry, agriculture, mining, transport, and manufacturing sectors.“

SWM-GHG Calculator



TOOL FOR CALCULATING GREENHOUSE GASES (GHG) IN SOLID WASTE MANAGEMENT (SWM)

Developed by

ifeu

Sponsored and financed by

Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

gtz
Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

kfw ENTWICKLUNGSBANK

››› “Standard solution” sanitary landfill?

- Economic framework conditions ⇨ low-cost solutions
- Compromise of environmental soundness ⇔ economic viability
- Leachate and landfill gas emissions pose a latent environmental risk
- Methane emissions can only partly (30 – 40%) be captured
- Financing of cost of aftercare is uncertain

➡ **Advanced SWM concepts highly desirable !**

››› Outline of presentation

Assessed waste management concepts and strategies

I. Simple organisation, no separate collection	• Sorting out of dry recyclables and high calorific value materials • Mechanic-biological pre-treatment of residual waste (MBT)
II. Recycling and energetic utilisation	• Separate collection of dry recyclables • Sorting out of residual waste, high calorific value materials • MBT
III. Recycling, biological and energetic utilisation	• Separate collection of recyclables and bio-waste • Sorting out of recyclable materials, high calorific value materials • MBT
IV. Thermal waste treatment	• Thermal treatment / waste-to-energy • Concepts with and without upstream separate collection / material and biological recycling

Universität Rostock

Traditio et Innovatio

Analysed waste management concepts

System-element		Collection		Sorting		Biological recycling		Mechanical–biological treatment			Energetic Recycling	
		Separate Collection of potential Recyclables	Separate collection of Organic Waste	Sorting of Recyclables	Sorting of high caloric Fractions	Compost Segregation of simple Organic Waste	Intensive Rot/ Fermentation of Organic Waste	MBT simple	MBS / MPS	MBT intensive Rot / MBT Fermentation	EBS-HKW	Thermal Waste Treatment
Group I	AWK Ia			●				●				
	AWK Ib			○	●			●				
	AWK Ic			○					●			
	AWK Id			○	●					●		
Group II	AWK IIa	●		●				●				
	AWK IIb	●		○	●			●				
	AWK IIc	●		○					●			
	AWK IId	●		○	●					●		
Group III	AWK IIIa	●	●	●		●		●				
	AWK IIIb	●	●	○	●		●	●				
	AWK IIIc	●	●	○	●	●				●		
	AWK IIId	●	●	○			●		●			
Group IV	AWK IVa			○							●	
	AWK IVb	●		○							●	
	AWK IVc	●	●	○		●					●	
	AWK IVd	●	●	○			●				●	

