

Integrated Waste Management Planning in the Southern Region of Azerbaijan

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1 Introduction

A new National Solid Waste Management Strategy (NSWMS) has been recently developed for the country of Azerbaijan. Key principles underlying the development of the strategy are the integrated waste management approach, the acceptance of the 4 R's (reduce, reuse, recycle, recover) as priority steps and the adoption of the polluter pays principle. Towards that direction, the strategy has introduced new technical, legal, institutional, financial and social framework arrangements.

In this context, the Southern Region of Azerbaijan (Lankaran Region) was the first area in the country to develop an integrated waste management plan that is in accordance with the new targets and framework arrangements.

The plan was developed in the framework of the Program EuropeAid/135522/DH/SER/AZ by the companies ICP Ingenieurgesellschaft mbH, EPTA SA and Enviroplan SA.

The target area is located in the southern part of the Republic of Azerbaijan and consists of six administrative areas (Rayons). It is bordered by Iran to the west and south and by the Caspian Sea to the east. The total population of the area is 893,458 inhabitants. Rural population represents 72.8% and urban population 27.2% of the total population. The economy in the region is focussed on agriculture and the food industry.



Figure 1: Lankaran Economic Region

2 Methods

For the development of the waste management plan, a systematic approach was used. The first step was to assess the existing situation in waste management in terms of technical, financial, social and institutional capacity. For this reason, several missions took place in the Region. During those missions, interviews were held with the heads of the Rayons and the Departments for Housing and Communal Services (DHCS), which are responsible for waste management. In addition, a weighing campaign was implemented, during which the amount of collected waste and the capabilities of the existing collection system were documented. Prior to the meetings, a comprehensive questionnaire was prepared by the consultant and sent to the DHCS. The information provided in the questionnaires were confirmed during the meetings. The assessment of the existing situation delivered input data for the elaboration of the waste management plan and a matrix with deficiencies in the waste management sector.

As a next step, four alternative waste management scenarios were created and evaluated. For the purposes of selection of the appropriate waste management system, the PROMETHEE II (Preference Ranking Organization Method for Enrichment Evaluation) method has been used.

Based on the final scenario recommended the consultant elaborated a phased roll out plan for the staged implementation of the foreseen infrastructure and an investment plan with different financing options.

3 Current situation analysis

3.1 Waste amount and composition

The yearly estimated waste quantity amounts to 98,115 tons. From that amount 57% is produced in urban and 43% in rural areas. The waste composition is presented in the next table.

Table 1: Waste amount and composition (2015)

Waste fractions	Yearly quantity (tn)	Yearly quantity (%)
Total recyclables produced (paper/cardboard, plastic, glass, metal)	27,050	27.6%
C&D waste and sand	3,748	3.8%
Electrical and electronic waste	383	0.4%
Household hazardous waste	912	0.9%
Organic waste	44,338	45.2%
Wood and mixed garden waste	10,224	10.4%
Textile, shoes and leather	3,032	3.1%
Other	8,428	8.6%
Total waste produced	98,115	100%

The specific waste production per capita ranges between 0.3-0.65 kg/cap/day.

3.2 Collection

The collection coverage rate (%) for urban and rural population, per Rayon as reported by the respective DHCS is the following:

Table 2: Collection coverage rate in urban and rural regions

No.	Rayon	Urban population (Rayon capital cities) %	Rural population %
1	Lankaran	40-50	0
2	Masalli	40	0
3	Jalilabad	40	0
4	Astara	30	0
5	Lerik	100	0
6	Yardimli	100	0

This practically means that collection services are only offered only in the major cities of the Region. Around 80% of the vehicles actively used for collection are relative new. However, their condition is not always good. Most vehicles have bald tyres and rusted or damaged parts.

During a weighing campaign that was implemented in the cities of Lankaran and Massali the capabilities of the existing collection vehicles were assessed. The average amount of waste collected was 2-2.5 tons/round.



