Costing the Integrated Waste Management Bylaw

Keynote address at City of Cape Town Waste Minimisation Summit, 11 March 2009, The River Club, Observatory

presented
by
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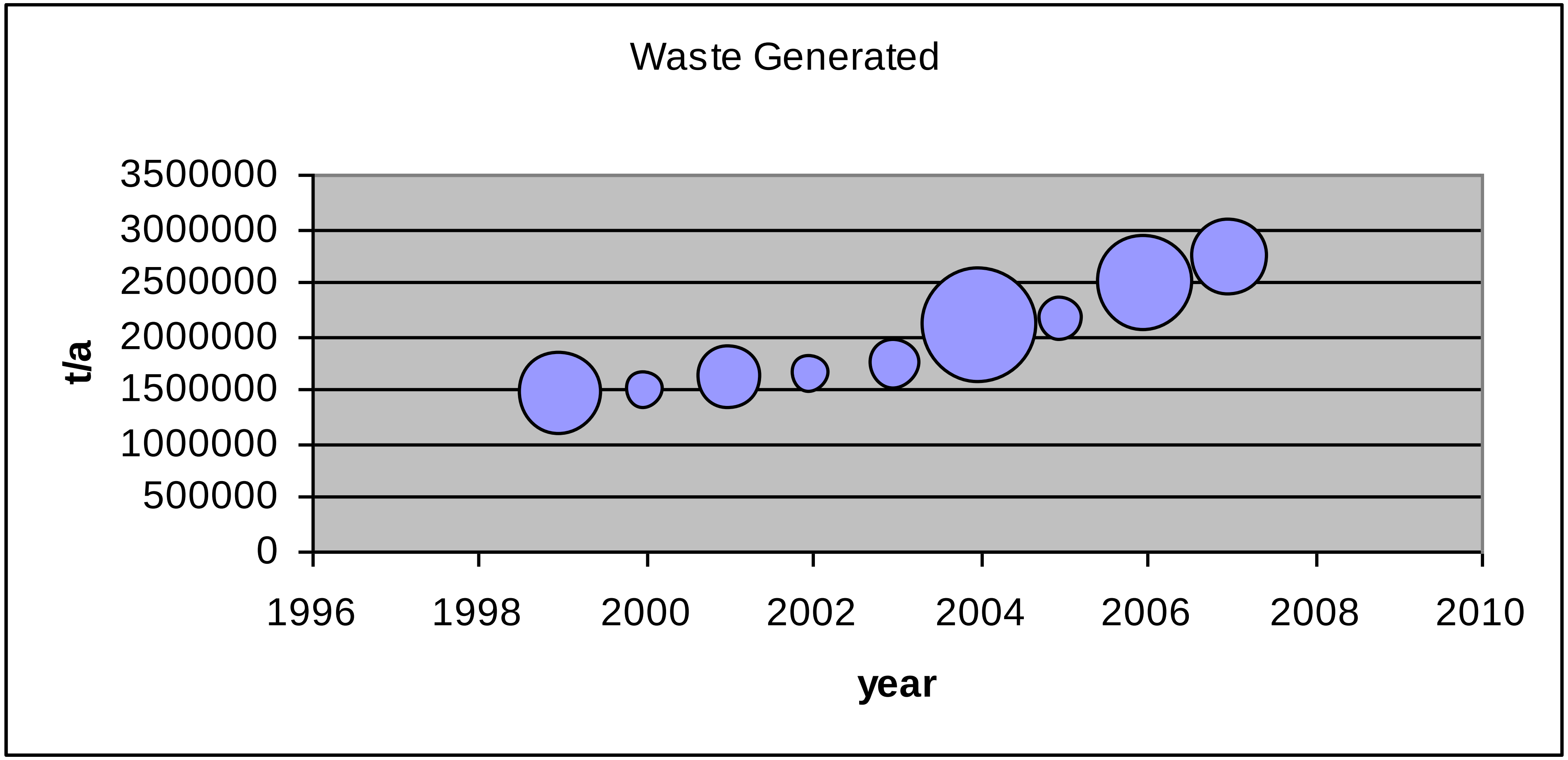
Increasing waste