Definition of model waste types

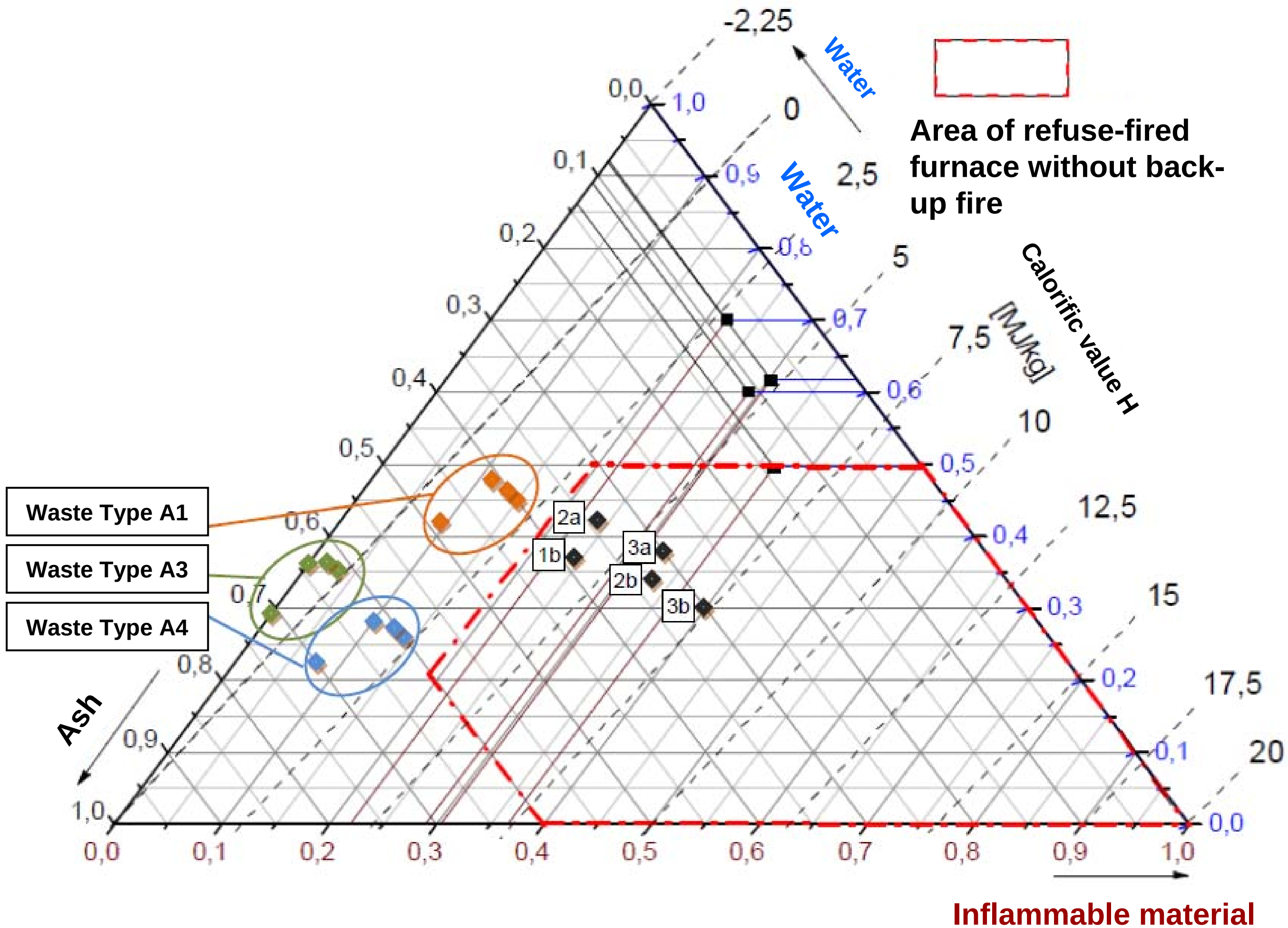
Group A:	**GDP < 2.000 EUR/cap/a - lower-middle income**
Waste type A1:	Tropical and semi-tropical climate, urban areas
Waste type A2:	Arid and semiarid climate, urban areas
Waste type A3:	Tropical and semi-tropical climate, rural areas
Waste type A4:	Arid and semiarid climate, rural areas
Group B:	**GDP 2.000 – 4.000 EUR/cap/a - middle income**
Waste type B1:	Tropic and semi-tropical climate, urbane and rural areas
Waste type B2:	Arid and semiarid climate, urban and rural areas
Group A:	**GDP 4.000 – 6.000 EUR/cap/a - higher-middle income**
Waste type C1:	Tropical and semi-tropical climate, urban and rural areas
Waste type C2:	Arid and semiarid climate, urban und rural areas

