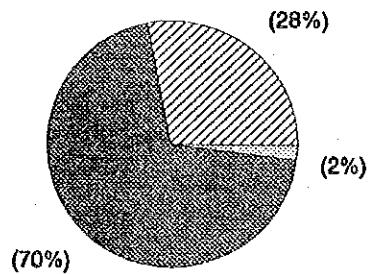
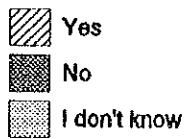


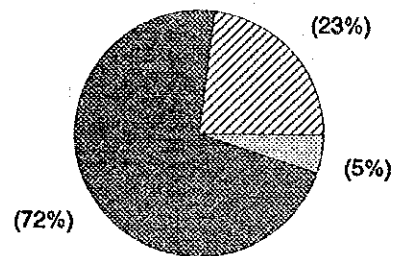
Q3--8 Do you discharge waste at fixed time?

	Residential Area	Commercial Area
Yes	28 %	23 %
No	70 %	73 %
I don't know.	2 %	5 %

Legend



Residential Area

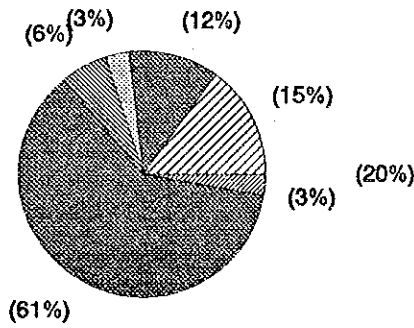
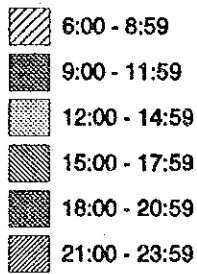


Commercial Area

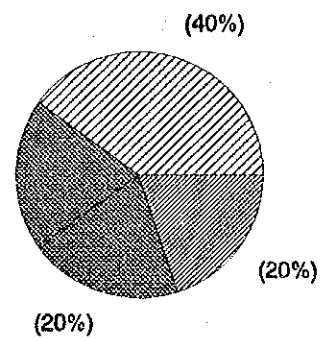
Q3--9 If "Yes", what time do you usually discharge your waste?

	Residential Area	Commercial Area
6:00 - 8:59	15 %	40 %
9:00 - 11:59	12 %	20 %
12:00 - 14:59	3 %	0 %
15:00 - 17:59	6 %	0 %
18:00 - 20:59	62 %	20 %
21:00 - 23:59	3 %	20 %
24:00 - 2:59	0 %	0 %
3:00 - 5:59	0 %	0 %
I don't know.	0 %	0 %

Legend



Residential Area









Commercial Area

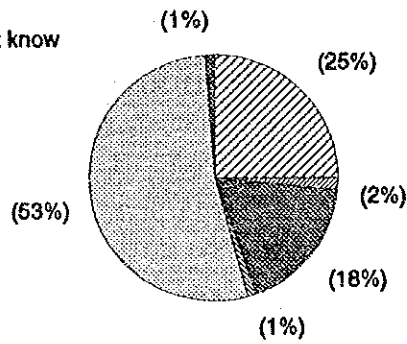
Q3-10 What type of container do you use for waste collection?

	Residential Area	Commercial Area
Individual container of the MPO (110 liter)	25 %	32 %
Individual container other than the one of MPO	1 %	9 %
Communal container of the MPO	53 %	54 %
Communal container other than the one of MPO	1 %	5 %
Others	18 %	0 %
I don't know.	2 %	0 %

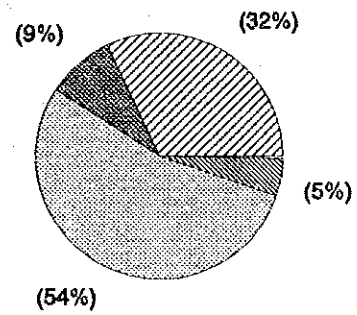
Note: Contents of "others";  
 - dust chute - 15 answers  
 - metal containers - 1 answer  
 - no container - 1 answer

Legend

-  MPO container 110 l
-  Individual container
-  Communal MPO contain
-  Other communal cont.
-  Others
-  I do not know



Residential Area







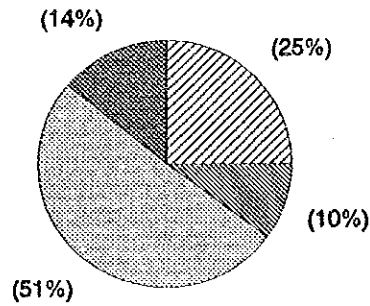
Commercial Area

Q3-11 Where is your container for waste collection located?

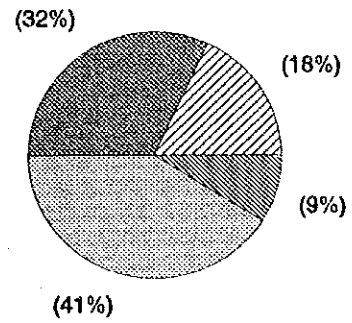
	Residential Area	Commercial Area
In front of my premises	25 %	18 %
Behind the premises	14 %	32 %
Communal container yard of the building	50 %	41 %
Curb side near my building	10 %	9 %

Legend

-  In front of premises
-  Behind the premises
-  Communal cont. yard
-  Curb side near house



Residential Area



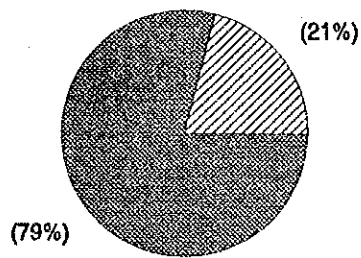
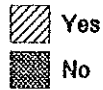
Commercial Area

Q3-12 Do you have any problems of your container for waste collection?

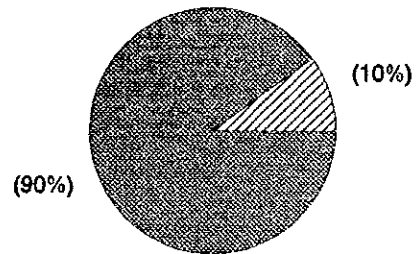
	Residential Area	Commercial Area
Yes	21 %	10 %
No	79 %	90 %

If yes, please answer to the question No.3-13.

Legend



Residential Area



Commercial Area

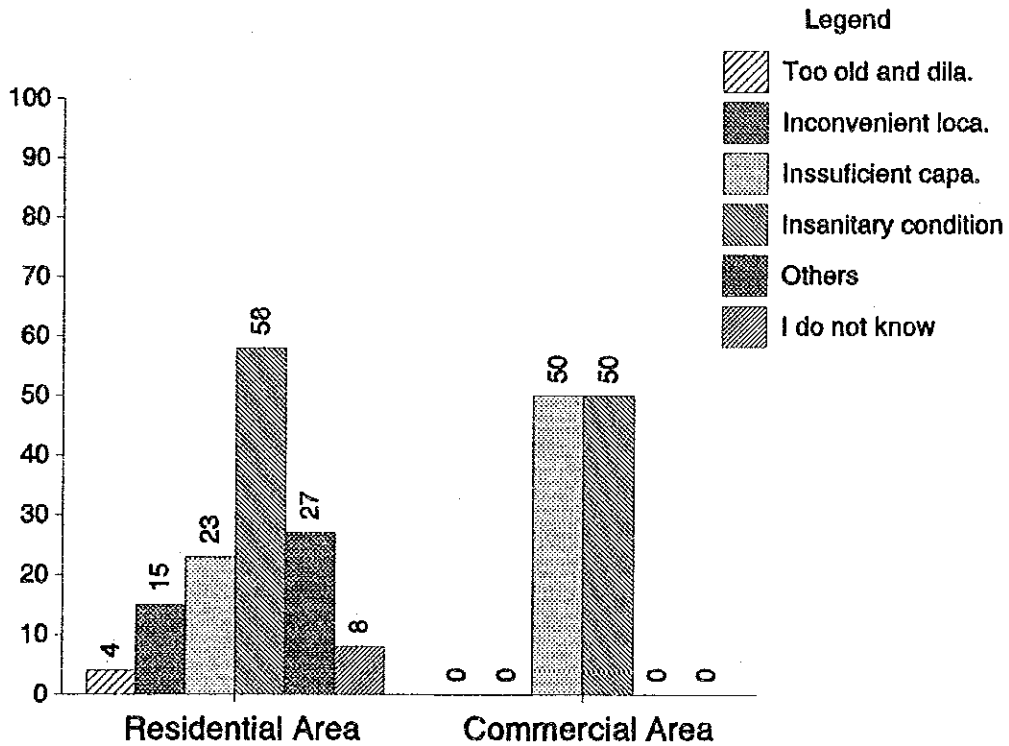
Q3-13 What is the problem(s) of your container(s)? (Plural answer)

	Residential Area	Commercial Area
Too old and dilapidated	4 %	0 %
Inconvenient location	15 %	0 %
Insufficient capacity	23 %	50 %
Insanitary condition	58 %	50 %
Others	27 %	0 %
I don't know.	8 %	0 %

Note: Contents of "others";

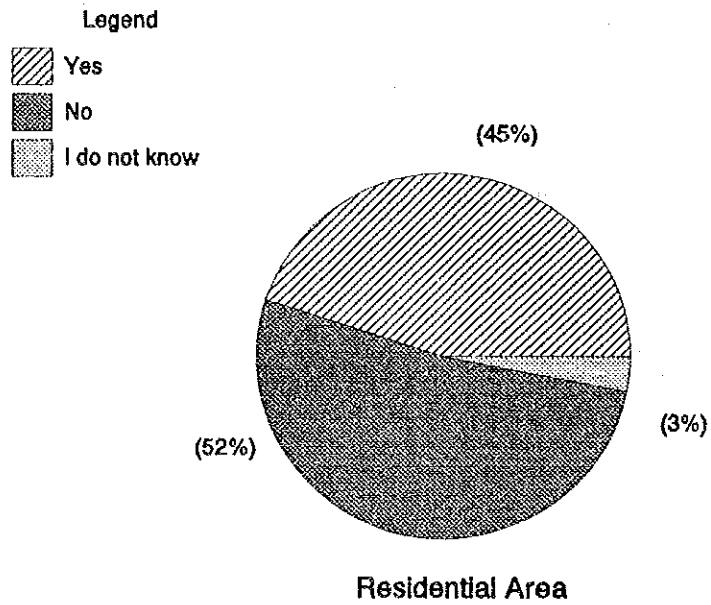
- hole in dust chute is too small - 1 answer
- no containers for old bread for animals - 1 answer
- rats in the container - 1 answer
- workers from MPO sometimes destroys containers - 1 answer
- difficult to open the container - 2 answers

If you answer 3.dust chute to the question No.3-5, please answer to the question No.3-14 and No.3-15.



Q3-14 Are you able to co-operate to carry your waste to communal containers fixed in your areas without using dust chute, if you are requested so.

	Residential Area
Yes	45 %
No	52 %
I don't know.	3 %







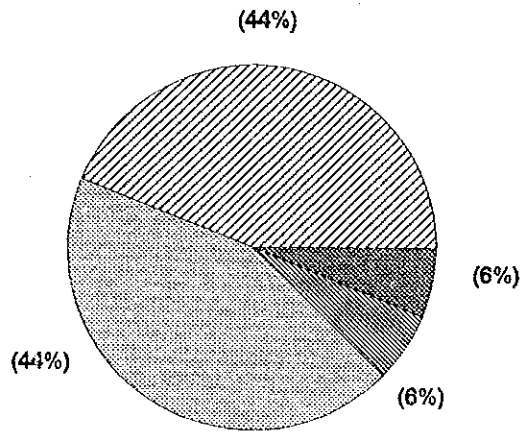
Q3-15 If "No", what are the reasons?

	Residential Area
Present system is better.	44 %
We have nobody who will carry the waste to communal containers.	0 %
Communal containers are far.	44 %
Communal containers are not hygienic.	6 %
Others	6 %

Note: The answer of "others" is that waste compartment is often closed.

