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ISWM Planning

Workshop on Integrated Solid Waste Management

Implementing the Green City Agenda ADB

Objectives

L. ISWM Overview: a quick refresher...

2. Asia Pacific Demands: is the region prepared?

> 3. ISWM Planning: How can ADB assist DMCs plan to meet future demands?



What is municipal solid waste (MSW)?

- A general term for 'non-hazardous' solid waste
- Comprises of the majority of total waste generation
- Generated by households, commercial and institutional establishments (shops, offices, schools, government buildings)
- Non-hazardous wastes from industrial and medical facilities
- Green waste from landscaping activities
- Street sweeping and other cleaning operation waste
- Household hazardous wastes, such as residue chemicals from cleaning



MSW Composition

Households:

- Organic waste (35-55 percent) Primarily food and organic residue
- Paper (10-15 percent)
- Plastics (10-15 percent)
- Glass (5-10 percent)
- Others (1-5 percent)
 - Leather, wood, metals, electronic waste

Commercial, institutional Industrial, medical (non-haz) Green waste Street sweepings/cleaning



1. Preparation

- Survey area selection,
 - Residential: high, medium, low income, 100 households each
 - Commercial: shops, restaurants, markets and industrial facilities (non-haz)
 - Institutional: offices, schools, government facilities, hospitals, clinics (non-haz)
- Door-to-door consultations, questionnaire, interviews and instruction
- Waste processing area set up



1. Implementation

- Daily collection for eight day period
 - Mixed dry recyclables (yellow bags for residential, white for commercial/institutional)
 - Wet residual waste (blue bags for residential, black for commercial/institutional)
- Waste from each generator recorded and weighed to nearest gram:
 - Glass
 - Metals (ferrous/non ferrous)
 - Paper/cardboard
 - Plastics
 - Wood
 - Leather/rubber
 - Food/organic
 - Household waste
 - Residuals/other
- Bulk density measured in standard containers
- Waste then mixed and informal recyclers extract their normal target materials
- Materials extracted by recyclers is weighed to ascertain recycling efficiency for each component
- Commercial and institutional waste weighed in the same way





1. Analysis

- Consolidation of data
- Estimates of per capita generation and composition by income level
- Estimates of total household generation utilizing demographic data
- Estimates of commercial and institutional waste composition
- Inferred total MSW
- MSW projections





System Evolution



MSW Segregation

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THE LABO



MSW Collection

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MSW Transfer















MSW Disposal (SLF)

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MSW Disposal (WTE)

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Part 2 Asia Pacific Demands: Is the region prepared?

DMC		Dopulation	MSW Ge	eneration
	DIVIC	Population	TPD	ТРҮ
1	Afghanistan	25,500,100	11,475	4,188,391.43
2	Armenia	3,024,100	1,361	496,708
3	Azerbaijan	9,235,100	4,156	1,516,865
4	Bangladesh	152,518,015	68,633	25,051,084
5	Bhutan	738,580	332	121,312
6	Cambodia	15,135,000	6,811	2,485,924
7	China, People's Republic of	1,359,920,000	611,964	223,366,860
8	Cook Islands	14,974	7	2,459
9	Fiji	858,038	386	140,933
10	Georgia	4,483,800	2,018	736,464
11	India	1,233,840,000	555,228	202,658,220
12	Indonesia	237,641,326	106,939	39,032,588
13	Kazakhstan	17,053,000	7,674	2,800,955
14	Kiribati	106,461	48	17,486
15	Kyrgyz Republic	5,551,900	2,498	911,900
16	Lao PDR	6,580,800	2,961	1,080,896
17	Maldives	317,280	143	52,113
18	Marshall Islands	56,086	25	9,212
19	Micronesia, Federated States of	101,351	46	16,647

DMC		Dopulation	MSW Generation					
	DIVIC	Population	TPD	ТРҮ				
20	Mongolia	2,754,685	1,240	452,457.01				
21	Myanmar	53,259,000	23,967	8,747,791				
22	Nauru	9,945	4	1,633				
23	Nepal	26,494,504	11,923	4,351,722				
24	Pakistan	184,232,000	82,904	30,260,106				
25	Palau	20,901	9	3,433				
26	Papua New Guinea	7,059,653	3,177	1,159,548				
27	Philippines	98,351,000	44,258	16,154,152				
28	Samoa	187,820	85	30,849				
29	Solomon Islands	561,000	252	92,144				
30	Sri Lanka	20,277,597	9,125	3,330,595				
31	Tajikistan	8,000,000	3,600	1,314,000				
32	Timor-Leste	1,066,409	480	175,158				
33	Tonga	103,036	46	16,924				
34	Turkmenistan	5,240,000	2,358	860,670				
35	Tuvalu	11,323	5	1,860				
36	Uzbekistan	29,559,100	13,302	4,855,082				
37	Vanuatu	264,652	119	43,469				
38	Viet Nam	88,780,000	39,951	14,582,115				
	Total	<u>3,598,908,536</u>	<u>1,619,509</u>	<u>591,120,727</u>				
	World Population (Total) Percent of World Population	7,111,000,000 50.61						