Properties of model waste types

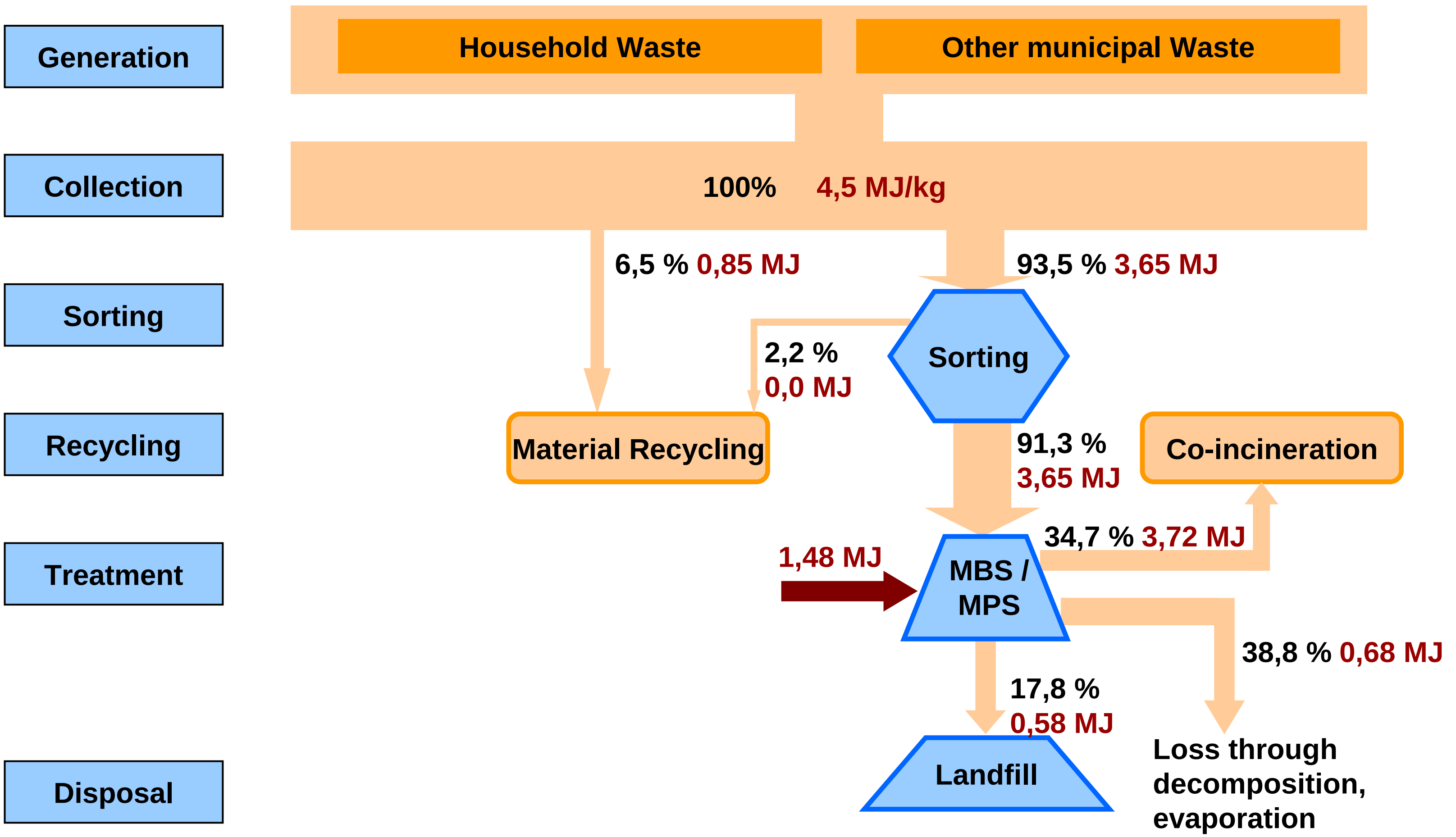
	Organic waste*	Inert Material/ Others	Recyclable Material**	Water Content	Lower Calorific Value H_u [MJ/kg]	GHG-Potential*** [Mg CO_2-äqu./Mg Waste]
Waste Type A1	**≥ 65%**	**15 – 25%**	**≤ 15%**	**≥ 40%**	**3 – 4**	0,8 – 1,3
Waste Type A2	**≥ 65%**	**15 – 25%**	**≤ 15%**	**≤ 40%**	**4 – 5**	0,8 – 1,3
Waste Type A3	**≤ 45%**	**≥ 40%**	**≤ 15%**	**≥ 30%**	**2 – 3**	0,5 – 0,8
Waste Type A4	**≤ 45%**	**≥ 40%**	**≤ 15%**	**≤ 30%**	**3 – 4**	0,5 – 0,8
Waste Type B1	**50 - 65%**	**≤ 20 %**	**15 – 25%**	**≥ 40%**	**4 – 5**	0,9 – 1,4
Waste Type B2	**50 - 65%**	**≤ 20 %**	**15 – 25%**	**≤ 40%**	**5 – 6**	0,9 – 1,4
Waste Type C1	**≤ 50%**	**≤ 20 %**	**≥ 25%**	**≥ 40%**	**5 – 6**	0,9 – 1,4
Waste Type C2	**≤ 50%**	**≤ 20 %**	**≥ 25%**	**≤ 40%**	**6 – 7**	0,9 – 1,4

*   Only Bio-Waste; PPK sub-summarized under Recyclable Material
** Dry Recyclables: paper, cardboard, metal, glass, plastics, textiles, packaging
***lower value: with methane correction factor 0,65, higher value: long-term emission potential