Figure 1 *Solid waste generation, City of Cape Town (kg/pp/day)*



Landfill capacity

Table 1 *Remaining landfill air space and life span*

Landfill	Remaining Footprint (Ha)	Remaining Airspace (m^3 x million)	Remaining Airspace (tonnes x million)	Current Deposition Rate (T/month)	Remaining Site Life (Years)
1. Coastal Park	20	7.0	5.7	**40,000**	**9**
2. Bellville South	18 (10 lined)	6.0	4.8	**70,000**	**5**
3. Vissershok					
3(a) Vissershok South	28 (8 lined)	9.0	11.3	**100,000**	**6**
3(b) Additional 10m height	70	6.0	7.5	**-**	**4**
3(c) The Triangle	12	4.0	5.0	**-**	**3**
3(d) Vissershok North	50	16.0	20.0	**-**	**9**
4. New Site	176	68.8	55.0	**-**	**30**
Total	374	116.8	109.3	**210,000**	

REMAINING AIRSPACE AND LIFESPANS AT 01-11-2007

Increasing constraints...

Figure 2: *Intervention simulations: Solid waste generated and landfill capacity*

IWM By-law objectives

- To separate waste at source as far as practically possible.
- To ensure that services are delivered by a legitimate Waste Management Service Provider.
- To regulate all entities involved in providing waste management services or generating waste.
- To enforce the law to prevent degradation of and impact on the environment and human well-being.
- To reduce the cost impacts on the Council resulting from irresponsible and/or unlawful waste management.
- To avoid waste, and where it cannot be avoided, to enforce minimisation of waste as far as practically possible.

Waste minimisation options

- Residential/industrial/commercial waste management:
  - Dual-bag collection system
  - Drop-off green waste
  - Drop-off builder’s rubble
  - Drop-off household hazardous waste
- Community waste management:
  - Central neighbourhood drop-off facilities/buy-back centres

Approach to costing

- For the baseline situation, OPEX and CAPEX were quantified per year and per solid waste management function for all aggregated categories of costs.
- For alternative waste minimisation options, OPEX and CAPEX was quantified per function as based on Cape Town's existing pilot programmes and waste minimisation efforts.
- Scenarios were built on how waste minimisation can be achieved by relying on expert opinion and inputs from city managers.
- These scenarios were translated into measurable physical and cost units. Net additional costs or benefits to the municipality for waste minimisation options were calculated under certain identified scenarios.
- Sensitivity analysis was performed on certain key variables as informed by city managers and expert opinion