Workshop on Integrated Solid Waste Management, ADB DMC (Operational) Waste Generation (Preliminary) 2013-09-14 13.50

Population (2013-09)	3,598	million	Recycling ef	ficiency	
Growth rate annum	1.00	percent	2014	5	percent
Per cap MSW gen.	0.45	kg/person/day	2015	5	percent
Per cap gen increase annum	1.00	percent	2016	10	percent
			2017	15	percent
			2018	20	percent

percent percent percent 2019 beyond 20 percent In place density 0.60 tons/m3

> Inflation 3.00 percent

	Year	Population	Per Cap Gen.	Total Gen	Total Gen	Recycling	Recycl capture	Residual MSW	Residual MSW	Aerial 5m Cover	MSW Syster	m Cost (US\$)	Recycle Avoided
		millions	kg/day	million TPD	million TPY	percent	million TPY	million TPY	million m3/year	km2	per ton	US\$ million	US\$ million
1	2014	3,598	0.45	1.62	591	5	30	561	936	187.14	30	16,843	886
2	2015	3,634	0.45	1.65	603	5	30	573	955	190.90	31	17,697	931
3	2016	3,670	0.46	1.68	615	10	61	553	922	184.49	32	17,615	1,957
4	2017	3,707	0.46	1.72	627	15	94	533	889	177.74	33	17,480	3,085
5	2018	3,744	0.47	1.75	640	20	128	512	853	170.65	34	17,286	4,322
6	2019	3,782	0.47	1.79	653	20	131	522	870	174.08	35	18,163	4,541
7	2020	3,819	0.48	1.82	666	20	133	533	888	177.58	36	19,083	4,771
8	2021	3,858	0.48	1.86	679	20	136	543	906	181.15	37	20,051	5,013
9	2022	3,896	0.49	1.90	693	20	139	554	924	184.79	38	21,068	5,267
10	2023	3,935	0.49	1.94	707	20	141	566	943	188.50	39	22,136	5,534
11	2024	3,974	0.50	1.98	721	20	144	577	961	192.29	40	23,258	5,815
12	2025	4,014	0.50	2.02	736	20	147	588	981	196.16	42	24,438	6,109
13	2026	4,054	0.51	2.06	750	20	150	600	1,001	200.10	43	25,677	6,419
14	2027	4,095	0.51	2.10	765	20	153	612	1,021	204.12	44	26,978	6,745
15	2028	4,136	0.52	2.14	781	20	156	625	1,041	208.23	45	28,346	7,087
16	2029	4,177	0.52	2.18	797	20	159	637	1,062	212.41	47	29,784	7,446
17	2030	4,219	0.53	2.23	813	20	163	650	1,083	216.68	48	31,294	7,823
18	2031	4,261	0.53	2.27	829	20	166	663	1,105	221.04	50	32,880	8,220
19	2032	4,304	0.54	2.32	846	20	169	676	1,127	225.48	51	34,548	8,637
20	2033	4,347	0.54	2.36	863	20	173	690	1,150	230.01	53	36,299	9,075
21	2034	4,390	0.55	2.41	880	20	176	704	1,173	234.63	54	38,140	9,535
22	2035	4,434	0.55	2.46	898	20	180	718	1,197	239.35	56	40,073	10,018
23	2036	4,478	0.56	2.51	916	20	183	732	1,221	244.16	57	42,105	10,526
24	2037	4,523	0.57	2.56	934	20	187	747	1,245	249.07	59	44,240	11,060
25	2038	4,569	0.57	2.61	953	20	191	762	1,270	254.07	61	46,483	11,621
26	2039	4,614	0.58	2.66	972	20	194	778	1,296	259.18	63	48,840	12,210
27	2040	4,660	0.58	2.72	991	20	198	793	1,322	264.39	65	51,317	12,829
28	2041	4,707	0.59	2.77	1,011	20	202	809	1,349	269.71	67	53,918	13,480
29	2042	4,754	0.59	2.83	1,032	20	206	825	1,376	275.13	69	56,652	14,163
30	2043	4,802	0.60	2.88	1,052	20	210	842	1,403	280.66	71	59,525	14,881
					24,012		4,530	19,482	32,469	6,494		962,218	230,006

If the next 30 years of the region's MSW was placed in a line of stationary waste trucks....