Legend

-  Present system OK
-  Containers are far
-  Cont.-not hygienic
-  Others



Residential Area








Q3-16 How are your bulky wastes disposed? (such as large condemned furniture or electric appliances)

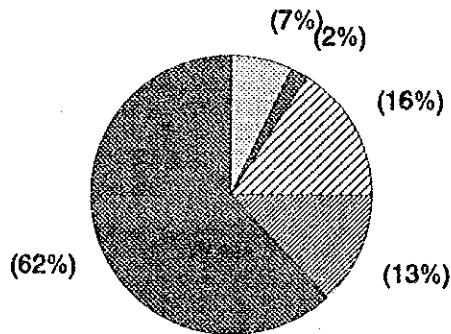
	Residential Area	Commercial Area
Collected by the WPO	16 %	5 %
Sold and/or collected by special collector	2 %	5 %
Carry to landfill site by ourselves	7 %	5 %
Sold to Junkyard	0 %	0 %
Others	63 %	32 %
I don't know.	13 %	55 %

Note: Contents of "others";

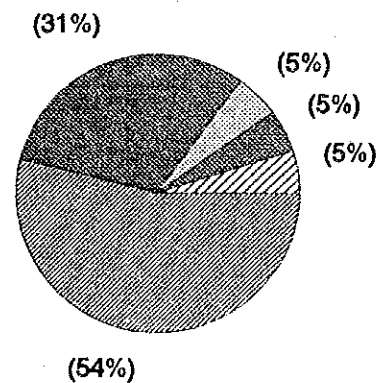
- given or sold to other family members - 9 answers
- given or sold to other people - 4 answers
- we don't have such a waste - 48 answers
- we leave it near the containers ( somebody can take it from this place, if he needs ) - 17 answers
- we keep it in the besement, garage etc. - 4 answers
- we burn it - 6 answers
- we burn it or keep it - 2 answers

Legend

-  Collected by MPO
-  Another collector
-  Disposed by ourselves
-  Others
-  I do not know



Residential Area



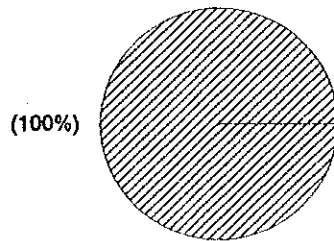
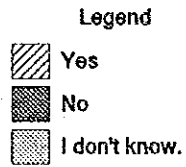
Commercial Area

#### IV Questions on Services of Waste Collection in Your Area

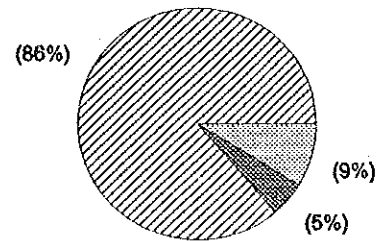
Q4-1 Is there a collection service in your area?

	Residential Area			Commercial Area
	Apartment	Detached	Total	
Yes	100 %	100 %	100 %	86 %
No	0 %	0 %	0 %	5 %
I don't know.	0 %	0 %	0 %	9 %

If "Yes", please answer the followings; (No.4-2 - No.4-9), otherwise go to V.



Residential Area



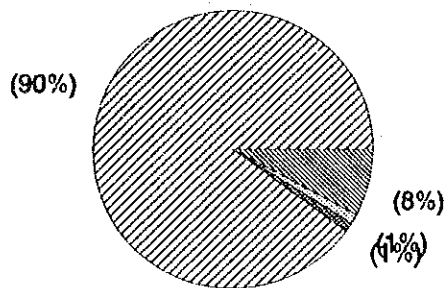
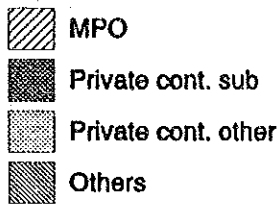
Commercial Area

Q4-2 Who collects your wastes?

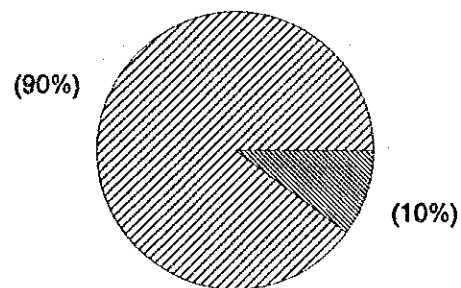
	Residential Area	Commercial Area
MPO	91 %	90 %
Private contractor sub-contracted by MPO	1 %	0 %
Private contractor other than the above	1 %	0 %
Others	8 %	10 %

Note: contents of others;  
 - I don't know - 10 answers  
 - cooperative -1 answer

Legend



Residential Area

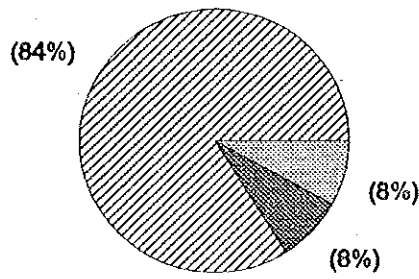
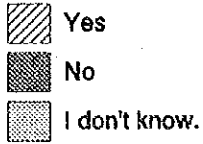


Commercial Area

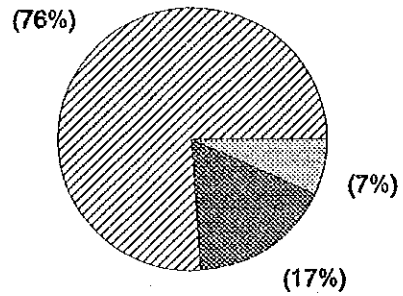
Q4-3 Are you satisfied with the collection service?

	Residential Area		Commercial Area
	LPEC	Non LPEC	
Yes	84 %	76 %	80 %
No	8 %	17 %	10 %
I don't know.	8 %	7 %	10 %

Legend

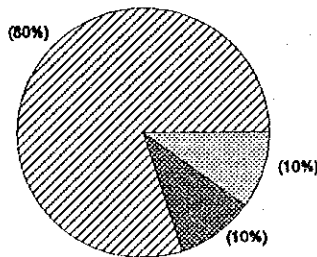


LPEC



Non PEC

Residential Area



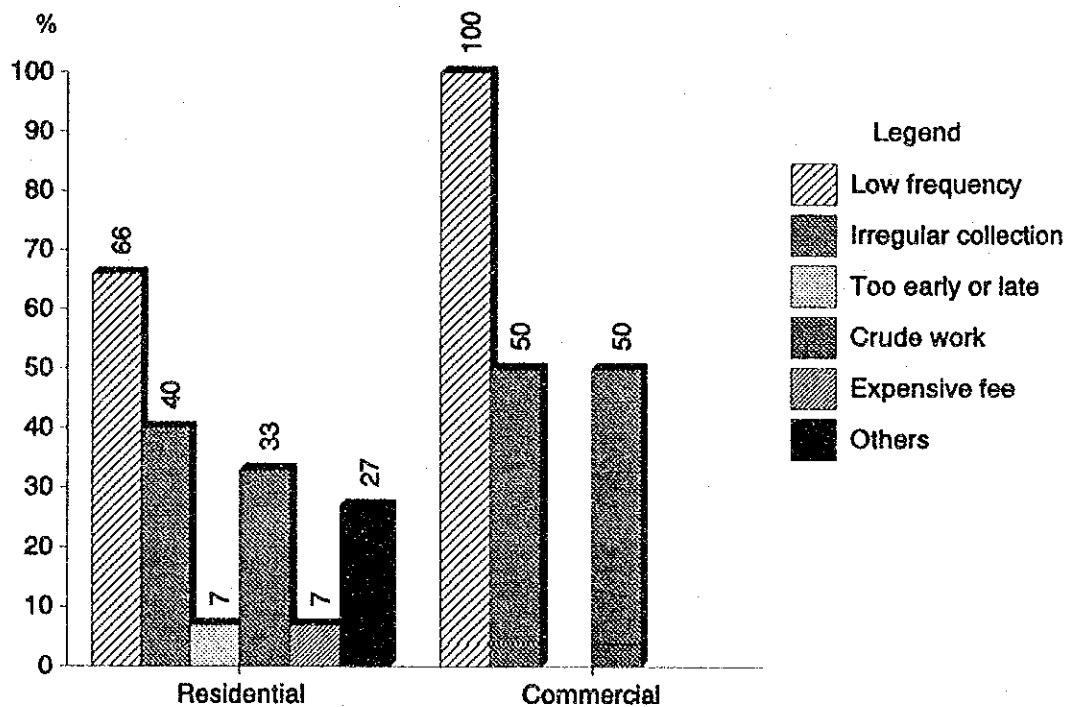
Commercial Area

Q4-4 If "No", what are the reasons? (Plural answer)

	Residential Area	Commercial Area
Frequency of collection service is low.	66 %	100 %
Collection time is irregular.	40 %	50 %
Collection time is very early or late.	7 %	0 %
Behavior of workers are bad.	0 %	0 %
Collection work is crude.	33 %	50 %
Collection fee is expensive.	7 %	0 %
Collection fee system is not fair.	0 %	0 %
Others	27 %	0 %

Note: Contents of "others";

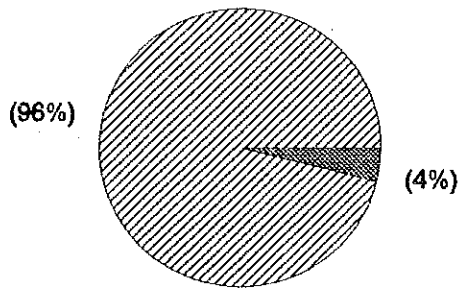
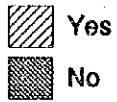
- noise, dust - 1 answer
- bad sanitary conditions - 1 answer
- MPO workers broke containers - 1 answer
- containers may sometimes block gates - 1 answer
- insufficient number of containers - 1 answer



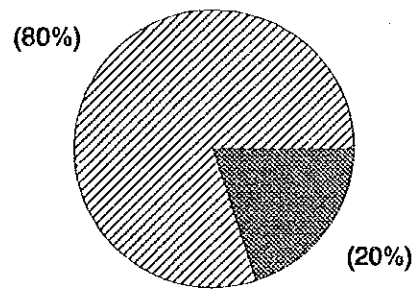
Q4-5 Do you know how the waste discharged from your house is collected?

	Residential Area	Commercial Area
Yes	96 %	80 %
No	4 %	20 %

Legend



Residential Area



Commercial Area






Q4-6 If "Yes", how is the waste collected?

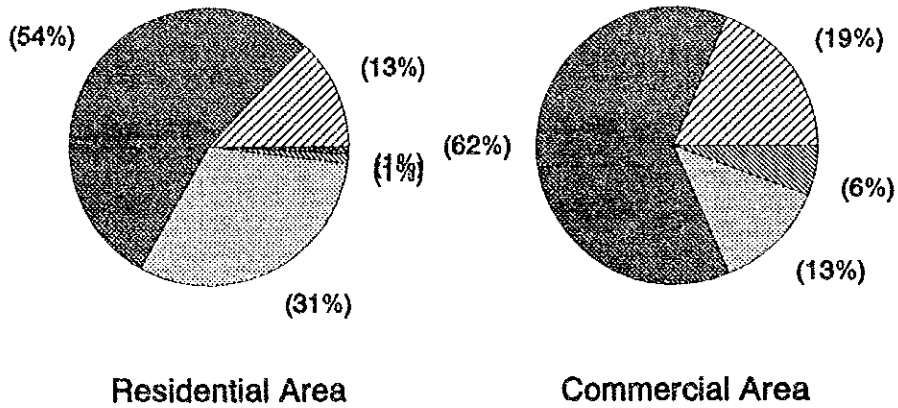
	Residential Area	Commercial Area
Door to door collection system by collection worker.	13 %	19 %
Residents, themselves carry waste to a communal container.	54 %	63 %
Collection from dust chute in the building.	31 %	13 %
Others	1 %	6 %
I don't know.	1 %	0 %

Note: Contents of "others";

- some residents burn, some discharge to the container - 1 answer
- containers are emptied by unidentified firm - 1 answer

Legend

-  Door to door collect
-  Residents-themselves
-  Dust chute
-  Others
-  I do not know










Q4-7 How often is your waste collected?

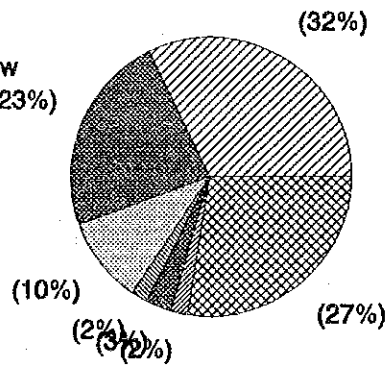
	Residential Area	Commercial Area
Once 3 days	32 %	25 %
Once 3 - 7 days	23 %	25 %
Once 8 - 14 days	10 %	0 %
Once 15 - 20 days	2 %	5 %
Once 21 - 30 days	3 %	0 %
Others	2 %	10 %
I don't know.	27 %	35 %

Note: Contents of "others;"

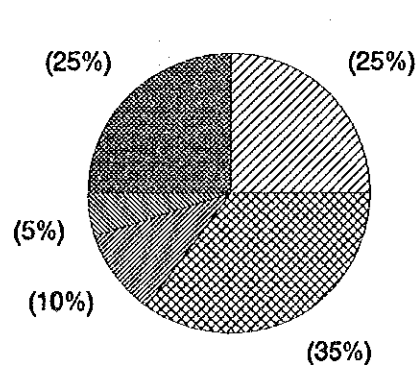
- every day - 4 answers
- every 2 days - 2 answers
- every few days - 1 answer
- when we ask - 1 answer
- not regulary - 1 answer
- almost every day - 1 answer

Legend

-  Once 3 days
-  Once 3 - 7 days
-  Once 8 - 14 days
-  Once 15 - 20 days
-  Once 21 - 30 days
-  Others
-  I do not know



Residential Area



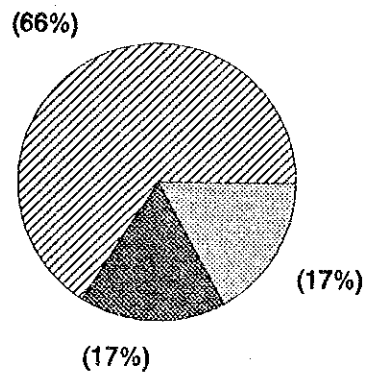
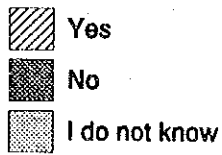
Commercial Area



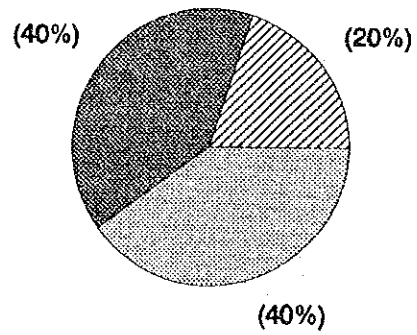
Q4-8 Is collection service done at fixed time in the day?