Incineration properties of model waste types



Model II c


Generation
Collection
Sorting
Recycling
Treatment
Disposal
Household Waste
Other municipal Waste
100% 4,5 MJ/kg
6,5 % 0,85 MJ
93,5 % 3,65 MJ
2,2 %
0,0 MJ
Sorting
Material Recycling
91,3 %
3,65 MJ
Co-incineration
34,7 % 3,72 MJ
1,48 MJ
MBS /
MPS
38,8 % 0,68 MJ
17,8 %
0,58 MJ
Landfill
Loss through
decomposition,
evaporation

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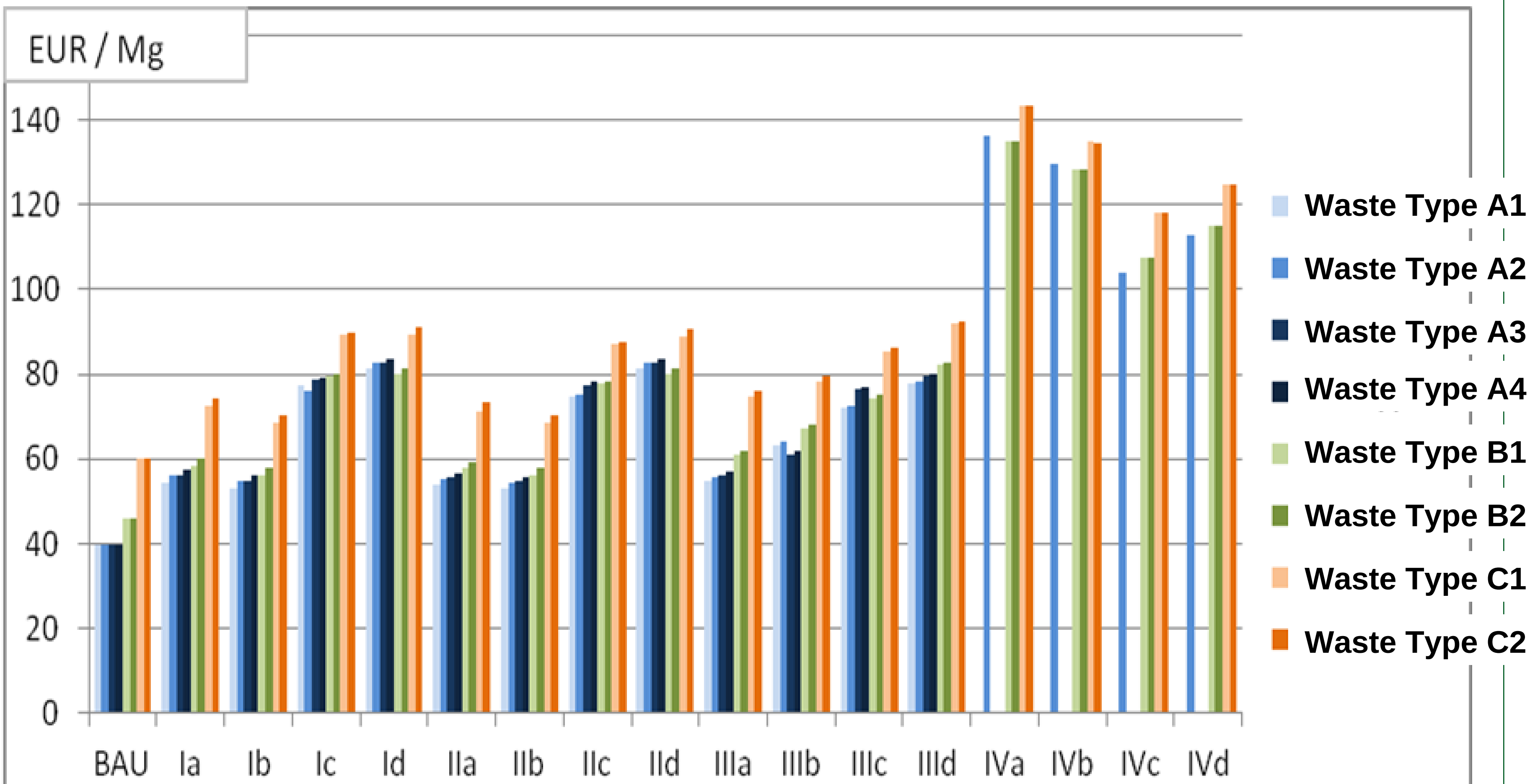
››› Cost of SWM technologies as a function of GDP