...the line would circumnavigate the earth over *one thousand times*.....



...or extend to about *one third of the way to the sun....* ...assuming that the over 5 billion truck trips needed to transport the MSW travel an average of 20 km per trip....

...the cumulative truck travel distance is over 100 billion km

...about 15 times the distance to Pluto.....



Are We Ready?

The Asia Pacific SWM Scorecard

Estimates and guestimates;

Unhealthy worker conditions	
low	extremely
Cost recovery	
Systems sustainability	low fragile
Success	marginal

Are We Ready?

Scorecard Notes

Common deficiencies:

- A coherent SWM strategy does not exist.
- Regulatory frameworks are in place; specific provisions are not.
- Regulatory monitoring and enforcement is virtually nonexistent.
- Institutions lack capacity in SWM planning, management, engineering, environmental compliance, PPP/contracting, tariff implementation, customer service, and media and public relations.
- Municipal service delivery is extremely weak; concepts of waste minimization, segregation, recycling, collection, transfer, disposal and environmental compliance are not well understood.
- Recycling is informal and efficiencies are low: formalized waste minimization, segregation and recycling initiatives do not exist.
- Cost recovery is poor and where tariffs exist, they are low. Municipal SWM systems suffer from a lack of segregation and recycling, poor (or absent) collection services, inefficient transfer and the open burning or dumping of waste which causes acute environmental and social impacts.

Part 3 ISWM Planning: How can ADB assist DMCs to plan to meet future demands?

1

Karachi SWM Sector Roadmap

Issues

Waste generation is growing

Karachi's population of over 16 million generates about 8,300 tons per day

A national regulatory framework is in place, local provisions are not

A city level policy framework is urgently needed to guide and regulate Karachi's sector development

An institutional framework exists, but does not function adequately Institutions are grossly understaffed, and lack capacity in many sector areas

Municipal service delivery is extremely weak

Poor, inefficient collection and transfer services, two open dumpsites and many illicit dumping grounds

Recycling is effective, but the health and environmental impacts are severe Workers exposed to dangerous conditions, waste burning, significant environmental damage







Karachi SWM Goals and Objectives

- 1. An <u>effective regulatory framework</u> for the environmentally safe and healthy management of all municipal and hazardous solid wastes generated in Karachi.
- 2. Efficient, coordinated, integrated and transparent <u>institutions</u> at the city, town and union level, able to effectively manage the city's waste over the long term.
- 3. An educated, involved and environmentally-aware <u>Karachi public</u>, able and willing to progressively reduce total waste generation, maximize the segregation of waste at source for subsequent recycling, and willing to partner with the relevant institutions to promote efficient and sustainable community collection, improve community health conditions and progressively eliminate illicit dumping.
- 4. A sustainable and equitable **primary collection system** serving all areas of Karachi, with the gradual expansion of direct house-to-house collection using appropriate motorized vehicles wherever possible, and a highly organized UC-based secondary storage collection point system where it is not, with the gradual elimination of waste picking in the streets and burning and illicit dumping in vacant areas.

Karachi SWM Goals and Objectives

- An efficient and expanding <u>municipal waste collection, transfer and disposal</u> <u>service</u> covering all the communities of Karachi, with regularized collection and the efficient and environmentally safe transfer, treatment and disposal of wastes.
- 6. A vibrant and sustainable <u>recycling system</u>, building on the existing habits of primary source segregation (at households and commercial establishments) and improved secondary segregation, where the recycling of wastes is maximized within a healthy and safe working environment.
- 7. Proper collection, storage, treatment and disposal of <u>hazardous wastes</u> generated in Karachi from industrial, medical and other sources.
- 8. Creating an enabling environment and supporting **private sector involvement** in the segregation, recycling, collection, transfer, treatment and disposal of wastes, and prioritizing the involvement of lower income recycler groups wherever possible.