	Residential Area	Commercial Area
Yes	66 %	20 %
No	17 %	40 %
I don't know.	17 %	40 %

Legend



Residential Area



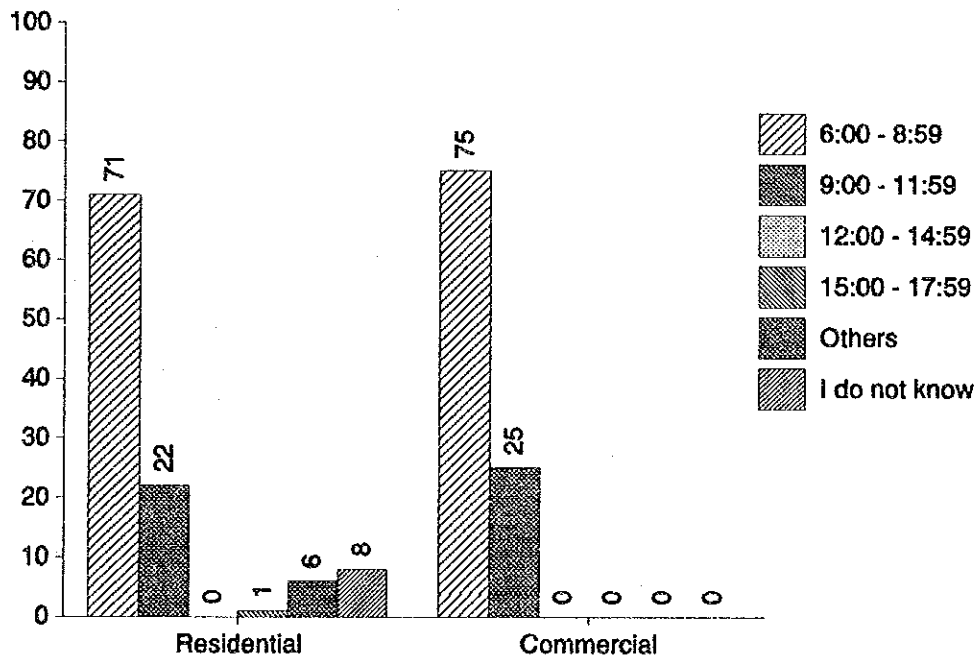
Commercial Area

Q4-9 If "Yes", what time is your waste normally collected? (Plural answers)

	Residential Area	Commercial Area
6:00 - 8:59	71 %	75 %
9:00 - 11:59	22 %	25 %
12:00 - 14:59	0 %	0 %
15:00 - 17:59	1 %	0 %
Others	6 %	0 %
I don't know.	8 %	0 %

Note: Contents of others;

- at 5:00 - 1 answer
- between 5:00-8:00 - 1 answer
- before 6:00 - 2 answers
- between 6:00-12:00 - 3 answer

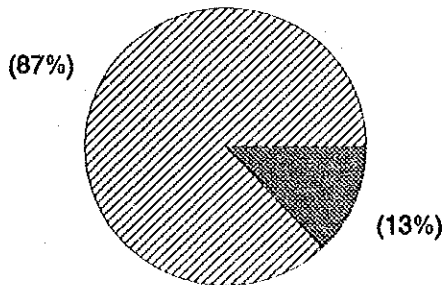
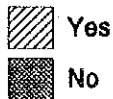


**V Questions on Resource and Recycling**

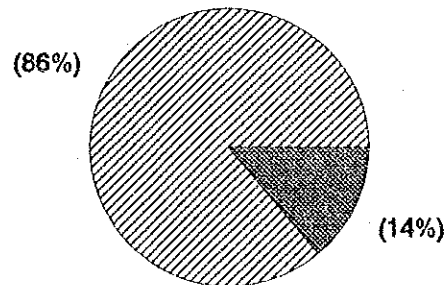
Q5-1 If the municipality introduces a separate waste collection system to utilize waste(i.e. for instance you are requested to segregate your wastes into i. food waste, ii. incombustible waste and iii. other wastes), do you cooperate with the system?

	Residential Area	Commercial Area
Yes	87 %	86 %
No	13 %	14 %

**Legend**



**Residential Area**



**Commercial Area**






Q5-2 If "No", what are the reasons?

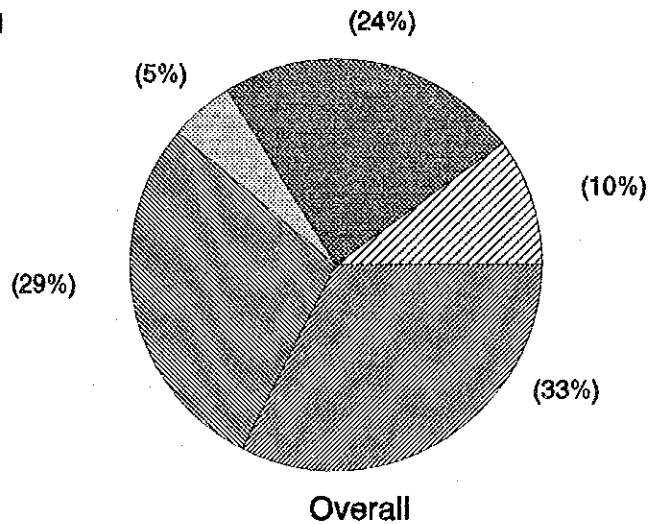
	Overall
It requires several containers or plastic bags.	10 %
It requires certain effort.	24 %
It requires several public containers.	5 %
It is inconvenient.	29 %
It may increase collection cost.	0 %
Others	33 %

Note: Contents "others";

- I don't know - 3 answers
- no time - 2 answers
- we burn our waste - 1 answer
- it would go to slowly and waste would get rotten - 1 answer
- no place for buckets - 1 answer

Legend

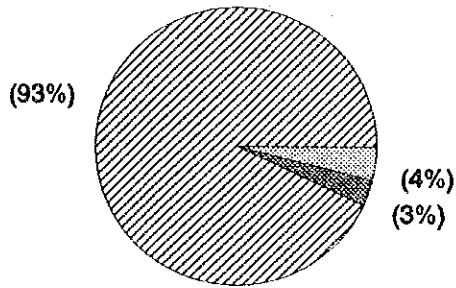
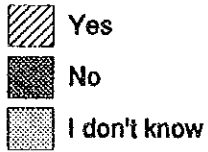
-  Cont.-required
-  Effort- required
-  Public cont.required
-  It is inconvenient
-  Others



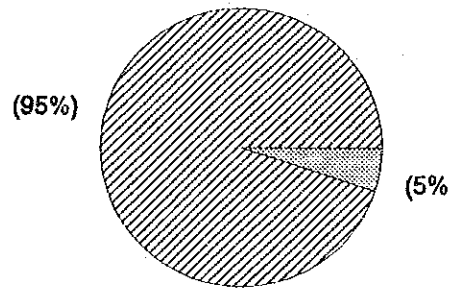
Q5-3 Do you think resource recovery from wastes and recycling are necessary?

	Residential Area	Commercial Area
Yes	93 %	95 %
No	3 %	0 %
I don't know	4 %	5 %

Legend



Residential Area



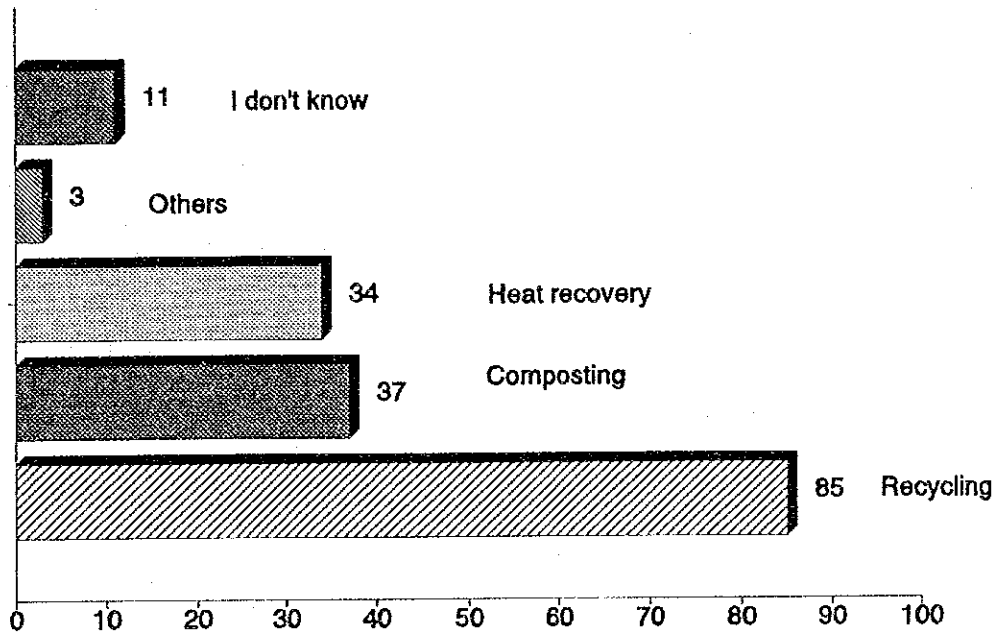
Commercial Area

Q5-4 What kinds of resource recovery from wastes and recycling do you know?  
 (Reply as many as you know); (Plural answer).

	Overall
Recycling of reusable materials such as papers, bottles, etc.	85 %
Composting (Fertilizer from wastes)	37 %
Heat recovery by incineration	34 %
Others	3 %
I don't know	11 %

Note: Contents of "others";

- waste segregation - 2 answers
- some garbage can be eaten by animals - 1 answers

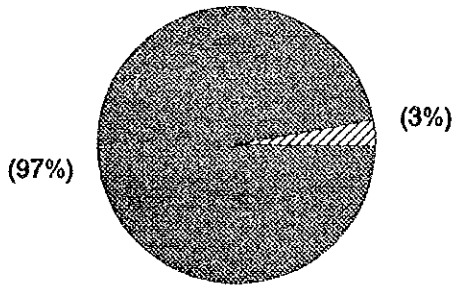
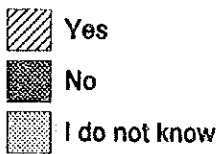


Q5-5 Do you have someone who comes around to collect or buy your reusable or recyclable materials?

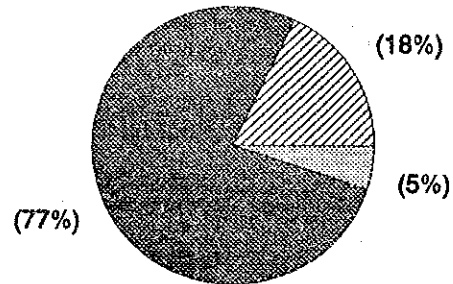
	Residential Area	Commercial Area
Yes	3 %	18 %
No	97 %	77 %
I don't know.	0 %	5 %

If "Yes", please answer the followings; (No.5-6 – No.5-7)  
 Otherwise go to No.5-8.

Legend



Residential Area



Commercial Area

Q5-6 If "Yes", how often does the collector comes around your place?

	Overall
Once a week	2 answers
Once a month	2 answers
Once every two month	0 answer
Once a half year	1 answer
Once a year	0 answer
I don't know.	1 answer

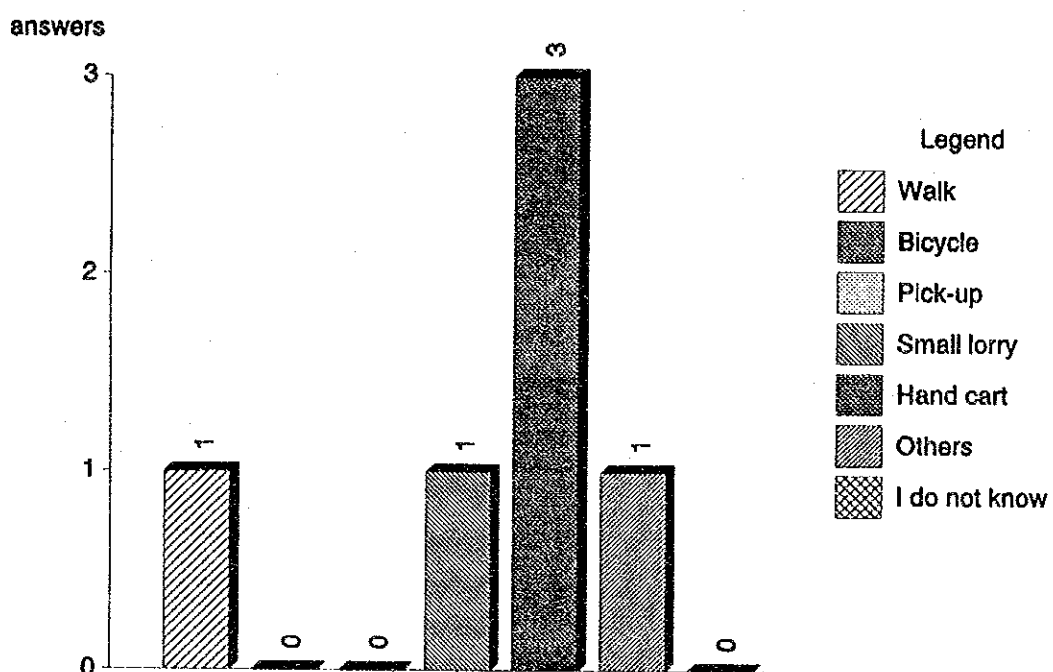




Q5-7 What kinds of transportation does the collector use to haul them?