Figure 2: Refuse collection vehicles (RCV)

Collection containers are placed mainly on central roads, avenues, and other central points of interest such as squares, parks etc. There are two types of waste containers used for the collection of waste. The first type is a two-wheeled metal container with a capacity of approximately 300-350 L. The second type is a four-wheeled metal container with a capacity of approximately 1,000 L. Around 50% of the containers are damaged (lid missing, holes, wheels broken) and/or rusted.



Figure 3: Collection containers

3.3 Waste treatment and disposal

No waste treatment takes place in the Region, except from a small pilot initiative in the Masalli Rayon. Currently, there is also no sanitary landfill and waste is disposed in uncontrolled dumpsites.



Figure 4: Uncontrolled dumpsites

3.4 Institutional structure

The central government and the regional divisions of the Ministries (mostly the Ministry of Economy and the Ministry of Ecology and Natural Resources) are in charge of waste management planning, policy or strategies at national and regional level. In the Regions, the Rayon Executive Powers (REP) are responsible for the collection, treatment and disposal of household waste. The REPs have the authority to design and construct new infrastructure in their administrative areas, however the central government should ensure project financing. The DHCS is the competent department within the REP to provide waste management services. The Municipalities are not involved in waste management operations at all.

3.5 Financial situation

Funding for municipal solid waste (MSW) management in the Lankaran Region is mainly provided by the central government. The governmental subsidies granted for waste management activities cover 53% to 96% of the total expenses depending on the Rayon. The rest of the expenses are covered through the collection of fees from the users of the waste management system. The official tariff for the population is 3.6 AZN/inh./year (2.11 €/year). However the affordability rate per individual is estimated to 10 AZN/year (5.87 €/year).

The conversions are based on the exchange rate of 1 Euro = 1.7008 AZN as per 17.05.2016 (source: Central Bank of the Republic of Azerbaijan)

The fee recovery rate is very low and this leads to an over-dependence on funding from the central government. In the major cities fee recovery from the population is estimated to range between 6-43% of the total inhabitants.

4 Evaluation of alternative waste management scenarios

After having established the baseline the next step was to formulate and assess alternative waste management scenarios in order to select the most appropriate one to be used as a basis for the new waste management plan. The scenarios were based on the newly established objectives and targets for waste management and took into account regional waste production and composition as well as the existing waste system infrastructure. The four scenarios are presented in the following table:

Table 3: Alternative waste management scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Collected waste fractions	- MSW - Green Waste	- MSW - Green Waste	- MSW - Green Waste - Recyclables	- MSW - Green Waste - Recyclables - Organics
Civic Amenity Centres	√	√	√	√
Home composting				√
Mixed bin treatment		√	√	√
Recyclable waste bin			√	√

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
treatment				
Organic waste bin treatment				√
Garden / wood waste treatment	√	√	√	√
Regional sanitary landfill	√	√	√	√

For the purposes of selection of the appropriate waste management system, the PROMETHEE II (Preference Ranking Organization Method for Enrichment Evaluation) method has been used. The evaluation criteria of the multi-criteria analysis are presented in the next table:

Costs Criteria	Sustainability Criteria
(C1) Capital investment cost	(S1) Governance principles
(C2) Recurrent cost affordability	(S2) Skills capacity needed
(C3) Market demand for by-products	(S3) Natural resource conservation
	(S4) Environmental quality protection
	(S5) Public health protection
	(S6) Socio-cultural preferences

The **recommendation** of the study was to implement scenario 3, which includes the following:

- Upgraded collection of mixed municipal waste
- Separate collection of recyclable materials
- A Regional sanitary landfill
- A Regional mechanical biological treatment plant
- Waste transfer stations network
- Civic amenity centres