Karachi SWM Sector Performance Indicators

Indicator	Performance Target					
	2013	2020				
Waste Reduction and Recycling						
Recycled waste as a percentage of total waste (tons)	40 percent	50 percent				
Number of Karachi residents aware of and involved in solid waste management issues as a percentage of total population.	100 percent	100 percent				
Waste Collection, Transfer and Disposal						
Number of waste generators serviced by municipal collection (residential and commercial) as a percentage of total number of generators.	90 percent	100 percent				
Amount (tons) of residual waste reaching disposal sites as a percentage of total residual waste generation	90 percent	100 percent				
Number of missed/late waste truck collection cycles as a percentage of total cycles	3 percent	1 percent				
Hazardous Waste Management						
Number of hazardous waste generators serviced by hazardous waste management system as a percentage of total number of generators.	25 percent	100 percent				
Amount (tons) of hazardous waste processed through system as a percentage of total residual waste generation	25 percent	100 percent				

Proposed Strategic Objectives

Issues	Summary Actions	Timeframe	Agency
Strategy 1. Strengthening the L	egal Policy Framework		
Although a national SWM	Review existing laws, rules and regulations on SWM	Q3 (2007) to Q4 (2007)	
framework is in place, a policy	Convene a regulatory working committee	Q4 (2007)	City District Government
urgently needed	Prepare a policy framework.	Q4 (2007) to Q3 (2008)	of Karachi (CDGK) with
	Prepare and enact necessary policy framework legislation	Q2 (2008) to Q3 (2008)	Protection Agency
	Implement a public information campaign regarding policy.	Q4 (2008) Onwards	(SEPA)
	Implement a HWM regulatory development process	Q3 (2008) to Q4 (2009)	
Strategy 2. Rebuilding and Stre	ngthening the SWM Institutions		
Institutional capacity for	Provide long-term capacity building support to CDGK	Q3 (2007 to Q2 (2012)	CDHK
effective SWM is weak at all	Strengthen the capacity of the town SWM administrations	Q3 (2007 to Q2 (2012)	Towns
strengthened	Capacity building at the UC level	Q3 (2007 to Q2 (2012)	UCs
	Strengthen the SWM regulatory agencies	Q3 (2007 to Q2 (2012)	SEPA
Strategy 3. Replacing Municipa	I Infrastructure		
Existing municipal infrastructure	Provide basic infrastructure to UCs	Q1 (2008) to Q2 (2010)	CDGK
is inadequate to meet growing	Develop six regional transfer station systems	Q3 (2007) to Q2 (2012)	CDGK
lieeus	Develop three major regional sanitary landfill (SLF) facilities	Q3 (2008) to Q4 (2011)	CDGK
	Develop a comprehensive HWM system for Karachi	Q3 (2009) to Q2 (2013)	CDGK
	Implement a dumpsite remediation program	Q1 (2010) Onwards	CDGK
Strategy 4. Improving Primary \	Naste Collection and Integrating the Informal Sector		
Primary waste collection	Develop a detailed improvement action plan	Q3 (2007) to Q1 (2008)	
requires urgent improvement to	Identify areas for piloting	Q4 (2007) to Q1 (2008)	CDGK in conjunction with
eliminate illicit dumping and	Implement, evaluate pilots, upscale and replicate as necessary	Q2 (2008) to Q1 (2009)	the 18 towns and 178
integrate the informal sector	Identify enterprise development opportunities	Q1 (2008) to Q4 (2008)	Union Councils
The formalized system	Develop waste picker rehabilitation program	Q1 (2008) to Q2 (2012)	

Proposed Strategic Objectives

Issues	Summary Actions	Timeframe	Agency
Strategy 5. Optimizing Private S	Sector Involvement		
Optimal involvement of the	Enhance private sector involvement in UC primary collection	Q3 (2007) to Q2 (2012)	CDGK/Union Councils
private sector is essential to	Support private sector entities active in the recycling sector	Q3 (2007) to Q2 (2012)	CDGK/Union Councils
the SWM system	Outsource town municipal waste collection services	Q3 (2008) to Q2 (2009)	Towns/CDGK
	Develop transfer station systems utilizing DBO methodologies	Q3 (2007) to Q2 (2012)	CDGK
	Develop sanitary landfill facilities utilizing DBO methodologies	Q3 (2008) to Q4 (2011)	CDGK
	Develop a HWM system through private sector concession arrangements	Q3 (2009) to Q2 (2013)	CDGK
Strategy 6. Engaging the Public			
An effective solution to the	Conduct a survey on Knowledge, Awareness and Practice (KAP)	Q3 (2007) to Q4 (2007)	
SWM problems of Karachi can	Develop an IEC program	Q1 (2008) to Q2 (2008)	
public participation, achieved	Encourage behavioral change through targeted messages	Q1 (2008) Onwards	
through an extensive city-wide	Identify, organize and train key leaders to serve as IEC focal persons	Q1 (2008) Onwards	CDCK
communication (IEC) campaign	Promotion through tri-media exposure and interpersonal interactions,	Q1 (2008) Onwards	CDGK
should be launched using the	Collaborate with informal groups to launch an extensive IEC campaign.	Q1 (2008) Onwards	
interpersonal means	Set up an Ecology Learning Center	Q3 (2008) Onwards	
	Continuously monitor, evaluate and modify IEC campaign effectiveness	Q2 (2008) Onwards	