Model

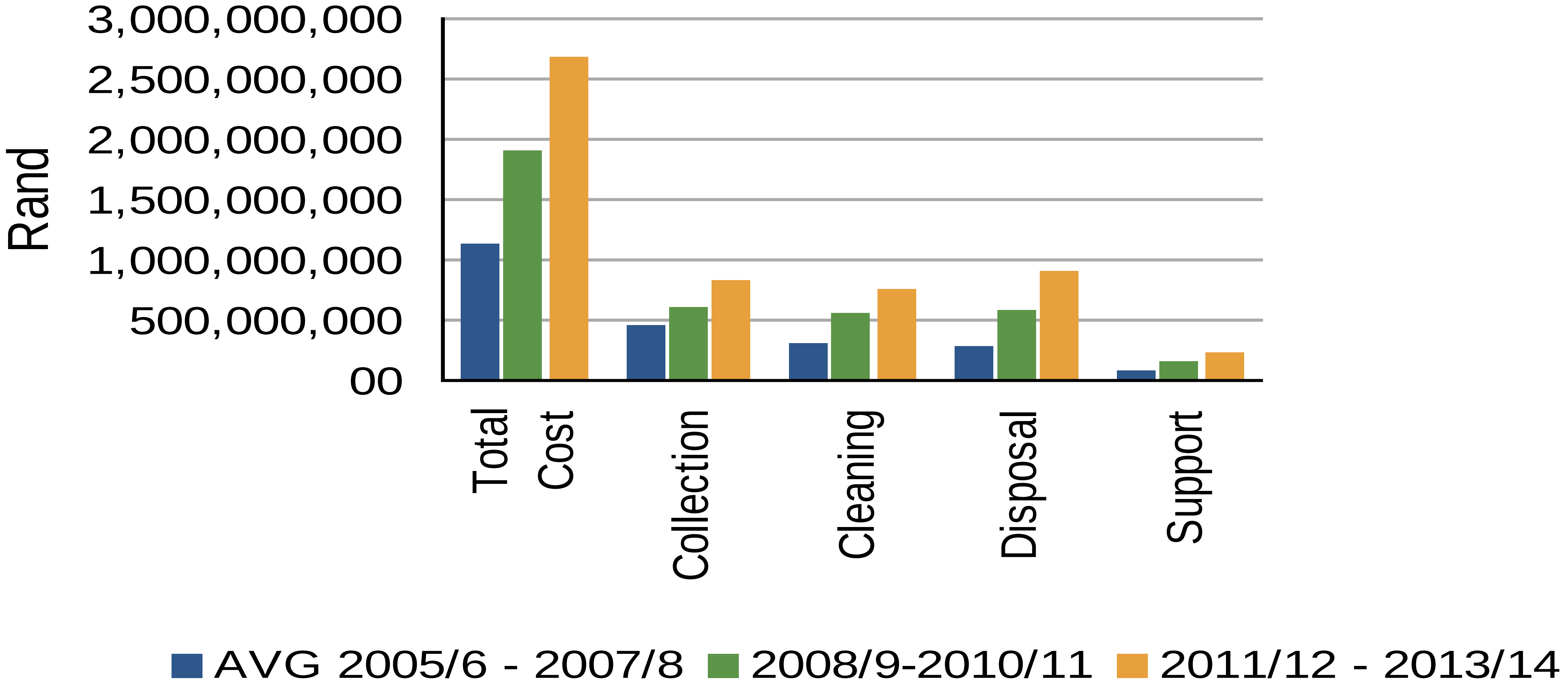
Net Additional Benefit = Total Additional Benefit - Total Additional Costs

Net Additional Benefit =

Market Value Recyclables (MVR) +
Avoided Disposal Cost (ADC) +
Savings in Indirect Costs (SIC)) -
Additional Cost to Collect (ACC) -
Additional Cost to Process (ACP) -
Additional Cost to Transport (ACT))

Baseline SWM costs (I)

Figure 3: OPEX & CAPEX, 2005/6 - 2013/14



Baseline SWM Costs (II)