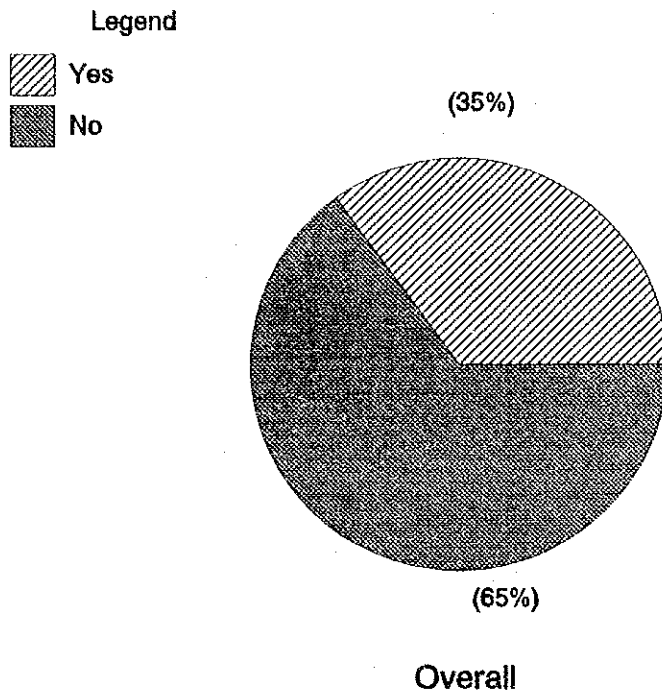
	Overall
Walk	1
Bicycle	0
Pick-up Truck	0
Small Lorry	1
Handcart	3
Others	1
I don't know.	0

Note: "other" means a trolley



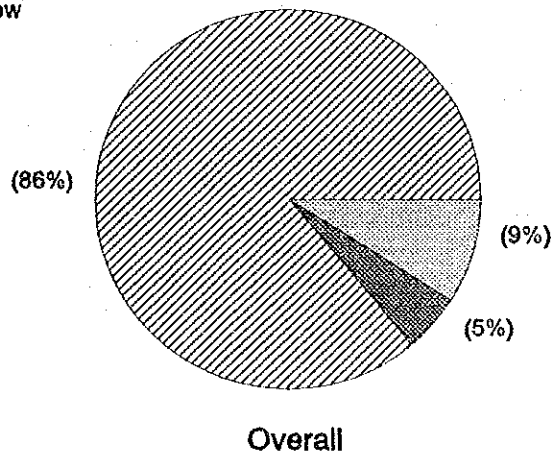
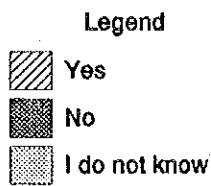
Q5-8 Instead of selling recyclable materials to the collector, do you sell the recyclable materials to the shops?

	Overall
Yes	35 %
No	65 %



Q5-9 If the resident association of cooperative in your area were to raise some funds (in order to engage beneficial activities for residents), through sale of reusable or recyclable materials, would you be able to contribute or participate?

	Overall
Yes	86 %
No	5 %
I don't know.	9 %





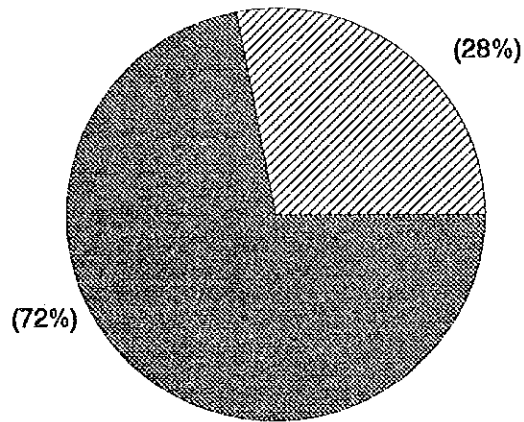
Q5-10

Do you feed food wastes to your animals?

	Overall
Yes	28 %
No	72 %

Legend

-  Yes
-  No



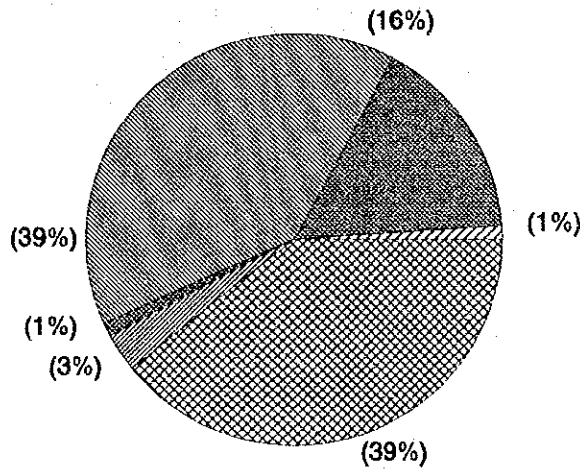
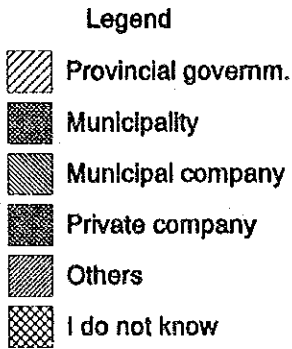
Overall

VI Collection Fee and Financial Matters

Q6-1 Do you know which authority is responsible for Municipal Solid Waste Management?

	Overall
Provincial government	1 %
Municipality	16 %
Yourself	0 %
Municipal company (public) for example MPO	39 %
Private company	1 %
Others	3 %
I don't know.	39 %

Note: Contents of "others";  
 - administration (of buildings ) - 3 answers  
 - there is no organisation responsible on - 2 answers






Residential Area

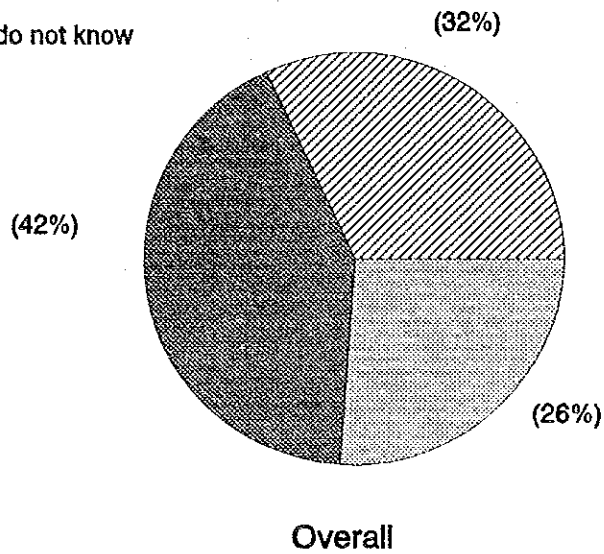
Q6-2

The present Municipal Solid Waste Management is being carried out by the MPO, municipality and private companies. Do you think the present MSWM is appropriate?

	Overall
Yes	32 %
No	42 %
I don't know	26 %

**Legend**

-  Yes
-  No
-  I do not know

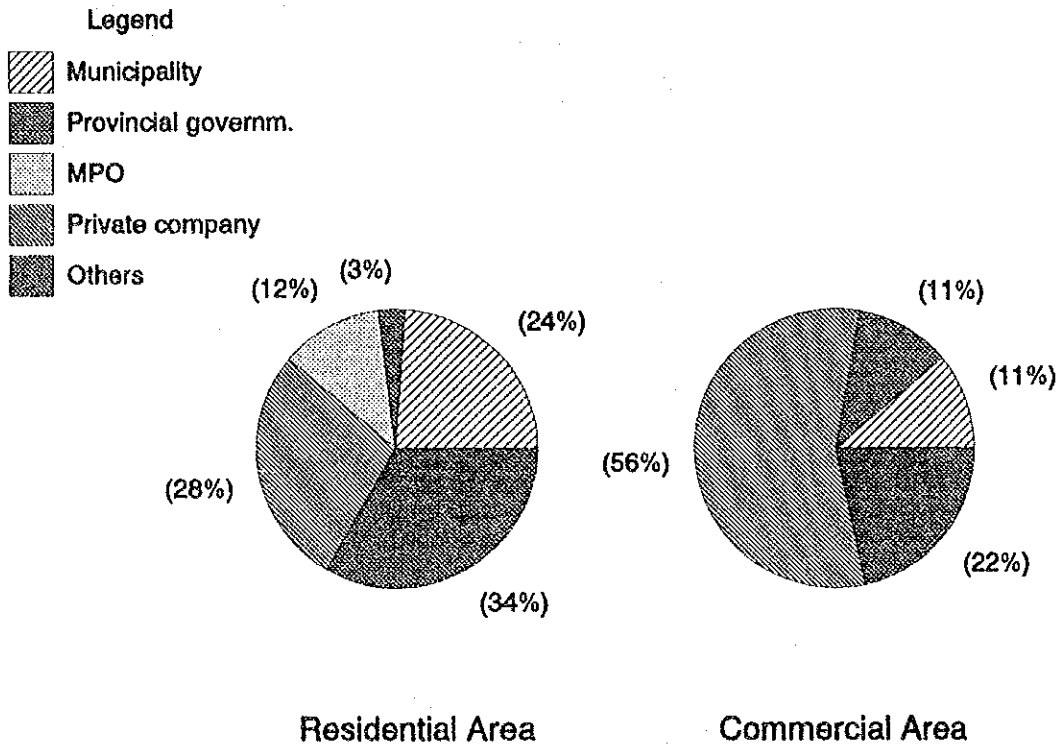


Q6-3 If "No", what organization should take responsibility on MSWM?

	Residential Arca	Commercial Area
Municipality	24 %	11 %
Provincial government	3 %	11 %
MPO	12 %	0 %
Private company	28 %	56 %
Others	34 %	22 %

Note: Contents of "others";

- private company with enough money - 2 answers
- I don't know - 8 answers
- administration ( of buildings ) - 3 answers
- anybody who can make it good - 7 answers
- private and communal company - 1 answer
- residents - 1 answer
- Good company other than MPO - 1



Q6-4 How much do you pay for the collection service per a month?

	Residential Area	Commercial Area
_____ z/month	36,486	22,500
I don't know	99 answers	18 answers







Note: Only 33 persons gave answers.

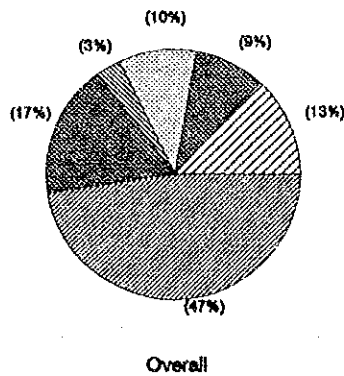
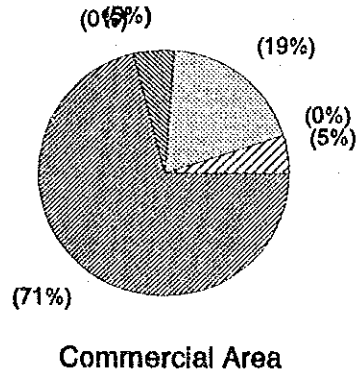
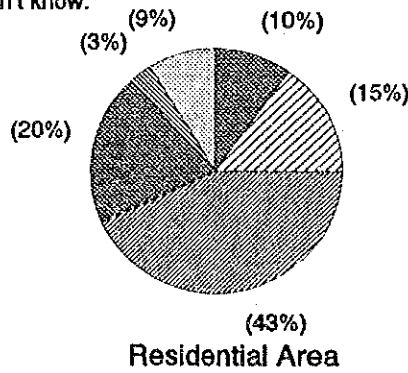


Q6-5 How do you think about collection fee?

	Residential Area	Commercial Area	Overall
Expensive	15 %	5 %	13 %
Little bit expensive	10 %	0 %	9 %
Little bit cheap	9 %	19 %	10 %
Collection fee system is not fair.	3 %	5 %	3 %
It is suitable	20 %	0 %	17 %
I don't know.	43 %	71 %	47 %

Legend




-  Expensive
-  Little bit expensive
-  Little bit cheap
-  Fees - not fair
-  Suitable
-  I don't know.