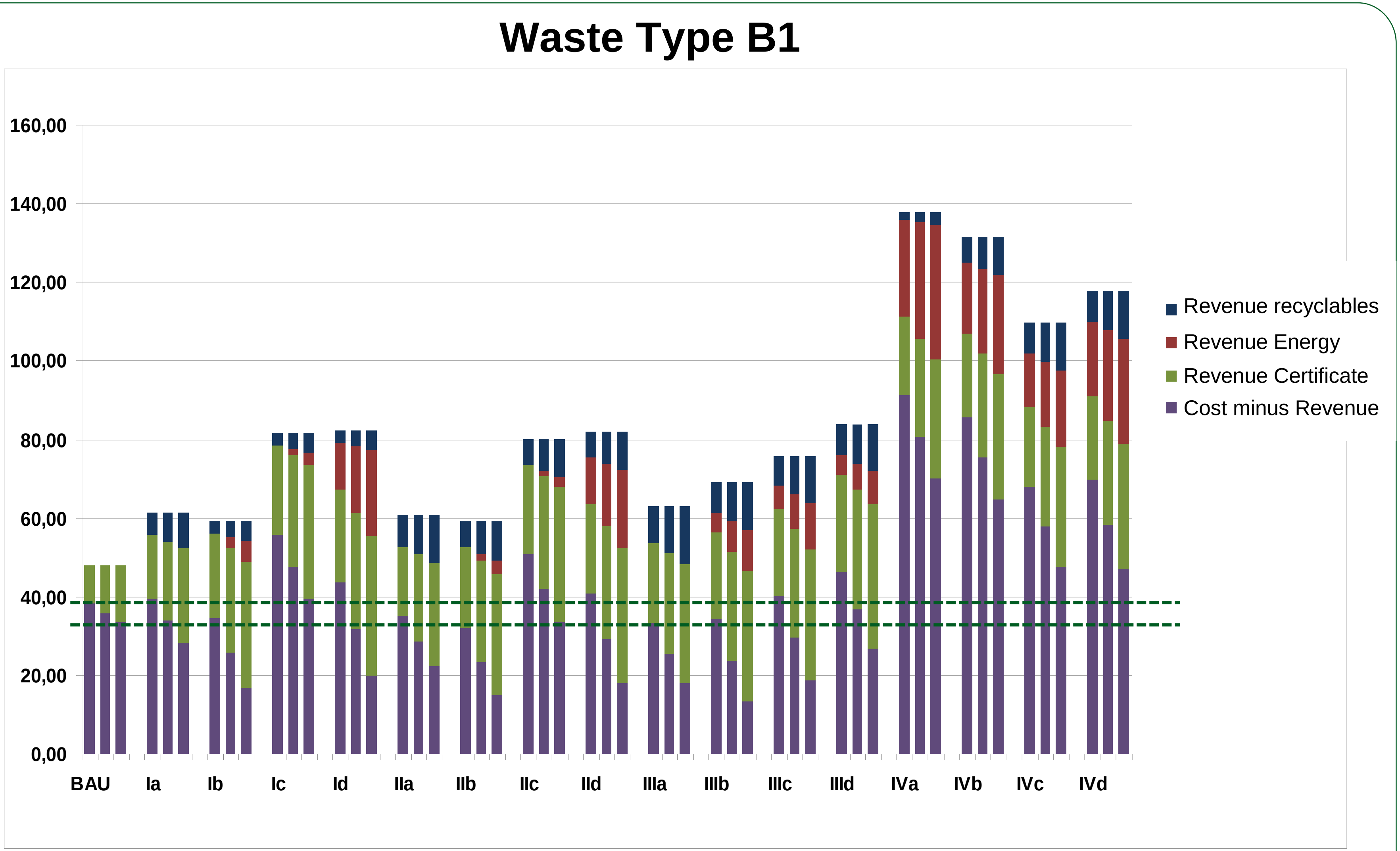
GDP [EUR /cap/year] **Method / Technology**	**< 2.000** [EUR/Mg]	**2.000 – 4.000** [EUR/Mg]	**4.000 – 6.000** [EUR/Mg]	**25.000 – 30.000** [EUR/Mg]
Source Separation of dry Recyclables	20 - 30	25 - 35	35 - 45	60 - 70
Sorting of high caloric Fractions / RDF	15 - 25	20 - 30	25 - 35	50 - 60
Composting of separately collected Bio-waste	20 - 30	20 - 30	20 - 30	35 – 50
Intensive Rotting / Fermentation of Bio-waste	50 - 60	50 - 60	50 - 60	70 - 90
Simple MBT	15 - 25	20 - 30	20 - 30	35 - 50
MBT intensive Rotting or Fermentation	40 - 50	40 - 50	45 - 55	75 - 90
MBS / MPS	40 - 50	40 - 50	45 - 55	65 - 80
Waste to Energy Plant	60 - 80	60 - 80	65 - 85	90 - 120
Thermal Waste Treatment	70 - 90	70 - 90	75 - 95	110 - 140
Sanitary Landfill	10 - 20	12 - 22	15 - 25	40 - 60

