

Environmental Management Accounting in practice

4 elements in a model for collection of waste

May 2007



Object of this model

The object of this model is to assess the advantages and disadvantages of the applied collection methods compared to:

- The existing environment
- Working environment
- Customer service
- The finances of the business

Collection methods for waste collection

- Collection in sacks with compaction vehicles
- Collection in sacks with micro vehicles
- Collection in containers (to be picked up)
- Collection in tipping containers
- Use of mobile suction
- Use of stationary waste suction

An Environmental Accounting Model - with 4 elements

Environment

Use of resources and emissions in relation to collection and transport of waste and effect on the degree of waste sorting

Occupational Health and Safety/Working Environment

Working environment for truck drivers, absence due to illness and accidents at work

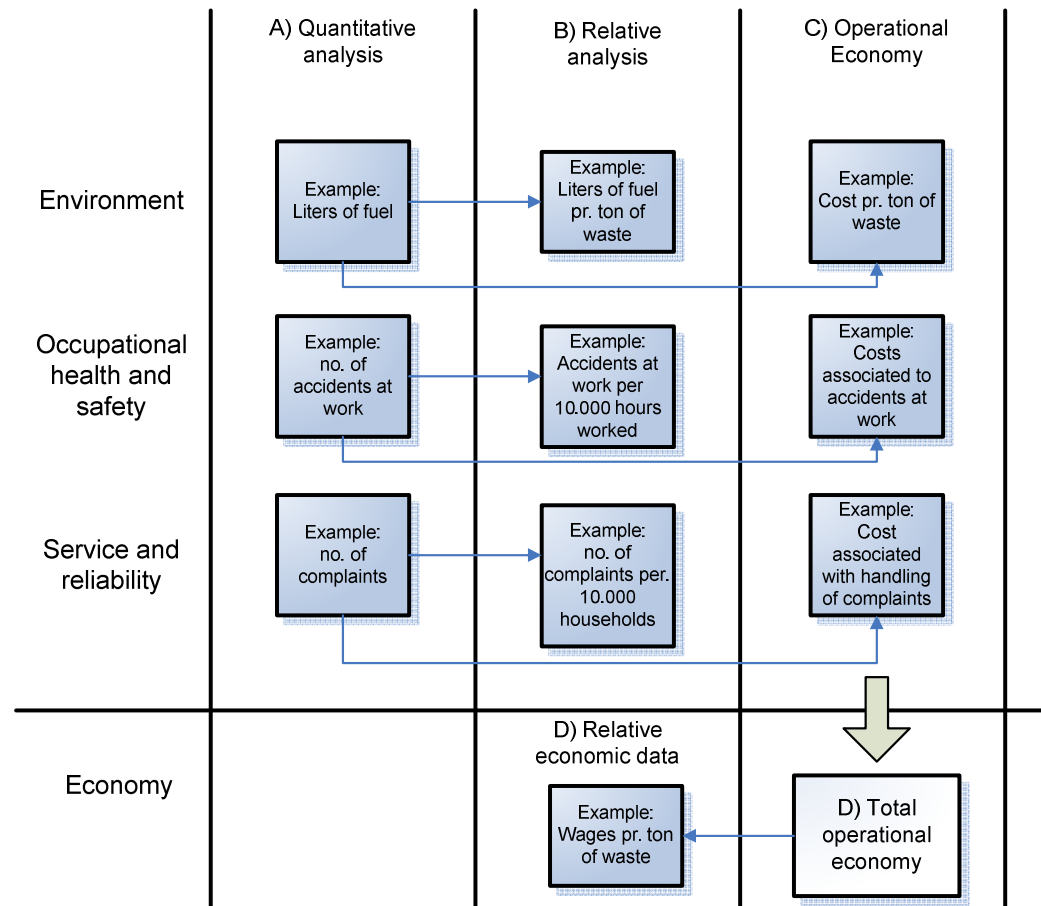
Service

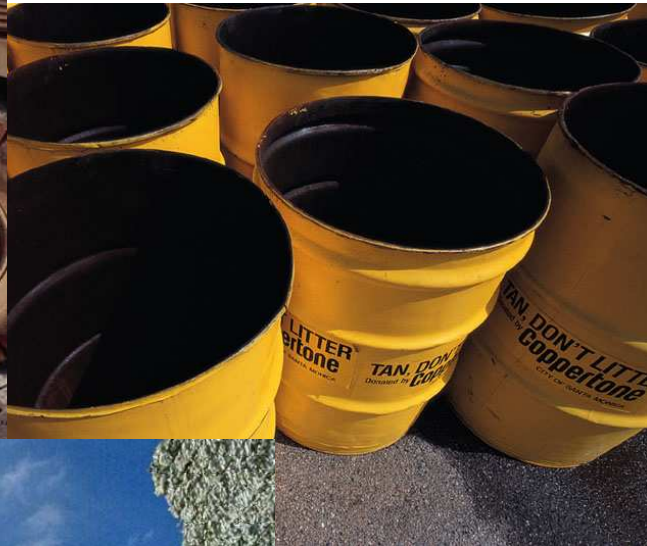
Reliability, user friendliness, adaptation to the city