Recommended Infrastructure Components

- 1. Basic infrastructure for the UC primary collection systems, including collection carts, communal collection bins and where appropriate, small-scale community MRFs.
- 2. Specially designed road collection vehicles to support an efficient, transparent and reliable town municipal waste collection service for each of the 18 towns, in order to pick up all wastes within each respective town, either directly from households/commercial establishments or communal collection points, and transfer the wastes to designated regional transfer stations.
- 3. Six strategically located regional transfer station systems, each to receive wastes from designated town municipal waste collection services, densify the waste, load the waste into large transfer vehicles, and transport the waste to the sanitary landfills.
- 4. Three major regional sanitary landfill (SLF) facilities, designed to full international engineering and environmental standards, capable of collectively providing a minimum of 50 years disposal capacity for Karachi.
- 2. A comprehensive HWM system to provide for the proper management of the city's hazardous waste from industrial, medical and other sources. The system is envisioned to include specially designed waste containers at the generator location, specially designed road vehicles for the collection and transfer of hazardous wastes, and a hazardous waste treatment and disposal facility.



FIGURE 11: SWM FINANCING PLAN															
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Domand															
Estimated Daily Source Generation of Municipal Solid Waste (Tons/Day)	7,481														
Annual Waste Generation Growth (Percent)	2.13	6.00	6.00	5.50	5.50	5.50	5.50	5.50	5.00	5.00	5.00	5.00	5.00	4.50	
Annual At Source Municipal Waste Generation (Million Tons)	2.73	2,89	3.07	3,24	3.41	3.60	3,80	4.01	4,21	4.42	4,64	4.87	5.12	5,35	55.37
At Source Republing Efficiency (As Recent Wet Weight of At Source Total)	10.00	11.15	10.21	12.46	14.60	15 77	16.02	10.09	10.00	20.29	2164	22.60	22.95	25.00	
Residual Waste Entering Primary Collection System (Million Tons)	2.46	2.57	2.69	2.80	2.92	3.03	3.16	3.28	3.40	3.52	3.64	3.77	3.90	4.01	45.15
	15.00			10 IF											
Secondary Recycling Efficiency in Communities (As Percent of Waste Entering Primary System)	30.00	15.38	25.00	20.00	16.54	16.92	17.31	17.69	18.08	18.46	18.85	19.23	19.62	20.00	
Residual Waste in Primary Collection System Post Segregation/Illicit Dumping (Million Tons)	135	147	159	179	2.00	2.22	2.33	2.44	2.55	2.69	2.81	2.97	3.09	3.21	32.51
Street Superings (Other Wester (Demont of Annual At Course Municipal Wester Consertion)	1100	11.00	11.00	11.00	11.00	11.00	1100	11.00	11.00	11.00	11.00	11.00	11.00	11.00	
Street Sweeping/Other Wastes Amount (Million Tons)	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.46	0.49	0.51	0.54	0.56	0.59	6.09
Waste Picked up by Town Collection Service and Delivered to Transfer Stations (Million Tons)	165	1/9	193	2.14	2.37	2.61	2.74	2.88	3.01	3.18	3.32	3.50	3.66	3.80	38.60
Waste Compacted and Transported to Sanitary Landfill Facilities (Million Tons)	165	179	191	2.04	2.13	2.35	2.47	2.59	2,71	2.86	2,99	3.15	3,29	3.42	35.36
Capital Costs (US\$ M illion)															
UC Primary Collection System Infrastructure	-	3.40	3.40	3.40	-	-	-	-	-	-	-	3.40	3.40	3.40	20.40
Transfer Stations															
Korangi Facility	-	4.10	4.10	-	0.50	0.50	-	-	-	-	-	100	1.00	-	11.20
Orangi Facility	-	4.10	4.10	-	0.50	0.50	-	-	-	-	-	100	1 <u>.</u> 00	-	11,20
Mewashaw Facility	-	4.10	4.10	-	0.50	0.50	-	-	-	-	-	100	1.00	-	11.20