Figure 4: OPEX 2005-2014

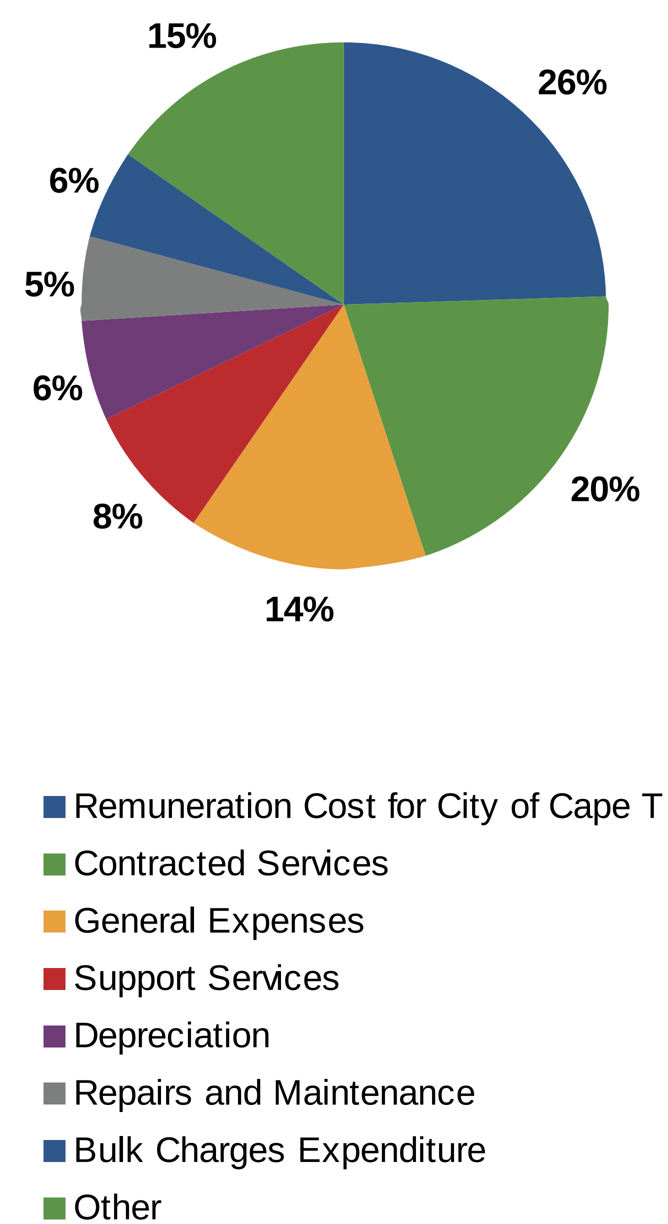