Economy

Operating economy, environmental/resource economics

Analytical elements for the Environmental Accounting Model





Quantitative analysis

Indicators	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6
Sorting of large waste items ^[1]	Better sorting	Better sorting	Sorting not satisfactory	Sorting not satisfactory	Better sorting	Better sorting
Resource consumption						
Litres of fuel per ton of waste	3,4					15,9
Electricity consumption per ton of waste	0,11				70	
Water consumption (litres) per ton of waste	5					
Emissions						
kg CO ₂	9					42
g SO ₂	0,1				23	
g NO _x	77					404
g CO	8,9					42
g HC	4,1					8,4
g PM	0,09					0,37
Noise ^[2]	+++		+	+	+	+++
Smell ^[3]	Open system	Open system	Open system	Open system	Closed system	Closed system
Working environment						
Accidents/10000 workers	1583			0		0
Service						
Regularity	98,92%	99,31%	97,9%	99,58%	98,5%	98,64%
Economy						
Direct costs per ton of waste			799		5460	
Environmental costs per ton of waste			23		152	

[1] There are more large waste items in large containers and tipping containers than in smaller waste containers. This, however, does not necessarily mean less recycling or more dangerous substances

[2] Relative comparison of noise: + illustrates the lowest noise level, +++ the highest noise level

[3] Relative comparison of smell: a closed system is characterised by less smell than an open system

The internal benchmarking – an illustration

	<i>Method 1: Best environmental performer</i>	<i>Method 2: Best economic performer</i>	<i>Environmental improvement for EUR 65:</i>	
Degree of waste sorting	Good	Medium	Improvement of waste sorting	☺
Litres of fuel per ton of waste	3,1	3,89	0,79	☺
Consumption of electricity per ton of waste	0,59	1,77	1,18	☺
Consumption of water per ton of waste	8,6	12,6	-4,2	☺
kg CO2	8,5	10,8	2,3	☺
g SO2	0,24	0,31	0,07	☺
g NOx	72	94	22	☺
g CO	8,9	10,3	1,4	☺
g HC	3,8	3,8	0	-
ppm particles	0,15	Unknown	?	-
Noise	+++	+	More Noise	☹
Smell	Open system	Open system	No difference	-

The applied indicators per ton of waste per collection method were:

- Source sorting
 - Effect
- Resource consumption
 - Diesel consumption
 - Electricity consumption
 - Water consumption

The applied indicators per ton of waste per collection method were:

Emissions:

- CO₂
- SO₂
- NO_x
- Co
- HC
- pm
- Noise
- Odour

The applied indicators per ton of waste per collection method were:

- Working environment
 - Accidents at work
- Service
 - Regularity
- Direct costs
- Attributable costs
- Total costs

Waste separation adds environmental and financial benefits!

- environmental and financial effects of better source sorting

Reduction in environmental impact if all paper was recycled			
	SO ₂	CO ₂	NO _x
Emission factor by incineration (g/ton)			
Reduction due to smaller amount of delivered waste for incineration (kg)			
Increase in emission from transport (kg)			
Net effect			

Economic effect if all paper was recycled	
	DKK 1000
Reduced costs for waste treatment	
Increased earnings from delivery of paper for recycling	
Increased collection costs	
Net effect	

Generally

Collection according to Method 1 meets the waste objectives of the Municipality of Copenhagen best

The 5 objectives in Waste Plan 2008 for the Municipality of Copenhagen	Assessment of methods for collection of waste
Less waste and less dangerous substances in waste	No demonstrable effect
Better utilisation of waste resources and less waste for incineration	Method 3 and 5 are less efficient in terms of collecting large waste items
Most environment for the money	Method 1 is the most environment efficient collection method
A waste system appropriate for the city	All collection methods suit different parts of the city
'A logical and well-known waste system'	All collection methods are assessed to be easy to use

What can the results be used for?



- Find the most cost effective method with clear environmental advantages
- The results recognise advantages and disadvantages of each method
- The results contribute to an improved basis for decisions and new investments
- The results can be used in the dialogue with authorities and political stakeholders

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