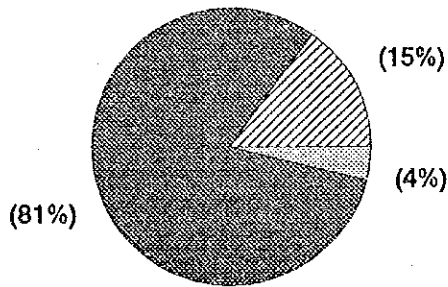


Q6-6 Do you pay the collection fee directly to the collection company or through your cooperative?

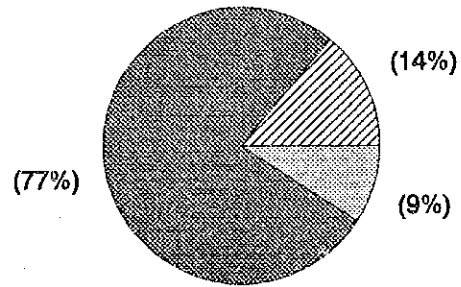
	Residential Area	Commercial Area
Directly (by yourself)	15 %	14 %
Through the Cooperative	81 %	77 %
I don't know.	4 %	9 %

Legend

-  Directly-yourself
-  Through the Coopera
-  I do not know



Residential Area

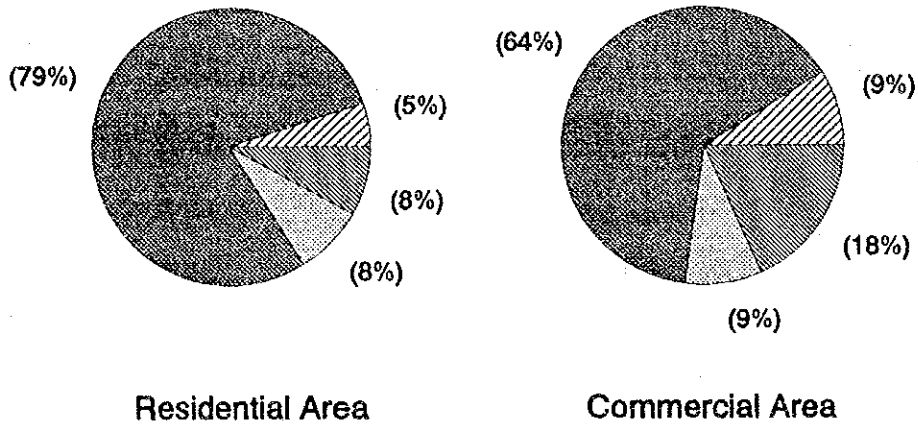
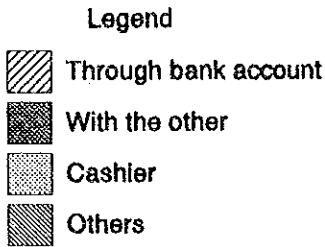


Commercial Area

Q6-7 Who or how collect the fee?

	Residential Area	Commercial Area
Through bank account	5 %	9 %
With the other payment to the Cooperative Cashier of enterprises	79 %	64 %
Cashier of enterprises	8 %	9 %
Others	8 %	18 %

Note: Contents of "others"  
 - MPO worker - 5  
 - I don't know - 7

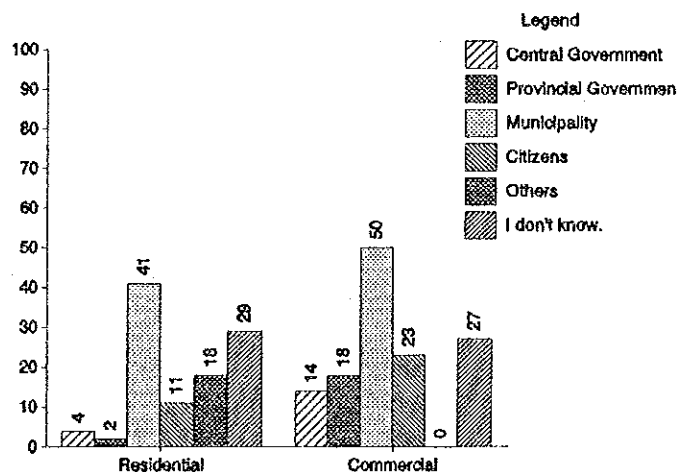


Q6-8 The present waste management cost is not sufficient for maintaining the beautiful sight of the City and its environment. Do you think who should bear the extra cost? (Plural answers)

	Residential Area	Commercial Area
Central government	4 %	14 %
Provincial government	2 %	18 %
Municipality	41 %	50 %
Citizens by means of collection fee increase	11 %	23 %
Others	18 %	0 %
I don't know.	29 %	27 %

Note: Contents of "others";

- Money amount would be OK if the quality of service were improved - 2
- those, who pollute the environment - 5
- business men - 1
- unemployed person - 1
- somebody, who deals with environmental protection - 1
- administration ( of buildings ) - 3
- MPO - 1
- all - 1
- factories - 1
- company, who can manage without extra costs - 1
- money come from penalties etc. - 1
- public works - 1
- company who deals with waste management - 1
- we need proper waste management - 1
- we should use present fees better - 2
- citizens should keep everything tidy -

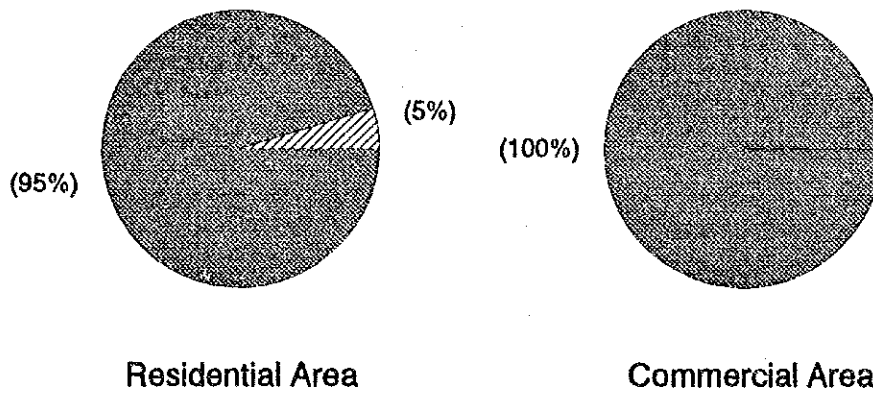
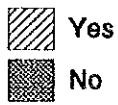


**VII Public Cooperation**

Q7-1 Have you ever had any guidance of methods of proper discharge?

	Residential Area	Commercial Area
Yes	5 %	0 %
No	95 %	100 %




**Legend**

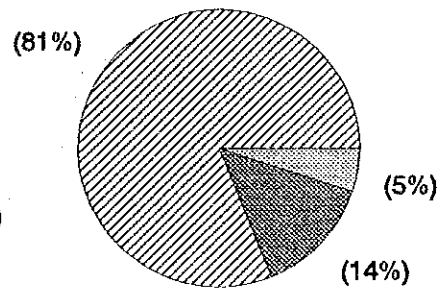
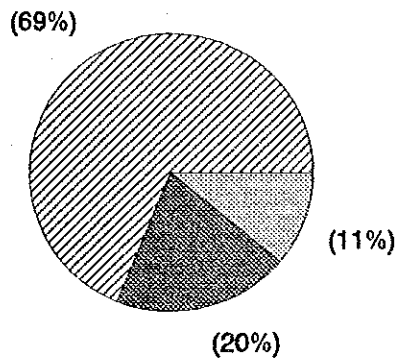


Q7-2 Do you think "Clean Day" should be organized?

	Residential Area	Commercial Area
Yes	69 %	82 %
No	20 %	14 %
I don't know.	11 %	5 %

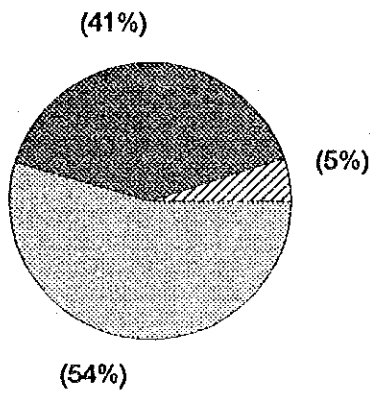
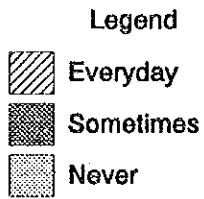
Legend

-  Yes
-  No
-  I do not know

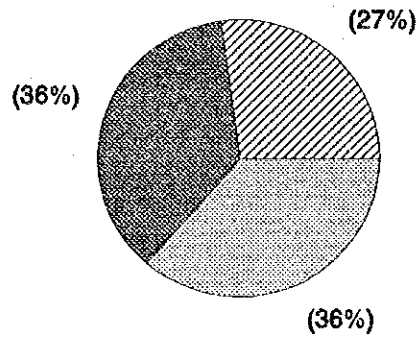


Q7-3 Does anyone in your family clean the road shoulder or adjacent public area in front of your house except for as the guardian?

	Residential Area	Commercial Area
Yes, everyday	5 %	27 %
Yes, sometimes	41 %	36 %
No	54 %	36 %



Residential Area

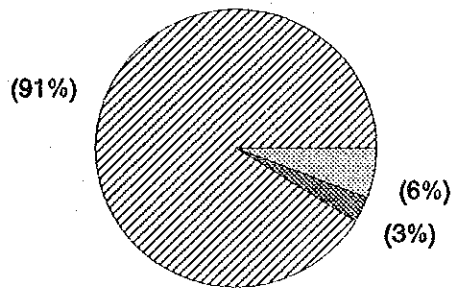
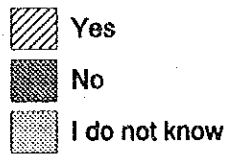


Commercial Area

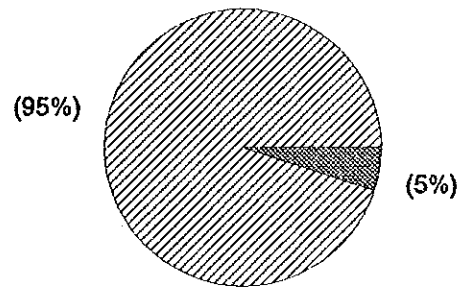
Q7-4 Do you think the public cooperation is necessary in order to maintain the beautiful city and its environment?

	Residential Area	Commercial Area
Yes	91 %	95 %
No	3 %	5 %
I don't know	6 %	0 %

Legend



Residential Area



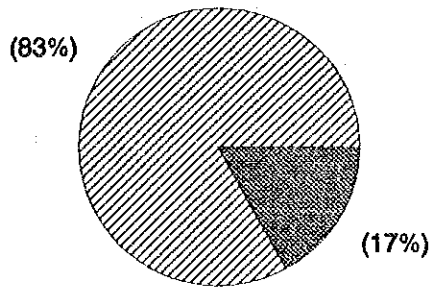
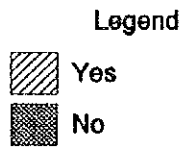
Commercial Area



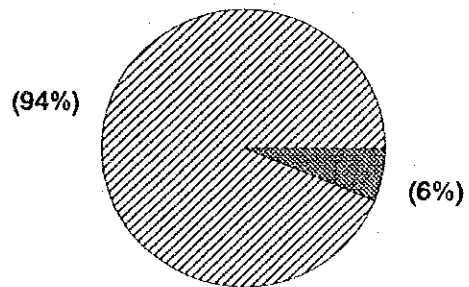
Q7-5 If "Yes", can you cooperate with maintaining the beautiful city and its environment?

	Residential Area	Commercial Area
Yes	83 %	94 %
No	17 %	6 %

Note: There were 18 answers of "I don't know"



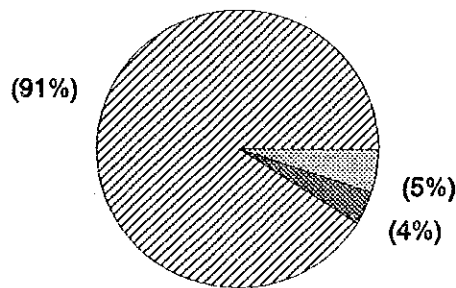
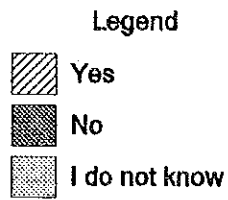
Residential Area



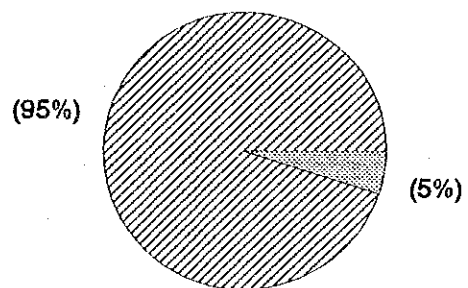
Commercial Area

Q7-6 Do you think public education of campaign for maintaining the beautiful city and its environment is necessary?