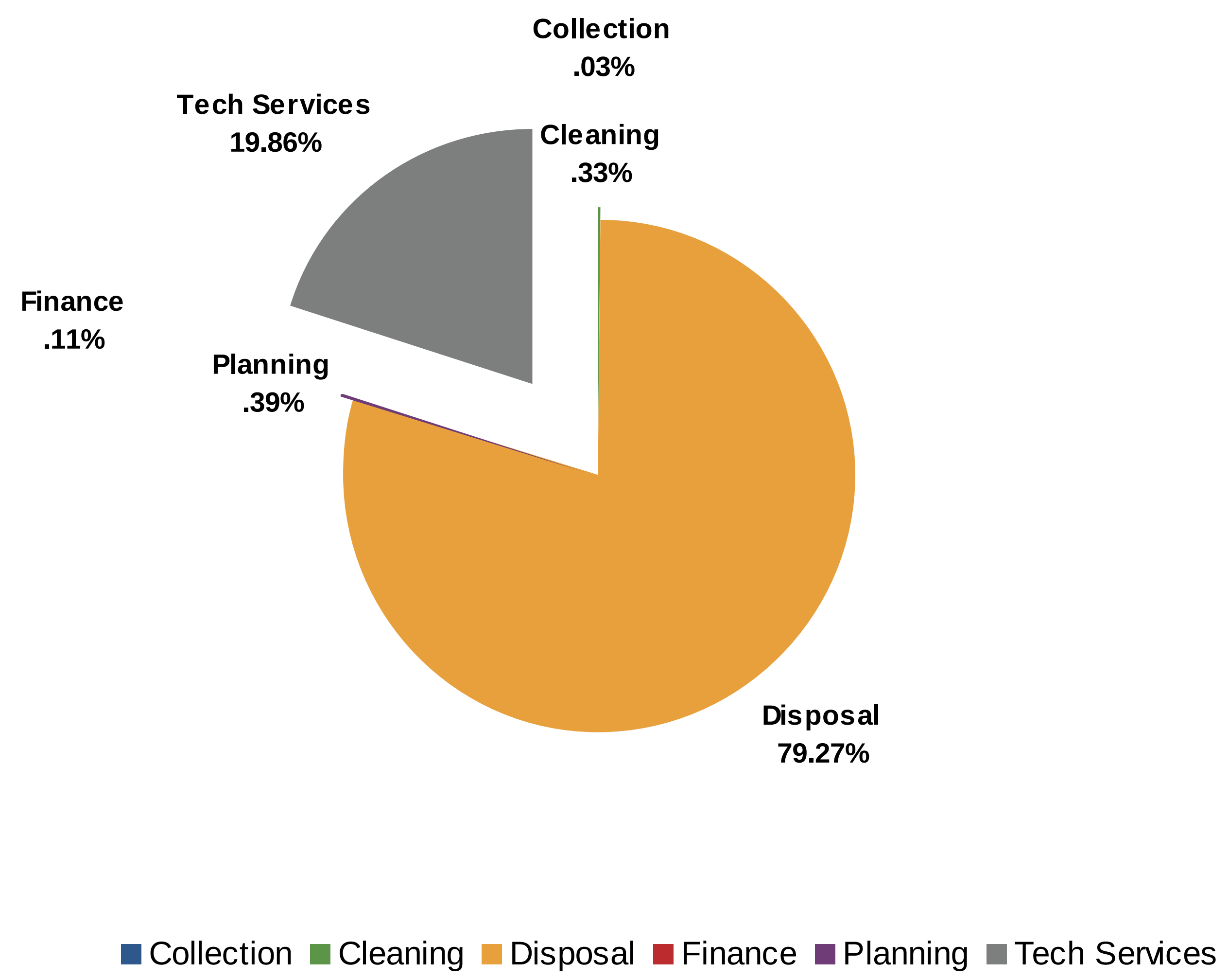
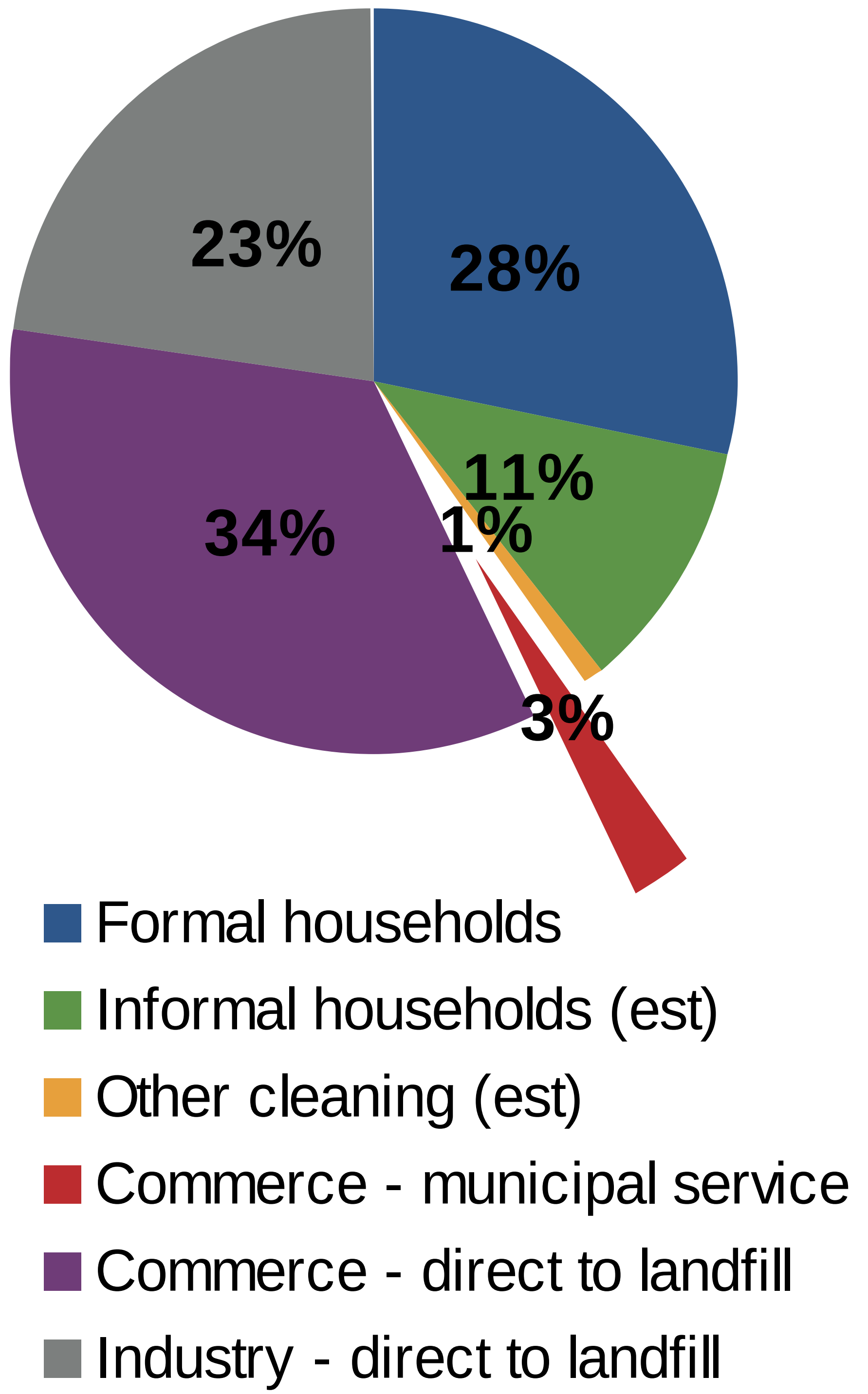