Cost of SWM concepts



Type of Waste Management Concept

Cost and cost coverage



Cost minus revenues compared to BAU-model

Abfall-typ	AWK	Gruppe I				Gruppe II				Gruppe III				Gruppe IV			
		Ia	Ib	Ic	Id	IIa	IIb	IIc	II d	IIIa	IIIb	IIIc	IIId	IVa	IVb	IVc	IVd
A1	Basisszenario	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	nicht anwendbar			
	Szenario 1	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
	Szenario 2	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
A2	Basisszenario	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R
	Szenario 1	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R
	Szenario 2	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R
A3	Basisszenario	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	nicht anwendbar			
	Szenario 1	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
	Szenario 2	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
A4	Basisszenario	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	nicht anwendbar			
	Szenario 1	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
	Szenario 2	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R	R/R				
B1	Basisszenario	R/R	R/R	R/R	R/R	Y/R	Y/Y	R/R	R/R	G/Y	Y/Y	R/R	R/R	R/R	R/R	R/R	R/R
	Szenario 1	R/R	Y/Y	R/R	R/R	Y/Y	G/Y	Y/R	R/R	G/G	G/Y	Y/Y	Y/R	R/R	R/R	R/R	R/R
	Szenario 2	Y/Y	Y/Y	Y/R	Y/R	Y/Y	G/G	G/Y	Y/R	G/G	G/G	G/G	G/Y	R/R	R/R	R/R	R/R
B2	Basisszenario	R/R	R/R	R/R	R/R	Y/R	Y/Y	R/R	R/R	G/Y	Y/Y	R/R	R/R	R/R	R/R	R/R	R/R
	Szenario 1	Y/R	Y/Y	R/R	R/R	Y/Y	G/Y	Y/Y	R/R	G/G	G/Y	Y/Y	Y/Y	R/R	R/R	R/R	R/R
	Szenario 2	Y/Y	G/Y	Y/Y	Y/R	G/Y	G/G	G/G	G/Y	G/G	G/G	G/G	G/G	R/R	R/R	R/R	R/R
C1	Basisszenario	R/R	Y/R	R/R	R/R	Y/Y	Y/Y	Y/R	R/R	G/Y	Y/Y	Y/R	Y/R	R/R	R/R	R/R	R/R
	Szenario 1	Y/Y	Y/Y	Y/R	R/R	G/Y	G/G	Y/Y	Y/Y	G/G	G/G	G/Y	Y/Y	R/R	R/R	R/R	R/R
	Szenario 2	Y/Y	G/Y	Y/Y	Y/Y	G/G	G/G	G/G	G/Y	G/G	G/G	G/G	G/G	R/R	R/R	R/R	R/R
C2	Basisszenario	R/R	Y/R	R/R	R/R	Y/Y	Y/Y	Y/R	R/R	Y/Y	Y/Y	Y/R	Y/R	R/R	R/R	R/R	R/R
	Szenario 1	Y/Y	Y/Y	Y/Y	R/R	G/G	G/G	G/G	Y/R	G/G	G/G	G/Y	G/Y	R/R	R/R	R/R	R/R
	Szenario 2	Y/Y	G/Y	G/Y	Y/Y	G/G	G/G	G/G	G/Y	G/G	G/G	G/G	G/G	R/R	R/R	R/R	R/R

Legende:
- G (grün): Kosten ohne I mit Diskontierung geringer als BAU-Modell
- Y (gelb): Kosten ohne I mit Diskontierung etwa gleich wie BAU-Modell
- R (rot): Kosten ohne I mit Diskontierung höher als BAU-Modell

››› Conclusions

Financial sustainability requires steady and reliable revenues

- 60 – 70% of the total costs of advanced SWM are operating/running cost
- Low-interest credits or grants alone can not ensure financial sustainability