	Residential Area	Commercial Area
Yes	91 %	95 %
No	4 %	0 %
I don't know	5 %	5 %



Residential Area



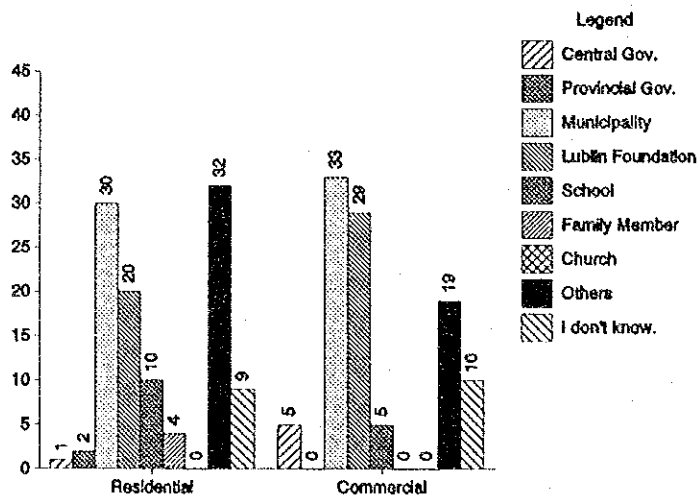
Commercial Area

Q7-7 If "Yes", who should take such action? (Plural answers)

	Residential Area	Commercial Area
Central government	1 %	5 %
Provincial government	2 %	0 %
Municipality	30 %	33 %
Lublin Foundation for Environmental Protection	20 %	29 %
School	10 %	5 %
Family member	4 %	0 %
Church	0 %	0 %
Others	32 %	19 %
I don't know.	9 %	10 %

Note: Contents of "others";

- apartment administration - 10 answers
- Sanepid - 1 answer
- company asked by municipality - 1 answer
- mass-media - 4 answers
- organization related to environmental protection - 3 answers
- those, who are in charge of MSWM - 1 answer
- residents unification ( Samorzad ) - 5 answers
- MPO - 2 answers
- all institution mentioned the above - 13 answers
- anybody - 1 answer
- apartment cooperatives - 3 answers
- Green Party - 1 answer
- active residents - 1 answer



## 5) Findings

### a. General

- i. As well as the City of Poznan, the number of persons staying in a sample residence was **4.0 person**.
- ii. The areas of the residence were **53.4 m<sup>2</sup>** for apartments and **108.4 m<sup>2</sup>** for detached type houses. These figures are a little smaller than those of Poznan.
- iii. The sample residents were selected by the interviewers or surveyor of the WACS when they visited the sample houses and the some one were in the houses. Upon consideration of this selection manner, the ratios of public servant and no working people for the employment of the masters of houses are very high; i.e. public servant is **40% (35 %)** and no working is **47 % (39 %)**. The ratios in parentheses are those of Poznan results. This figure may cause the financial difficulty of the Municipality as well as the central and provincial government.
- iv. The average expenditure of a household is about 2 to 4 million złotych per month as well as Poznan.
- v. More than 80 % of interviewees have communal container within a distance of 50 m from their houses and shops.

### b. Discharge of Waste

- i. Regarding ash from heating equipment, the ratios of discharging ash with other mode of wastes are about **7.8 %** for residential area and **8.9 %** for commercial area respectively. The figure of the residential area is three times less than it of Poznan City (**27.7 %**) while the figure of the commercial area is two times more than it of Poznan (**4.6 %**). The ash discharging month is 6 to 8 months per year.
- ii. The ratio of using dust chute is about **24 %** in residential area. The figure is 8 times more than it of Poznan (**3 %**). In case of Lublin, it seems to require a certain effort if the municipality will prohibit the use of dust chute. Because more than half of the residents who use the dust chute answered that they would not stop to use their dust chutes due to the inconvenience.

- iii. The use of plastic bag for discharge of waste is limited to 22 % in residential area and 35 % in commercial, while the use of plastic bucket is very popular. This may contribute not only to reduce waste volume but also to the waste compaction ratio in the landfill.
- iv. Waste is not discharged at fixed time because more than 70 % of citizens do not discharge their waste at fixed time.
- v. The problems regarding waste container for collection service is not very much (21 % in residential area and 10 % in commercial). The main problem on the containers is its insanitary condition and second is insufficient capacity.
- vi. The generation of the bulky wastes may be a little.

**c. Waste Collection Services**

- i. As far as we determine by answer, the collection ratios in the residential area and commercial area are 100 % and 86 % respectively.
- ii. As compared with the results in Poznan (i.e. Sanitech), the service coverage of the MPO is much higher (90 %). This shows that the private contractors are under developed and the collection service is almost monopoly of MPO.
- iii. The ratio than it of Sanitech in Poznan (63 % in residential area and 52 % in commercial area).
- iv. The reasons of unsatisfaction of the services are first the low frequency of collection and secondly the irregular collection time.
- v. The frequency of collection in residential area is a little more than it of Poznan. The majority of citizen receive more than once a week collection service.
- vi. Collection services in residential area seem to be conducted at fixed time in major part of Lublin, while not at fixed time in commercial area.

**d. Resource Recovery and Recycling**

- i. More than 86 % of the citizens answered that they would like cooperate with separate waste collection system if the system would be introduced.

ii. **More than 93 %** of the citizens answered that the resource recovery from wastes and recycling were necessary, and one third of the citizens know the composting and heat recovery by incineration from wastes.

iii. In terms of recycling activities, the followings were identified;

- Door to door recycling activities were not common.
- The ratio of selling the recyclable materials to the recycle shops by the citizens was 35 % while it in the Poznan was 52 %.
- **86 %** of the citizens answered that they would cooperate with the recycling activities in their communities.
- **28 %** of the citizens fed food wastes to their animals.

**e. Collection Fee and Financial Matters**

i. **39 %** of the citizens did not know the responsible authority on MSWM.

ii. **42 %** of the citizens considered that the present MSWM was inappropriate while 32 % approved. It is deemed that many citizens would like to receive more efficient MSWM by private sectors.

iii. Most of the citizens (78 %) did not know the collection service fee, and majority of the citizens who know the fee did not have their opinion on the fee.

iv. More than 77 % of the collection fee were paid through the cooperative with the other payment to them.

v. According to the answers, the extra cost for the improvement of present MSWM would be shouldered by the followings in order.

- municipality (> 41 %)
- I don't know (> 27 %)
- citizens by means of collection fee increase (>11 %)

**f. Public Cooperation**

i. **More than 69 %** of the citizens think that "Clean Day" should be organized, and more than 46 % sometimes clean their adjacent public area.

- ii. **More than 91 %** of the citizens consider the public cooperation and public education campaign is necessary to maintain the city and its environment. **More than 83 %** of them can cooperate with maintaining the city and its environment.
- iii. The initiator for the campaign should be the following orders;
- municipality
  - others (specified in 4) the Results of the Survey)
  - Lublin Foundation for Environmental Protection
  - schools

# **CHAPTER 3**

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## **PROFILE OF MSWM IN LUBLIN**





## **CHAPTER 3      PROFILE OF MSWM IN LUBLIN**

The profile of the MSWM in Lublin was prepared by the personnel concerned with MSWM in Lublin in accordance with the form described in the Annex 1 of the manual. The following articles was prepared based on the description given by them.

### **3.1      General Information**

#### **1)      Population**

The population of Lublin Municipality in December,1991 was **352,500** according to the MIOS(Department of Environment in Lublin Municipality).

#### **2)      Area**

The area of the municipality is **147.55 km<sup>2</sup>** in December, 1992.

#### **3)      Annual Rainfall**

The annual rainfall is **566.1 mm**.

#### **4)      GRDP**

**877,255 million Zl** in 1989 and **2,693,137 million Zl** in 1990. The average monthly income of a household was **3,600,000 Zl** in 1992.

#### **5)      Annual Municipal Budget**

The budget of Lublin Municipality in 1993 is **596 billion Zl** for expenditure and **555 billion Zl** for income.

## 6) Data on Large Generation Sources on MSW & ISW

### a. Hospitals

The generation ratio is over **200 ton/year**(approx. **0.55 tons/day**) according to the statistics done in 1991 by the MIOS.

### b. Factories

The generation ratio from factories is **400,000 ton/year** (approx. **1,100 tons/day**) according to the statistics done in 1990 and 1991 by the PIOS (National Environmental Inspectorate).

### c. Others

According to the inspector for the municipal cleansing services of the Department of Municipal Management, the following data on large generation sources were given based on the authorized generation ratio of **1.57 m<sup>3</sup>/person/year** given by the Communal Economy Institute in Warsaw.

- cooperatives	: 298,292 m <sup>3</sup> /year
- municipal housing	: 101,657 m <sup>3</sup> /year
- single-family and multi-family housing and private houses	: 58,889 m <sup>3</sup> /year
- state entities, factories, offices, schools, banks, etc.	: 203,889 m <sup>3</sup> /year

## 7) Land Use

The present land use in Lublin was identified and the future land use plan was also elaborated in the City Master Plan of Lublin.

## 8) Infrastructure

According to the road section of the Department of Municipal Management, basic information on infrastructure is as follows:

- total road length	: 579 km
- paved road length	: 537 km
- unpaved road length	: 42 km

- municipal heat supply coverage area : 47 km<sup>2</sup>

## **9) Existing Relevant Studies and Information**

### **a. City Master Plan**

The City Master Plan of Lublin, i.e. "Plan Zagospodarowania Przestrzennego Lubelskiego Zespołu Miejskiego": Urban Planning Project in LZM(Lublin Municipal Complex), was first elaborated in December 1986. The Plan has to be reviewed every five years.

### **b. SWM Study**

In the past, the following studies on MSWM in the City of Lublin were carried out:

- Municipal Waste - Strategy for Waste Management and Applicable Methods for Collection and Treatment, June 1992
- Praca Badwcza, Unieszkodliwianie Odpadów Metoda Spalania Oraz Wykorzystanie Energii Ciepłej Do Celów Grzewczych: Study Work for Waste Utilization - Burning Method and Use of Waste Energy for Heating Purpose, April 1985

### **c. Topographical and Geological Data**

#### **i. Topography**

The City of Lublin is located between 51° 08' and 51° 18' in the north latitude, and between 22° 27' and 22° 41' in the eastern longitude. The city stretches 17.7 km from north to south and 15.3 km from west to east. The highest point in the city is El 233.7 m in the Rury District and the lowest is El 162.5 m in the Bystrzyca river. The city is located in the northern part of the Lublin Region(Eminence).

#### **ii. Geology**

Generally the geological structure in the Lublin consists of chalk bed, which appears 20 - 25 m below the surface ground, covered by very fertile soil which gives the very rich agricultural production in Lublin. The eastern part of the Lublin has 0.5 - 1.0 m thickness of sandy-silt soil.

## 3.2 EC PHARE Report

### 1) Purpose of the Study

The EC PHARE Report, "Municipal Waste -- Strategy for Waste management and Applicable Methods for Collection and Treatment" was elaborated for the Ministry of Environmental Protection, Natural Resources and Forestry under the auspice of the EC.

The purpose of the study is summarised as follows:

- to identify the major (issues might be a better word than problems) relating to the management of wastes currently facing municipalities;
- to identify for the EC and Polish Government the key (elements/factors) on which a national strategy for waste management can be based;
- to propose an overall policy for municipal waste treatment;
- to provide the EC and Polish Government with an overview of waste management technologies applicable to current and future conditions in Poland;
- to provide local authorities with a tool for the assessment of technologies together with new collection, treatment and payment systems;
- to provide national and local authorities with examples of designs of total handling systems (collection, treatment and disposal).

### 2) Study for Lublin

In order to provide local authorities with a tool for the assessment of technologies regarding MSWM, a number of catalogues has been prepared for different solid waste technologies. These catalogues were applied in the preparation of appropriate scenarios for solid waste management in three different cities.

Scenarios for storage, collection, treatment and disposal of municipal solid waste have been prepared for three Polish cities, Krosno, Plock and Lublin.

The scenarios have been prepared to comply with a set of priorities in that they must:

- Be economic bankable solutions
- Decrease the environmental impact
- Increase opportunities for recycling and resource recovery
- Reduce the quantity of solid waste requiring final disposal in landfills

The main source of information for the development of the scenarios are the catalogues, but much basic data was sought about the towns by means of:

- A preliminary questionnaire
- Meetings/correspondence with local authorities and experts
- Workshop number 1 where the treatment methods were presented and discussed
- A comprehensive questionnaire
- Meetings/correspondence with local authorities and experts
- Workshop number 2 where draft scenarios were presented and discussed

The two scenarios prepared for Lublin were summarised as follows:

Both scenarios rely heavily on landfill as a major means of disposing of waste. Planning for the new landfill is to commence during the first year and the existing site is to be domed to improve surface water run-off and subject to improved supervision. Since the new site is some 25 km from Lublin centre an investigation into the economics of a transfer station has been suggested.

The differences between the scenarios are that, at later stages, scenario I includes proposals for the production of compost, the production of energy by incineration and a consequent reduction in the requirements for landfill space. Scenario II which is a little less expensive, depends entirely on the landfill throughout the plan period.

### 3.3 Present Technical System for MSWM

#### 1) Basic Information

Primary MPO (Municipal Cleansing Enterprise) is engaged in municipal solid waste collection, transport and disposal. Also the Garrison Housing Administration and the Catholic Cemeteries Administration collect solid waste from the houses and sites managed by them. In a very small scope two private companies collect and transport the solid waste.