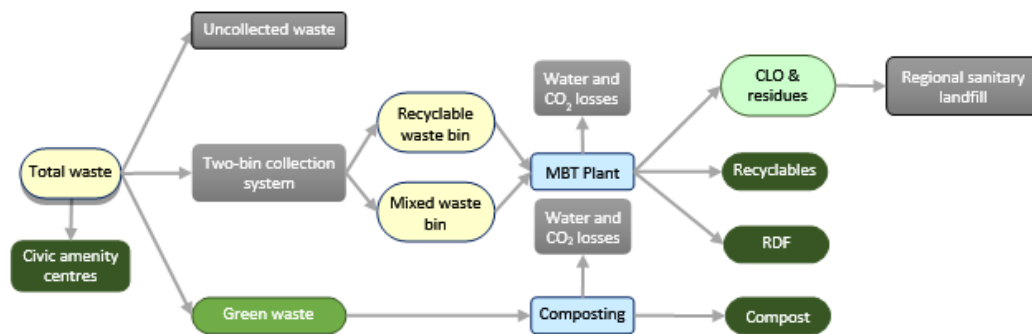


Figure 5: Recommended waste management scenario

The proposed scenario is foreseen to be implemented within a period of 20 years and is part of a regional waste management strategy, which is divided in three distinct phases. Each phase includes new investments and upgrades, which all are aligned with the arrangements of the National Solid Waste Management Strategy.

5 Investment and phased rollout plan

The investments proposed by the waste management plan over a period of 20 years are presented in the next table. The technical level of all investments considered has been tailored to the needs of the Region in order for the services to be affordable to operate and maintain.

Table 4: Proposed investment plan

	Phase 1 (2017-2022)	Phase 2 (2023-2029)	Phase 3 (2030-2036)
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	Phase 1 (2017-2022)	Phase 2 (2023-2029)	Phase 3 (2030-2036)
Total investment cost (AZN)	48,377,218	50,754,182	9,464,350
Total investment cost (€*)	28,443,801	29,841,358	5,564,646
Regional sanitary landfill	- Construction of infrastructure works (e.g. administration building, leachate treatment plant, guard house etc) - Construction of cell 1 for untreated waste	- Operation of cell 1 for untreated waste - Construction of cell 2 for treated waste from the MBT	- Construction of cell 3 for treated waste from the MBT - Operation of cell 2
Mechanical biological treatment (MBT) plant	-	- Construction of MBT plant	- Operation of MBT plant
Composting for green waste	- Construction using windrow composting technology	- Operation of composting plant	- Operation of composting plant
MSW collection (new trucks and containers)	- Implement upgraded collection services - Procurement of vehicles - Procurement of containers	- Implement upgraded collection services - Procurement of vehicles - Procurement of containers	- Implement upgraded collection services - Procurement of vehicles - Procurement of containers
Green waste collection	- Implement green waste collection - Procurement of open trucks	- Implement green waste collection - Procurement of open trucks	- Implement green waste collection - Procurement of open trucks
Recyclables collection	- Procurement of vehicles - Procurement of bring banks	- Implement recyclables collection through bring banks - Procurement of vehicles - Procurement of bring banks	- Implement recyclables collection through bring banks - Procurement of vehicles - Procurement of bring banks
Waste transfer stations (WTS)	- Construction of infrastructure works - Procurement of containers - Procurement of waste transportation vehicles	- Operation of WTS - Procurement of containers - Procurement of waste transportation vehicles	- Operation of WTS
Civic amenity centres (CAC)	-	- Construction of infrastructure works (e.g. paved area) - Procurement of mobile equipment	- Operation of CAC - Procurement of additional mobile equipment
Upgraded disposal in existing dumpsites	- Construction of infrastructure works	-	-

	Phase 1 (2017-2022)	Phase 2 (2023-2029)	Phase 3 (2030-2036)
	- Implement upgraded disposal		
Closure of open dumpsites	- Closure of dumps not used for upgraded disposal	- Closure of all dumpsites	-
Municipal garage /depot	- Upgrade/expand the existing depots - Construct new garage/depot	- Necessary expansions/upgrades in order to facilitate the additional vehicles	- Necessary expansions/upgrades in order to facilitate the additional vehicles

* based on the exchange rate of 1 Euro = 1.7008 AZN as per 17.05.2016 (source: Central Bank of the Republic of Azerbaijan)

6 Financing Options

In order to finance the necessary investments three options were considered. The options took into account different percentages of financing by the state and financing by debt (loan).