Gulshan-e-A bad Facility	-	4.10	4.10	-	0.50	0.50	-	-	-	-	-	100	1.00	-	1120
North Eastern Facility (To Be Determined)	-	-	-	-	4.10	4.10	-	-	-	-	-	-	-	-	8.20
Conitor d andfill Facilities															
Jam Chakro Facility	-	-	-	9.00	9.00	-	-	-	-	9.00	9.00	-	-	-	36.00
Razzagabad Facility	-	-	-	18.00	18.00	-	-	-	-	18.00	18.00	-	-	-	72.00
North Western Facility (To Be Determined)	-	-	-	18.00	18.00	-	-	-	-	18.00	18.00	-	-	-	72.00
Hazardo us Waste Management System															
System for Collection, Transfer, Treatment and Disposal of Hazardous Waste															
Subtotal	-	23.90	23.90	48.40	51.60	6.60	-	-	-	45.00	45.00	8.40	8.40	3.40	264.60
Operating Costs (US\$ M illions)															
Town Municipal Waste Collection (Private Sector Contracts - Cumulative)	2.89	6.25	6.76	7.51	8.30	9.15	9.61	10.09	10.54	11.13	11.62	12.26	12.80	13.29	132.20
Assumed Cost Per Ton US\$ 3.50															
Transfer Station Operations (Including Transfer to Disposal Facility	5.37	11.62	12.55	13.94	15.42	16.99	17.84	18.73	19.57	20.67	21,58	22.78	23.77	24.68	245.51
Assumed Cost Per Ton: US\$ 6.50															
Landfill Disposal	6.61	14.30	15.29	16.30	17.08	18.82	19.76	20.75	2168	22.90	23.91	25.23	26.33	27.34	276.29
Assumed Cost Per Ton: US\$ 8.00															
Subtotal	14.87	32.17	34.60	37.74	40.79	44.96	47.21	49.57	51.79	54.70	57.11	60.27	62.90	65.31	654.00
	<u> </u>														
Strategic Support initiatives (US\$ Millions)															
Strategy 1 SWM Legal Policy Framework	0.10	0.40	-	-	-	-	-	-	-	-	-	-	-	-	0.50
Strategy I: HWW Legal Policy Framework Strategy 2: Rebuilding and Strengthening SWM Institutions	0.20	0.10	0.40	0.40	0.40	0.20	-	-	-	-	-	-	-	-	2.00
Strategy 3: Implementing a Dumpsite Remediation Program	-	-	-	1.00	1.00	1.00	1.00	1.00	100	1.00	1.00	100	1.00	100	11.00
Strategy 4: Improving Primary Collection, Integrating the Informal Sector	0.40	0.80	0.80	0.80	0.80	0.40	-	-	-	-	-	-	-	-	4.00
Strategy 6: Engaging the Public	0.10	0.20	0.20	0.20	0.20	0.10	-	-	-	-	-	-	-	-	100
Subtotal	0.80	1.90	1.80	2.40	2.40	1.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	19.00
	<u> </u>					-			-						
TOTAL	15.67	57.97	60.30	88.54	94.79	53.26	48.21	50.57	52.79	100.70	103.11	69.67	72.30	69.71	937.60
	1	1	1	1		1	1	1	1	I		1	1		



Diagnostic and 'strategic take' of SWM in five DMCs in Central West Asia:

- Understand SWM strategy and policy complexities (or lack thereof)
- Develop initial intervention options / scenarios

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- Sound these development modalities with the respective governments
- Define strategic direction and targeted investments in the selected DMCs

REG-5763: Identifying Solid Waste Management Key Development Challenges and Initial Project Pipeline



Summary: Population

	ARM	GEO	AZE	UZB	KAZ
Population (millions)	3.26	4.44	9.00	28.50	16.09
Urban Population (percent)	64	53	52	37	58
Population Growth (percent)	0.3	0.6	1.2	2.2	1.3
Land Area (km²)	29,800	69,700	86,600	447,000	2,725,000
Population Density (pop/(km ²)	109	64	104	64	6



Summary: Waste Generation (million tons)

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		ARM	GEO	AZE	UZB	KAZ	Total
	Waste Generation (2011)	0.7	1.0	1.5	5.0	3.5	11.7
1	Waste Generation (2030)	1.0	1.5	2.5	7.5	5.0	17.5
l	Total Waste (2011-30)	15.0	25.0	40.0	120.0	80.0	280
	Recyclables (2011-30)	5.0	8.0	12.0	36.0	24.0	85

Summary: SWM System in the CW region

1. Waste Recycling

- No records
- Informal recyclers: unhealthy and wasteful practices
- Unsuccessful centralized schemes
- Recycling: probably <10 percent vs. +30 percent potential in the waste stream
- Lost opportunity?85 million tons to 2030.....