Figure 5: Total CAPEX 2008/9-2013/14



Waste mass balance



Waste Recovery

Figure 7 *Current waste recovery rates in the City*

TOTAL RECOVERED	t/yr	337997	
Other recycling	t/yr	224205	66.3%
Builders rubble crushed	t/yr	92716	27.4%
Composting at landfill	t/yr	9300	2.8%
Materials Recovery and Transfer	t/yr	4711	1.4%
Dual collection	t/yr	4462	1.3%
Drop-offs	t/yr	2444	0.7%
Yellow Bag	t/yr	159	0.0%

Waste Minimisation Scenarios: BAU

Table 2 *Description of waste minimisation scenarios: BAU*

	Function	**Definition of scenario**
1. Business as usual	Clean	Informal settlements refuse, animal carcass, litter bins, street cleaning, illegal dumping, beach cleaning, event cleaning, disasters, informal trading waste.
	Collect	Collection at 639 500 formal households (610 000 domestic + 39 500 vacant), collection at 63 400 non-residential sites. Pilot dual collection at 82 800 affluent households and 90 600 poorer households. Cost estimates only available in affluent areas.
	Dispose	Around 2.5Mt/yr. 3 landfills: Coastal Park, Bellville South, Vissershok. New site planned for 2013.
	Recovery	224 000t/yr other recycling, 4 700t/yr recovery at Athlone Recovery and Transfer Station (ARTS), 2 450t/yr at drop-off sites, 9 300t/yr composting and 91 000t/yr crushing of builders' rubble at drop-offs and landfills.

Baseline Unit Costs Service Delivery

Table 3 *SWM baseline unit costs of service delivery*

Business as Usual (BAU)	**R/yr**	**t/yr**	**R/t**
Total	R1.1bn	2,430,000	460
Collect	R460m	760,000	607
Clean	R310m	280,000	1107
Dispose	R270m	2,430,000	111
Support	R76m	2,430,000	31

Baseline Unit Cost Recovery

Table 4 *Baseline unit costs for waste recovery*

	R/yr	t/yr	R/t
Builders’ rubble crushing	R14m	93,000	151
Composting	R2.2m	9,300	231
ARTS	R5m	4,700	1 078
Drop-offs (excl. ARTS)	R35m	2,450	13 941
Dual collect	R8.5	4,500	1 910
Yellow Bag	na	159	na
Other Recycling	na	224,500	na

Waste Minimisation Scenarios: Affluent Separation

Table 5 *Description of waste minimisation scenarios: Afluent Separation*

2. Affluent separation	Clean	Informal settlements refuse, animal carcass, litter bins, street cleaning, illegal dumping, beach cleaning, event cleaning, disasters, informal trading waste.
	Collect	Collection at 639 500 formal households (610 000 domestic + 39 500 vacant), collection at 63 400 non-residential sites. **Roll-out of pilot dual collection to all affluent households.**
	Dispose	Around 2.5Mt/yr. 3 landfills: Coastal Park, Bellville South, Vissershok. New site planned for 2013.
	Recovery	224 000t/yr other recycling, 4 700t/yr recovery at Athlone Recovery and Transfer Station (ARTS), 2 450t/yr at drop-off sites, 9 300t/yr composting and 91 000t/yr crushing of builders' rubble at drop-offs and landfills. No new Material Recovery Facilities.