The magnitude of services provided by MPO is estimated at 95 %. During 1991 it disposed 662,727 m<sup>3</sup> solid waste on the Jawidz landfill. In order to organize the services properly the City was divided into 23 zones. Each zone is served by 1 collection truck and 23 vehicles are used in total for solid waste collection. Collection trucks pick up solid waste disposed in 110 dm<sup>3</sup>, 1100 dm<sup>3</sup> and KP-7 7.5 m<sup>3</sup> containers.

Collection frequencies are 1-3 times a week and once every fortnight for detached housing areas.

Number of waste containers is:

- |   |                |
|---|----------------|
| - containers of 110 l capacity              | - 15,848 units |
| - containers of 1100 l capacity             | - 4,639 units  |
| - containers of type KP-7 7.5m <sup>3</sup> | - 205 units    |

The owners or the users of the individual properties have contracts with MPO on solid waste collection and container leasing. The contracts stipulate frequency of collection and quantity of containers. The location map of present technical system is prepared as shown in Fig.3.3-1.

According to the Department of Municipal Management (DOMM), basic information on MSWM is as follows:

- |   |                             |
|---|-----------------------------|
| - generation ratio  | 2,070 m <sup>3</sup> /day   |
| - treatment and disposal  | 1,800 m <sup>3</sup> /day   |
| - apparent specific gravity<br>(obtained from the Anti-<br>Monopoly Bureau, Warsaw) | 240 kg/m <sup>3</sup>       |
| - composition of waste  | - see Tables 2.2-25 and -26 |







- About 95 % of collection services are provided by MPO, and only 5 % by other firms.
- Recycling at generation source is done but is conducted in a disorganized manner. For instance, food waste from restaurants is used as feed for animals and scavengers collect waste papers, bottles and bread from waste containers.
- MPO and other firms are responsible for the functioning of the equipment for solid waste collection and disposal. The general overhauls are contracted out to other organizations. Small repairs and preventive maintenance are executed by MPO's own workshop.
- New containers and vehicles cannot be purchased due to exorbitant prices.

### 3) Road Sweeping and Public Area Cleansing

According to the DOMM, the present road sweeping and public area cleansing system is as follows:

- road length for sweeping            30.5 km (29 km done by MPO)
- public area for cleansing            6.3 ha.
- inventory of equipment
  - .(motor) sweeper "Brodwey"    1 units
  - .(motor) sweeper "Star"        4 units
  - .sprinklers "Liaz", "Skoda"    5 units
- MPO is responsible for the operation of the equipment. The general overhauls of equipment are contracted-out to other organizations, only small repairs and preventive maintenance are performed by MPO itself.
- All services connected with road and area cleansing are performed within the budget of Lublin City. 90% of the present cleansing services are performed by MPO and 10 % by the Municipal Economy Works (Zaklad Gospodarki Komunalnej).
- Present problem is lack of financial sources to maintain cleanliness of streets, squares, sites, etc..

#### **4) Intermediate Treatment**

There are no intermediate treatment facilities in the City. According to the City Master Plan of Lublin, the Zadebie functional area is designated as the only site proposed for the location of MSW intermediate treatment facilities such as a composting and an incineration plant.

#### **5) Final Disposal**

##### **a. Outline of the existing landfill**

At present the MPO is operating a landfill in Jawidz for municipal solid waste, which is located 28 km from the MPO depot. The landfill will cease its operation by the end of 1993.

##### **b. Operation and maintenance of landfill**

7 workers, including 2 watchmen are employed and a landfill compactor and 3 bulldozers are being operated. 2000m<sup>3</sup> blocks, which are 2m thick, are made in each landfill operation. The wastes dumped are levelled and compacted by bulldozers and the compactor. After the completion of each block, the area is covered by 40cm of sand.

##### **c. Organization**

MPO is responsible for the maintenance, operation and management of Jawidz landfill.

##### **d. Future landfill**

The future landfill at Rokitno, which has an area of 38 ha. and an average depth of 22m, is located 24 km from the MPO depot.

##### **e. Present problems**

The first problem is the high construction cost of the landfill at Rokitno. The other problem to be urgently solved is the transfer of the right for the management of the landfill to Lublin Municipality.

It will enable the Municipality to create competition and thus reduce the operation and cost of collection, haulage and disposal of MSW.

#### **f. Biogas proposal**

The Municipal government of Lublin made a contract with Hedeselskabet, Rodekro kontroet Danish Land Development Service in Viborg, Klostermarken 12, for the exploration of wells for the use of biogas: 6 wells will be dug (one at Jawidiz I and 5 at Jawidiz II). The biogas will be used at the prefabricated construction materials manufacturing factory near the landfill.

### **3.4 Present Institutional System for MSWM**

#### **1) Administration and Organization**

According to the Polish law in force, Lublin Municipality is obliged to create managerial conditions appropriate for solid waste generated in the City area. In Lublin, MPO is responsible at present for all activities concerning solid waste collection, haulage and disposal at the landfill. In order to establish competition in the field of solid waste collection and haulage, the municipal government is going to take over landfill management. This will also reduce solid waste management expenses.

Furthermore, the expenses for the construction of the new landfill at Rokitno is appropriated from the municipal budget. The City of Swidnik cooperates in the construction of the landfill at Rokitno, which has an area of 37.5 ha and is located in the region of Lubartow.

The agreement, which was concluded with Lubartow, stated the following conditions for the construction of a landfill at Rokitono:

The conditions were:

- i. Lublin Municipality shall construct a water supply and sewage system in the surrounding area of the new landfill.
- ii. The Municipality shall install a telephone system for the villages in the vicinity of the landfill.
- iii. The Municipality shall share the expenses for school development and local road improvement.

The construction cost of the new landfill is estimated at about 68 billion Zl. In addition, the compensation for Lubartow requires about 30 billion more.

The new landfill, which will have a total of 6.75 million m<sup>3</sup>, will be able to accommodate MSW for 50 years. The first phase landfill can also accommodate MSW for 11 years.

## 2) Financial Status

Municipal budget covers only the cost of construction. After construction, operation and maintenance costs shall be covered by the disposal fee. The landfill at Rokitno is considered as a sort of Municipal investment. The municipality spent 5.24 billion zl. in 1991 and 24 billion zl. in 1992, and the investment for 1993 will be 60.0 billion zl. At present, fee tariffs for solid waste collection, haulage and disposal at the landfill are as follows:

### a. Solid waste collection and haulage

per 1 m <sup>3</sup> /month -	55,000 zl
per capita/month -	7,200 zl

### b. Solid waste disposal at landfill

per 1 m <sup>3</sup>	40,000 zl
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### c. Containers' lease:

1 110 dm <sup>3</sup> container/month -	6,000 zl
1 1100 dm <sup>3</sup> container/month -	60,000 zl
1 K-P-7 container/month -	108,000 zl

All fees are specified in the contracts of the users. Fees can be paid at the MPO cash-desk or through direct debit. The Municipality covers the costs for 1 employee responsible for all matters related to solid waste management and City cleansing services.

## 3) Privatization

Privatization of services related to municipal cleansing appears to be very limited at present the two existing private companies collecting solid waste have only two

collection trucks. The right to manage the landfill will be handed over to the municipality after the privatization of MPO. This in turn will create equal opportunities for all companies disposing solid waste. At present, MPO does not bear the cost for disposal at landfill. Lublin will be divided into 3 zones for the execution of the cleansing services. The bid announcement will be published in the press to invite tenders for those services. Based on the reliability and offering of cheap services, three companies will be contracted to provide those services. After 2 - 3 years, it is assumed that one or two companies would conduct the whole operation.

#### **4) Regulation and Enforcement**

There are more than 100 illegal dumping sites in Lublin Agglomeration. The cost for the clearing of these dumping sites were shouldered by the municipality and the total amount spent in 1992 was 150 million zl. Those who dump waste illegally can be punished according to the Offence Code. Municipal police authorized to carry out the law is inefficiently enforcing it at present.

#### **5) Public Cooperation**

At present public cooperation is almost non-existent. There are a few telephone calls, the only form of public cooperation, informing illegal dumping cases. However, the informers may be the offenders themselves. A group of municipal councillors in cooperation with the inspector of City Cleansing Matters are preparing solutions which include the establishment of regulations for environmental protection to maintain cleanness in the City. The regulations force the citizens to contract waste collection services and ask the inhabitants, owners and users to maintain order and cleanness in their properties and adherent areas.

The regulations also include the introduction of waste separation (forming financial incentives for inhabitants) and heightening environmental awareness through campaign and education (particular among young people) in the mass media.

#### **6) Possible Improvement Measures**

According to the officer of DOMM, possible improvement measures require the following 3 directions:

- modernization of the technical equipment and facilities
- improvement of the management system

- development of various forms of cooperation with the citizens

Regarding modernization and development of technical equipment and facilities the construction of a new environmentally sound landfill, compost and (in future) incineration plants are considered.

The progress of solid waste collection and haulage will take place after the legalization of the above mentioned regulations (sec 5(?)). Furthermore, privatization of collection and haulage services will result in competition, potentially producing better services. The best companies with new technical equipment will remain in the market. A Fee system will provide incentives to motivate the citizens to separate their wastes.

### **3.5 Evaluation of Present MSWM**

#### **1) Technical System**

##### **a. Collection and haulage**

- i. According to the public opinion survey results, more than 80% of the interviewed citizens are satisfied with the present collection services. However, the main complaint on the present MSWM is the irregular collection service.
- ii. Since dust chutes have been observed to have insanitary problems in new apartment building areas, the system should be prohibited. With the people's cooperation, elevators will be utilized to discharge waste and dust chute system will be prohibited. Moreover, since the latter is one of the main obstructions in the introduction of a source separation of waste, it shall be terminated. However, the municipality seems to find it difficult to prohibit the use of dust chutes, because more than half of the residents answered that they will not stop using dust chutes due to its being inconvenient.
- iii. It is observed that soil, home renovation waste, ash, etc. are disposed into dustbins in detached and semi-detached areas. This attitude lowers the efficiency of waste collection. This discharging manner should be improved with the introduction of an incineration plant or a composting plant.

- iv. A collection system for bulky waste has not been established yet. Since the compactor vehicle is not capable for carrying this kind of waste, accidents occur and work efficiency is lessened.
- v. The arrangements for the collection and disposal of hospital wastes to landfill are somewhat less than satisfactory and arise out of shortage of incinerator capacity at the hospitals.

Unless there is effective and reliable segregation of wastes at the point of generation, hospital wastes should not be collected at the same time as domestic wastes or disposed at landfill.

**b. Road sweeping and public area cleansing**

**i. Road sweeping**

The roads of Lublin city are very clean and tidy and no urgent problems have been found except for the limited budget appropriated for this service. However, the Municipality endeavour to minimize costs by introducing various methods such as tendering. Efforts to introduce such new systems should be continued and completed while the existing road sweeping machineries are still fully capable. At present only a few MPO's road sweepers are working, due to decrease in contracted work.

**ii. Public area cleansing**

There are many parks and public squares in Lublin City and they are always maintained in tidy and clean condition. The necessity to introduce new measures was not recognized.

**c. Final disposal**

- i. Jawidz disposal site receives all kinds of waste because it is the only disposal site of Lublin City. This situation makes it difficult to obtain land use consensus from residents.
- ii. The amount of waste carried to and disposed at the Jawidz disposal site is not monitored by weight. This makes it difficult to understand the actual situation of MSWM and to take timely countermeasures.



- iii. Some waste is blown and scattered around the surrounding areas of the Jawidz disposal site, creating insanitary conditions, because earth covering operations are not properly done.
- iv. The new landfill at Rokitno is to be prepared and operated in accordance with current best practices in Western Europe to isolate it from the ground water. The ground water table is 5 m below the site base which is sand /gravel and very permeable, making lining of the site a necessity.
- v. **Business proposals on Municipal Solid Waste Management.**

The Poznan Municipality has received business proposals concerning collection, recycling, treatment and disposal of waste. The proposal includes participation of private companies in the planning and operation of the activities.

With the present economic situation of municipalities in Poland, business proposals, which may relieve the municipality of heavier investments and operations, are attractive offers.

"Profit", however, is the precept of the proposal and would, therefore, oblige the population served to pay.

It is important that the municipality carefully considers the proposal; not only in the light of the short term benefit, but the long term aspects as well must be evaluated.

**d. Treatment and recycling**

- i. The Lublin area has 3 district heating systems, and consideration can be given to the incineration of wastes to supplement this.
- ii. The recycling system has already been established but does not function sufficiently yet.

According to the public opinion survey result, nearly all interviewees answered that they are willing to cooperate in recycling. However, materials such as glasses are not reused as they are not directly profitable to the people. In order to promote the recycling activity of such materials, it is essential to educate people on the importance of environmental protection.

iii. Reusable materials such as steel cans, aluminium cans and cartons, especially the latter, are increasing but not recycled due to the absence of a plant in Lublin.