2. Waste Collection and Transfer

- Less than 70 percent of waste collected
- Many rural areas: no collection
- Systems struggling;
 - Lack of collection equipment
 - Small, dilapidated equipment
 - Long haul distances
 - Problematic cost recovery

Summary: SWM System in the CW region

3. Disposal

- About 97 percent of region's waste is burned or dumped in open dumpsites
- Causes significant atmospheric, surface and subsurface pollution
- To 2030, waste dumped in 3m thickness waste piles would cover over 300 km²



Summary: SWM Sector in the CW region

Regulations and Enforcement

- General legislative frameworks are in place, specific provisions are not
- Scattered ancillary provisions (UZB has 50+ secondary legislative documents)
- Environment ministries enforce regulations
- Enforcement is extremely weak
- Awareness of climate change and other international obligations 'paper thin'

Institutions

- National agencies plan and regulate; municipalities operate
- Major capability deficiencies at all levels; often do not understand SWM basics
- Unanimous sector concern expressed in national ministries in all countries
- Municipalities; focus only on truck and dump operations ('out of sight out of mind')

Summary: SWM Sector in the CW region

Private Sector Involvement To Date

- Informal recyclers in each nation; recycle tiny fractions, unhealthy practices
- Widespread 'contracting' of waste collection; annual contracts, often to SOE
- Dumpsites; public and private ownership, fees paid
- Examples;
 - Tbilisi; Government-owned company runs system on commercial basis
 - Baku; Two major private collection contractors, SOE runs disposal facility
 - Almaty; 32 collection contractors, private operator at major dumpsite

Cost Recovery and Tariffs	Tariffs (US\$/cap/month)	Capital	Cities
- Blending of consumer tariffs and central /	Armenia	0.56	≤ 0.40
municipal funds	Georgia	1.40	≤ 0.90
in place (a good sign)	Azerbaijan	0.15	≤ 0.15
Majority of tariffs unable to cover even	Uzbekistan	1.00	≤ 0.30
UAIVI	Kazakhstan	1.12	≤ 0.70

Critical Conclusions: SWM in the CW Region

The demand driver is highly significant: at least 280 million tons of waste to 2030

- Practically all SWM systems are incapable of meeting demand
- Coherent and integrated SWM development strategies do not exist
- Regulatory frameworks are in place, but weak, need refinement / enhancement
- Acute environmental degradation, threats to public health and the environment
- Institutional capacity for effective SWM is nascent.

SWM infrastructure and service delivery extremely weak or non-existent

- Tariffs are in place, but essentially too modest / not robust enough for cost recovery
- Waste collection, treatment and disposal are rudimentary in most places
- Waste segregation and recycling are still in infancy
- Recycling offers a significant development potential



Pressure is growing to deliver improved strategic, operational, technical and investment responses to SWM challenges

Strategic Direction for each of the five DMCs

Three key actions;

- 1. Focused / sharpened national SWM strategy
- 2. Prioritized and properly sequenced SWM investment program
- 3. Comprehensive institutional reforms and capacity support programs



Action 1 National SWM Strategy

- Define sector goals and objectives,
- Refine policy to meet goals,
- Strengthen the legal and regulatory framework,
- Define sector demands,
- Evaluate SWM best practices to meet demands,
- Select preferred SWM systems and processes,
- Identify and prioritize SWM system investments, including PPP,
- Evaluate costs and rationalize cost recovery mechanisms,
- Recommend sector assistance and institutional capacity building programs.

National SWM Strategy: Guiding Principles

- Waste is a resource
- All individuals must assume responsibility for the waste they generate
- Prevention, reduction and recovery for recycling and reuse is a priority focus
- Source (household) segregation is essential to any sustainable solution
- The informal private sector plays a critical role in recycling
- Active public participation is essential
- Residual waste must be properly handled, treated and disposed
- The SWM system has to be run on efficient performance-based commercial principles
- Private sector participation should be prioritized, and an enabling environment created
- Economic incentives need to be established
- All stakeholders have different roles and responsibilities in ensuring effective SWM, and they should be effectively integrated.