Compensations for GHG reductions could cover 30 – 50% of total cost

- Annex‘1 states have to set ambitious GHG reduction targets
  → energizing carbon markets
- Revenues for recyclables and energy could cover 20 – 30% of cost
- Developing, emerging and transition countries (DETC) should use 0.3 – 0.5% of their GDP for financing SWM

Advanced (municipal) SWM requires national regulations and institutions

- DETC should develop and adopt a clear swm policy
- DETC should develop financial instruments beyond user fees, in particular taxes/charges on certain products (extended producer responsibility)
- DETC should develop institutional structures
- NAMA / Sectoral approach to establish the ‘enabling environment’

Elements of a NAMA / Sectoral approach in Solid Waste Management

Framework conditions and infrastructure development

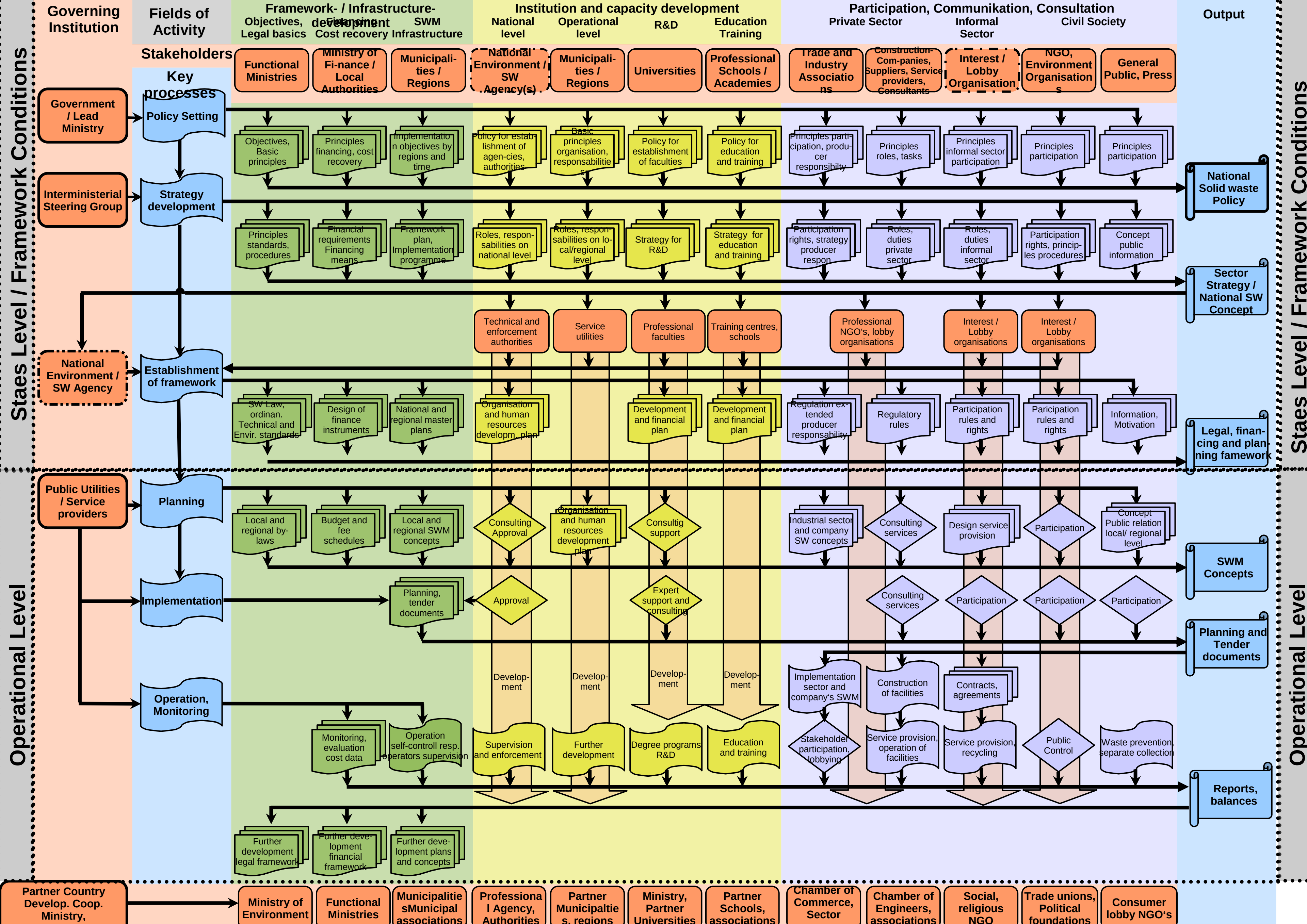
- Definition of objectives and legal framework
- Financing and cost recovery
- Planning and implementation of disposal plants