Model results: Affluent Separation

Table 6 *Model results for 'Affluent separation' scenario*

		R/yr	t/yr	R/t
Affluent separation	Total Additional Cost	R5.3m	9 760	541
	Additional Cost to Collect	R5m	9 760	510
	Value Airspace Savings	-R77 000	9 760	8
	Avoided Disposal Cost	-R1.1m	9 760	111
	Decrease in Revenue from Disposal	R1.5m	9 760	150

Waste Minimisation Scenarios: MaxiMin

Table 7 *Description of waste minimisation scenarios: MaxiMin*

3. MaxiMin	Clean	**Separation of informal settlement waste to buy-back/drop-off centres.** Landfill of animal carcass, litter bins, street cleaning, illegal dumping, beach cleaning, event cleaning, disasters, informal trading waste.
	Collect	Collection at 639 500 formal households (610 000 domestic + 39 500 vacant), collection at 63 400 non-residential sites. **Roll-out of pilot dual collection to all affluent household households.**
	Dispose	Around 2.5Mt/yr. 3 landfills: Coastal Park, Bellville South, Vissershok. New site planned for 2013.
	Recovery	**20% of capacity (470 000t/yr) waste recovery target for 2 existing and 3 new Material Recovery Facilities, 20% targets for recovery of builders' rubble and composting of greens.**

Model results: MaxiMin (I)

Table 8 *Model results for 'MaxiMin' scenario per cost variable*

		R/yr	**t/yr**	**R/t**
MaxiMin	Total Additional Cost	R185m	770,000	241
	Additional Cost to Collect	R5m	9 760	510
	Additional Cost to Process	R144m	760,000	189
	Value of Airspace Savings	-R6.1m	770,000	8
	Market Value of Recyclables	R13m	51,000	250
	Avoided Disposal Cost	-R85m	770,000	111
	Decrease in Revenue from Disposal	R115m	770,000	150

Model results: MaxiMin (II)

Table 9 *Model results for 'MaxiMin' scenario per waste minimisation option*

Waste Minimisation Option	Total Additional Cost	Total Additional Recovery	Total Additional Cost per ton recovered
MRFs & TS	R86m/yr	470 000t/yr	R189/t
Crushing of builders rubble	R19m/yr	126 000t/yr	R151/t
Composting of greens	R26m/yr	112 000t/yr	R231/t
Drop-offs & Buy-back	R27m/yr	51 000t/yr	R530/t
Dual collection	R5.3m/yr	9 760t/yr	R541/t

Sensitivity Analysis

Table 10 *Sensitivity analysis on 'MaxiMin' scenario*

	Change from MaxiMin (Rm)	**Additional Recovery (t/yr)**	**Additional Cost (R/t)**
(i) Lower targets (10%)	-50	335,000	402
(iv) Lower disposal tariffs (R110/t)	-40	770,000	189
(iii) Lower cost crushing & composting	-26	770,000	208
(vii) Low value for recyclables	-10	770,000	228
MaxiMin	0	770,000	241
(ii) Higher targets (30%)	50	1,200,000	196
(v) = (ii) + (iii) + (iv)	65	1,200,000	107
(vi) Doubling the cost of TS&MRFs	65	770,000	326

Conclusions (I)

- It is estimated that the cost of implementing the IWM bylaw would be R185m/yr (for the MaxiMin scenario) within a range of R128–R250m/yr
- The wide range of costs per ton recovered (R107/t - R402/t) for the options tested does suggest that more detailed specifications and thus costs estimates are needed for waste minimisation interventions before making final policy choices.

Conclusions (II)

- Low-volume curbside recycling and drop-off/buy-back options in its current form are expensive options
- Interventions aimed at handling mass volumes of waste, such as transfer stations & MRFs, crushing and composting operations come at a greater cost advantage then dual collection and drop-off/buy-back options
- These costs can be shared and absorbed partly by the private sector, if there is a commercially viable market for recycled materials.

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Limitations

- Treatment of capital expenditure
- Need to include full costs and benefits
- Updated figures on value of air space savings
- Future additional costs of transport

Recommendations

- Construct a physical waste mass balance over a number of years for the City.
- Quantify the additional costs of transport.
- Quantify avoided disposal costs, including savings on indirect costs, savings on planned expenses on transfer stations and on a new landfill.
- Update calculations on the value of air space in landfills.

Recommendations (ctd)

- Calculate the full costs of landfills, including social and environmental costs.
- Include more project-specific estimates for material recovery, crushing and composting facilities.
- Finalise how capital expenditure on waste minimisation support infrastructure will be financed.
- Formalise specific desired waste minimisation initiatives and do project-specific feasibility studies.
- Feed adjusted cost information into waste tariff modelling.