Action 2 SWM Investment Program

Objectives

- Phased investments in target regional centers and intermediary cities
- Commence with cities and regions with highest pressure points
- Provide comprehensive, modern and sustainable
 SWM system in each
- Meet internationally recognized best operational practices, standards and environmental commitments



A. Waste Collection Systems

- Improved and expanded waste collection systems
- Improvements to communal waste collection points
- Waste containers
- Waste collection vehicles

B. Waste Transfer Systems

- Large distances between urban and rural areas; waste transfer costs need to be minimized
- Consolidation of waste at transfer stations, and more complex transfer stations for urban areas with higher waste flows



C. Waste Disposal Systems

- Sanitary landfills designed to stringent specifications
- Waste is encapsulated, contaminated liquids and gases captured and treated
- Meet international environmental standards

D. Waste Recycling Systems

- Likely to include source (household, curbside) segregation and recycling
- Primarily an informal, private sector operation, with Government support and oversight



Action 3 Institutional Reforms and Capacity Support Programs

Institutional strengthening

Overall governance and accountability SWM sector strategic planning Operational management and technical capacity PPP assessment and involvement

Regulatory framework

Rationalizing (simplifying) existing legislation Supplementing with ancillary regulations Strengthening enforcement processes, including selfenforcement procedures





Action 3 (Continued) Institutional Reforms and Capacity Support Programs

Waste minimization and recycling Setting realistic goals Strategic stakeholder assessment Strategy formulation and implementation Long term Government support

Tariff development and cost recovery Sector financing review Medium term financing needs assessment Financing options, tariffs, PPP

Media and public awareness programs Understanding the sector How to minimize and segregate waste General environmental and waste handling education

ADB TA REG-7635: Identifying Solid Waste Management Key Development Challenges and Initial Project Pipeline FIGURE 16: ARMENIA INDICATIVE SWM SECTOR INVESTMENT PROGRAM												
		YEAR										
ACTIVITY		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1. SWM SECTOR INVESTMENT PROGRAM PREPARATIONS	2.0											
National SWM Strategy: Formulation and Approval	0.6											
SWM National Invstment Program: Formulation and Approval	0.5	<u> </u>	1									
Capacity Support Program: Formulation and Approval	0.2											
Yerevan SWM System PPP Support	0.7		- • • •									
2. NATIONAL SWM INVESTMENT PROGRAM (INDICATIVE)	95.0											
Phase I Investment Package	45.0	DESIGN CONSTRUCTION OPERATION										
SWM Systems in; Lake Sevan and Ararat Valley												
Phase II Investment Package	35.0					DESIGN	CONSTR	RUCTION		OPER	ATION	
Possible SWM Systems in;												
Gyumri, Vanadzor, Goris. Chambarak and Kapan												
Phase III Investment Package	15.0								DESIGN	CONSTR	RUCTION	OPERATION
Possible SWM Systems in;												
Stepanavan, Noyumberyan, Idjvan, Yeghognadzor and Others.												
3. SWM CAPACITY SUPPORT PROGRAM	3.0											
	3.0											
TOTAL	100.0	- <u></u> -	• # # -	• • • •		• 4 8 4	• # # {	<u> </u>	• # # f			• • • • •

PATA Outcomes (Sep-2013)

Uzbekistan

- ADB-funded US\$ 80 million Tashkent SWM investment program scheduled for Board approval in Q4, 2013
- Program includes rehabilitation and expansion of entire SWM system, provision of a new disposal site to 2060, and options to move to waste-to-rail
- Includes a capacity support package to assist to formulate a national SWM strategy, a citywide recycling program, and a media and public awareness campaign.
- Based on the strategy, Government is keen to move ahead with similar investments in Samarkand, the Fergana Valley and other urbanized areas

Armenia

- ADB-funded SWM investment program for the Sevan Lake and Ararat Valley regions to be formulated by mid-2014, including provision for national strategy development

Azerbaijan

 Potential PPTA in 2014 to formulate a SWM investment program for selected urban areas, including a national strategy

Kazakhstan and Georgia

- Under consideration

A New Paradigm: Regional Landfills in Armenia



Regional Landfills in Georgia



Regional Landfills in Uzbekistan





Regional Landfills in Uzbekistan



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A New Paradigm: Waste-to-Rail in Uzbekistan



Uzbekistan main Railway network 50 km collection zone alongside the railway



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