Institution building and capacity development

- Authorities for regulation, permission, supervision and enforcement
- Efficient project-executing agencies
- Research, development, scientific education
- Professional education and training

Participation of civil society

- Industrial and commercial associations, inter-trade organizations
- Supplier, service providers
  (Consultants, SWM disposal and construction companies)
- Informal sector
- NGOs, environment organizations
- The public, press



Governing Institution
Fields of Activity
Framework- / Infrastructure-development
Objectives, Legal basics
Financing, Cost recovery
SWM Infrastructure
Institution and capacity development
National level
Operational level
R&D
Education Training
Participation, Communikation, Consultation
Private Sector
Informal Sector
Civil Society
Output
Stakeholders
Functional Ministries
Ministry of Fi-nance / Local Authorities
Municipali-ties / Regions
National Environment / SW Agency(s)
Municipali-ties / Regions
Universities
Professional Schools / Academies
Trade and Industry Associations
Construction-Com-panies, Suppliers, Service providers, Consultants
Interest / Lobby Organisation
NGO, Environment Organisations
General Public, Press
Key processes
Staes Level / Framework Conditions
Government / Lead Ministry
Policy Setting
Objectives, Basic principles
Principles financing, cost recovery
Implementation objectives by regions and time
Policy for estab-lishment of agen-cies, authorities
Basic principles organisation, responsabilities
Policy for establishment of faculties
Policy for education and training
Principles parti-cipation, produ-cer responsibility
Principles roles, tasks
Principles informal sector participation
Principles participation
Principles participation
National Solid waste Policy
Interministerial Steering Group
Strategy development
Principles standards, procedures
Financial requirements Financing means
Framework plan, Implementation programme
Roles, respon-sabilities on national level
Roles, respon-sabilities on lo-cal/regional level
Strategy for R&D
Strategy for education and training
Participation rights, strategy producer respon
Roles, duties private sector
Roles, duties informal sector
Participation rights, princip-les procedures
Concept public information
Sector Strategy / National SW Concept
Technical and enforcement authorities
Service utilities
Professional faculties
Training centres, schools
Professional NGO's, lobby organisations
Interest / Lobby organisations
Interest / Lobby organisations
National Environment / SW Agency
Establishment of framework
SW Law, ordinan. Technical and Envir. standards
Design of finance instruments
National and regional master plans
Organisation and human resources developm. plan
Development and financial plan
Development and financial plan
Regulation ex-tended producer responsability
Regulatory rules
Participation rules and rights
Participation rules and rights
Information, Motivation
Legal, finan-cing and plan-ning framework
Operational Level
Public Utilities / Service providers
Planning
Local and regional by-laws
Budget and fee schedules
Local and regional SWM concepts
Consulting Approval
Organisation and human resources development plan
Consulting support
Industrial sector and company SW concepts
Consulting services
Design service provision
Participation
Concept Public relation local/ regional level
SWM Concepts
Implementation
Planning, tender documents
Approval
Expert support and consulting
Consulting services
Participation
Participation
Participation
Planning and Tender documents
Develop-ment
Develop-ment
Develop-ment
Develop-ment
Implementation sector and company's SWM
Construction of facilities
Contracts, agreements
Operation, Monitoring
Monitoring, evaluation cost data
Operation self-controll resp. operators supervision
Supervision and enforcement
Further development
Degree programs R&D
Education and training
Stakeholder participation, lobbying
Service provision, operation of facilities
Service provision, recycling
Public Control
Waste prevention separate collection
Reports, balances
Further development legal framework
Further deve-lopment financial framework
Further deve-lopment plans and concepts
Partner Country Develop. Coop. Ministry, Organisations
Ministry of Environment
Functional Ministries
Municipalities Municipal associations
Professional Agency, Authorities
Partner Municipalties, regions
Ministry, Partner Universities
Partner Schools, associations
Chamber of Commerce, Sector assoc.
Chamber of Engineers, associations
Social, religious NGO
Trade unions, Political foundations
Consumer lobby NGO's

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Dissertation (German):
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