- Financing Option 1: State financing 25% - Loan 75%
- Financing Option 2: State financing 50% - Loan 50%
- Financing Option 2: State financing 100% - Loan 0%

The debt terms assumed are the following: loans are (secured) denominated in AZN. Loan Maturity: 15 years. Type of loan: annuity / annual payment, grace period: 1 year while interest charges during grace period are capitalized (rolled-up). The borrowing nominal annual interest rate is 3% (fixed).

In all cases the amount (AZN) that has to be paid by the inhabitants of the Lankaran Region for full cost recovery was calculated and compared to the current base affordability of 10 AZN/inh/year.

	Phase 1	Phase 2	Phase 3
Required annual fee (in AZN) to be paid per inh. for full cost recovery	41	47	30
% increase of base affordability (10 AZN/inh.)	407%	472%	298%
Projected Gate Fee (AZN/tn)	n/a	47	67

	Phase 1	Phase 2	Phase 3
Required annual fee (in AZN) to be paid per inh. for full cost recovery	36	42	26
% increase of base affordability (10 AZN/inh.)	363%	416%	262%
Projected Gate Fee (AZN/tn)	n/a	42	64

	Phase 1	Phase 2	Phase 3
Required annual fee (in AZN) to be paid per inh. for full cost recovery	28	31	19
% increase of base affordability (10 AZN/inh.)	276%	305%	192%
Projected Gate Fee (AZN/tn)	n/a	30	58

7 Conclusions

The current waste management practices in the Region lag behind both the international standards and the waste management efficiency achieved in the greater Baku area. In addition, the forecasted population increase in the Region will only amplify the problems created by uncontrolled disposal and low collection coverage.

The implementation of the strategy will result to the improvement of the standards of living in the Region and will result to considerable benefits such as protection of public health, increased employment, recovery of resources and protection of the environment. Anticipated benefits include:

- Protection of the public health
Currently all the waste collected is disposed in open dumpsites. With the implementation of the proposed waste management plan new infrastructure will be constructed in order to mitigate the hazards from uncontrolled landfilling. In addition, the upgraded collection services will reduce the risks for public health from prolonged storage of waste in the curb.
- Increased employment in the Lankaran Economic Region
Currently 589 persons are employed in the DHCS of all Rayons and only a part of them is directly involved in waste management. With the implementation of the proposed regionalized waste management plan, it is expected that at least 850 employees will have to be directly involved with waste management operations.
- Recovery of recyclable materials
It is estimated that around 18% (by weight) of the collected waste will be recovered as recyclable material twenty (20) years after the implementation of the regional waste management plan through the civic amenity centres, recyclable material bins and the MBT facility. The respective revenues are estimated to 19 AZN per tn of collected waste considering current prices of recyclable materials.
- Protection of the air, water and earth resources in the region
The construction of the sanitary landfill, the closure of the open dumps, the increase of the collection coverage and the implementation of recycling schemes will contribute to the increased protection of air, water and earth resources in the Region.
- Reduction of waste for disposal
It is estimated that around 47% (by weight) of the produced waste will be diverted from landfills and dumpsites through the upgraded waste collection and treatment services 20 years after the implementation of the regional waste management plan.
- Landscape improvement and visual impact
Rehabilitation of the existing dumpsites will contribute to the improvement of the existing landscape and will benefit the visual impact of the Region to both permanent residents, tourists and other visitors.

8 References

EuropeAid/135522/DH/SER/AZ, Pre-feasibility Study for Regionalized Waste Management in the Southern Region of Azerbaijan, ICP Ingenieurgesellschaft mbH –EPTA SA-ENVIROPLAN SA, 2016