**e. Equipment owned by MPO**

i. Many containers are stolen, missing or hidden; MPO is responsible for the maintenance of the containers and, therefore provides the customers with these. The cost of this provision is a burden to MPO.

ii. Most vehicles are very old and repair costs are very high. In order to minimize the actual operation cost and maintenance of machineries, the repair cost and depreciation must be also taken into account. It is necessary to establish a calculation system in order to judge the optimum time to sell or dismantle the machine. It can be considered that buying new machines is more economical than using the existing old machines.

**2) Institutional System**

The following conclusions are made based on the evaluation of the present institutional system of MSWM in Lublin:

**a. General conclusions**

i. Incomplete legislation and absence of administrative and managerial tools at local level hinder proper MSWM with regard to:

- Enforcing compulsory household collection
- Enforcing competitive bidding of waste services
- Financing of waste services, raising of loans for investments

ii. Many Polish municipalities are ineffectual in providing an appropriate MSWM (and other public services as well) due to insufficient public backup. Only limited experience can be observed in inter-municipal cooperation as a tool to form appropriate financially capable units.

Further, the municipalities generally have difficulties in obtaining loans, thereby eliminating the possibility to carry out feasible, but fully invested heavy projects.

- iii. The tradition of public subsidization inherited from the former socialist system causes very low financial contributions from the users for public services. This results in inefficient and expensive services and lack in public interest in the services (a service is assessed by the fees charged).
- iv. It is very difficult to overcome opposition and obtain land for new waste facilities. Further, it is anticipated that the area where localization takes place will receive a compensation for the resulting nuisances. These obstacles may lead to inappropriate localization of waste facilities based on deals between bigger and smaller municipalities.
- v. There is a general lack of experience in competitive bidding and the supervision carried out in the construction of facilities is poor leading to frequent deviation from design.

**b. Conclusions related to Lublin Municipality**

- i. MSW-services in Lublin are generally carried out in a satisfactory way.

MPO is incorporated in the municipal organization as a unit accountable to the Department for Municipal Management, which supervises its activities.

In 1993, MPO will be privatized and a new company will be formed from it.

- ii. The drafted Law on Waste states the responsibility of the Municipality in municipal waste management and the selection of a collector.

Although Lublin Municipality is involved in the new collection company formed from MPO, it must consider competitive bidding as a tool to provide the citizens in future with the best services their money can buy.

- iii. The fee for the provided waste service is collected by the collector (MPO or private contractor).

The future fee collection system must be reorganized under municipal ordinance in order to provide unified services to the citizens. Also, a municipal control over the prices must be exercised to prevent racketeering or fluctuations in prices ending in poor services.

- iv. Containers and dust bins are provided to the users by MPO, however, the users do not sufficiently maintain them in sanitary condition.

In order to enforce maintenance and manifest an improved cleaning service, as well as adopt a self financed MSWM, users should provide their own containers.

- v. Generally, construction wastes constitute the majority of illegally dumped waste, mainly by small construction companies without waste storage and transportation facilities other than trailer and vans.

Lublin Municipality has taken several important steps to enforce waste services at construction sites to prevent illegal dumping. These should be required in the application and granting of all construction permits, thus expanding the services to new building construction areas.

# **CHAPTER 4**

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## **A DRAFT MSWM MASTER PLAN**

## **CHAPTER 4     A DRAFT MSWM MASTER PLAN**

### **4.1     Examination of Technical System Alternatives**

As described in section 3.2, the EC PHARE Report prepared the two scenarios in 2001 for the MSWM active plan of Lublin city below.

#### **a.     Scenario I includes the following elements**

- A Sanitary landfill at Rokitno
- A transfer station (600 tons/day) at the Wrotkow district
- A composting plant (40,000 tons/year) at the Wrotkow district or Rokitno landfill
- An incineration plant (50,000 tons/year) at the Wrotknow district or other suitable site
- Bottle and paper banks
- 12 public recycling and collection centres

#### **b.     Scenario II includes**

- A sanitary landfill at Rokitno
- A transfer station
- Bottle and paper banks
- 12 public recycling and collection centres

Due to time limit of this study, the examination of technical system alternatives was not carried out. Instead, based on the Scenario I of the EC Report, a draft MSWM Master Plan for the Lublin Agglomeration is prepared as below. The draft does not include a transfer station, a composting plant and bottle/paper banks due to the following reasons:

#### **i.     A transfer station seems to be unnecessary because:**

- present collection vehicles are large (12 – 16 m<sup>3</sup>) and compaction types;
- an incineration plant to be located within the urban area can be used as a transfer station; and
- the Rokitno landfill is not far from the centre of Lublin city (24 km from MPO base).

- ii. A composting plant is not that necessary because:
  - small demands for compost made from MSWM because of inclusion of unfavourable substances
  - limited financial availability
  - ongoing biogas utilization programme at the present Jawidze landfill
  - on-site composting seems to be more feasible
- iii. Need of bottle/paper banks highly depends on the market of the recycled materials and public cooperation. Therefore, the introduction of bottle/paper banks will be examined at the time of introduction of separate collection system for the incineration plant.

## 4.2 Planning Framework

Using the Poznan Study as a reference, the planning framework for the formulation of a draft MSWM master plan is set up in this chapter.

### 1) Goal, Targets and Strategies

#### a. Goal

The goal of the Solid Waste Master Plan is proposed as follows;

## *Development of Environmentally Sound Solid Waste Management System in Lublin Agglomeration*

through;

*Citizen's Participation,  
Establishment of Self-sustainable Solid Waste Manage-  
ment and  
Resource Recovery and Recycling".*

**b. Targets**

- To attain 100% collection service rate by the year 2001.
- To incinerate 100% combustible waste by the year 2010.
- To start operation of the sanitary disposal site by the year 1995.
- To terminate illegal dumping by the year 2001.

Table 4.2-1 Target Schedule

Unit: %

Target	1992	1995	2001	2006	2010
Collection service	?	?	100	100	100
Incineration	0	0	33	66	100
Sanitary landfill	?	100	100	100	100
Illegal dumping	?	?	0	0	0

**c. Strategies for the attainment of goal**

The proposed strategies for the attainment of the Goal are detailed in the following six paragraphs:

- Provision of facilities to apply to the basic objective for the execution of the Solid Waste Management.
- Provision of solid waste services and facilities to comply with minimization of solid waste production, minimization of the need for sanitary landfill, and utilization of solid waste as second raw materials and for energy production, according to the nature of the solid waste.
- Provision of appropriate and scheduled services to the citizens for the proper storage, collection and reception of solid waste. Illegal dumping must be eliminated.
- Self-financed solid waste management.
- Increase of public involvement in environmental protection and increase in public attention on environmental matters.
- Full control over activities related to Solid Waste Management and the cleanliness of the City.



## 2) Target Year and Population

### a. Target year

The master plan covers the period from the year 1994 to 2010. The targeted years for the master plan are as shown in Table 4.2-2.

Table 4.2-2 Target Year

Plan	Target Year
Master Plan	1994 to 2010
Long Term Improvement Plan	2004 to 2010
Medium Term Improvement Plan	1999 to 2003
Short Term Improvement Plan	1994 to 1998

### b. Population forecast

The City Master Plan of Lublin estimated the population of Lublin city as 326,991 in 1985 and 440,000 in 2005. The annual population growth rate is calculated at 1.72%. Based on the growth rate (1.72%), the population forecast is prepared both for the City of Lublin and Lublin Agglomeration, which includes Swidnik, Leczna and several small Guminas, as shown in Table 4.2-3.

Table 4.2-3 Population Forecast

Year	1985	1992	1995	2001	2005	2010
City of Lublin	326,991	352,500	371,000	411,000	440,000	479,000
Lublin Agglomeration	NA	492,500	518,500	574,000	614,000	669,500

### 3) Forecast for Waste Amount and Composition

#### a. Forecast on waste amount

##### i. Methodology

Waste generation will be projected based on population increase, creating a margin for the increase in generation ratio attributed to GDP increase.

Discharge ratio of domestic ash from households is assumed to reach zero (0) by the year 2001 due to increase in LPEC consumers and change in heat source from coal to other modes.

The most direct influence on waste generation is the change in population, and the estimated annual population growth in Lublin Municipality for the planning period is 1.72 %.

Based on the Japanese statistics regarding the relation between GDP and waste generation, the increase in waste generation per capita per year is estimated as:

- 1993 - 2000      1.4 %/year
- 2001 - 2010      2.7 %/year

##### ii. Forecast on waste amount

The forecast for MSW and other wastes is presented in Table 4.2-4 based on the WACS results and the above-mentioned assumptions.

Table 4.2-4 Forecast for MSW and Other Wastes, Lublin Agglomeration  
unit:tons/day; 1 year=365 days

	1992	2001	2010
<b>1. MSW</b>			
Household	182.2	243.9	361.4
Domestic Ash	14.8	0	0
Shop	3.2	4.3	6.4
Catering	2.6	3.5	5.2
Market	4.2	5.7	8.4
Institutional	16.5	22.0	32.6
Road Sweeping	18.6	24.0	36.8
Bulky	8.0	10.7	15.8
<b>2. Other Wastes</b>	41.1	55.0	81.5
<b>Total</b>	291.2	370.0	548.1

**b. Forecast on waste composition**

In Table 4.2-5, results of WACS on the MSW are compared with the data in Poland provided in the EC-Study; Municipal Waste – Strategy for Waste Management and Applicable Methods for Collection and Treatment, 1992. Data from a developed country like Denmark were also included.

**Table 4.2-5 Comparison of Waste Composition Data for MSW**

	* WACS 1992 without Ash	WACS 1992 with Ash	EC- Study, 1992	EC- Study, forecast 2010	Den- mark 1985
<b>1. Combustibles</b>	87.2	80.8	56	64	85
Garbage	61.1	56.6	38	27	35
Paper	14.2	13.2	14	28	41
(Dry Paper)	-	-	-	-	(17)
(Wet Paper)	-	-	-	-	(24)
Textile	3.1	2.9	2	2	-
Plastic	4.4	4.1	2	5	6
Grass and Wood	2.3	2.2	-	-	-
Leather and Rubber	2.1	1.9	-	-	-
Other Combustibles	-	-	-	2	3
<b>2. Non-Combustibles</b>	12.8	19.2	44	36	15
Metal	3.3	3.0	2	14	4
Glass	6.7	6.0	7	-	7
Ceramic and Soil	2.8	10.0	-	-	-
In-organic	-	-	35	22	-
Other(Non-Comb.)	0	0	-	-	4
<b>Total</b>	100	100	100	100	100

Note; \* Composition of MSW (without ash and measured) excluding road sweeping and bulky wastes.

Although the waste composition in Lublin and Poznan greatly differ at present, it is predicted to be the same in 2010. Main changes in present composition are as follows:

- Paper ratio will increase up to 28% as forecasted by the EC study.
- Garbage will decrease up to 34.0% as forecasted in Poznan study;
- Non-combustible ratio will increase up to 20% as forecasted in Poznan Study.
- Other fractions would only be considered as minor changes.

Based on the above, forecast for composition of MSW is done and tabulated in Table 4.2-6. Forecasts for both waste amount and composition are illustrated in Fig.4.2-1 and -2.

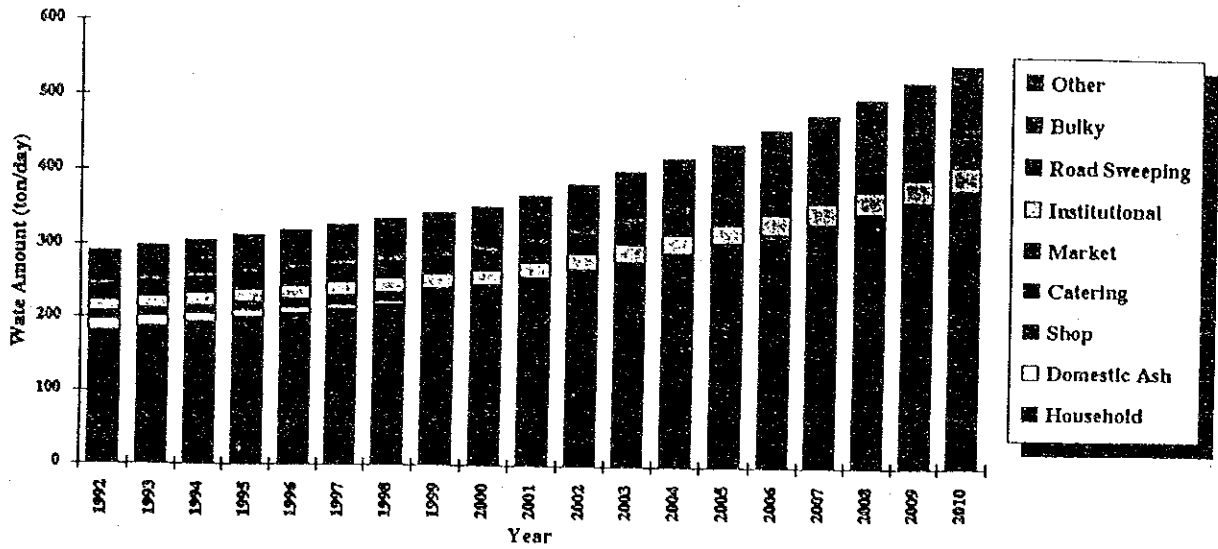


Fig.4.2-1 Forecast on Waste Amount

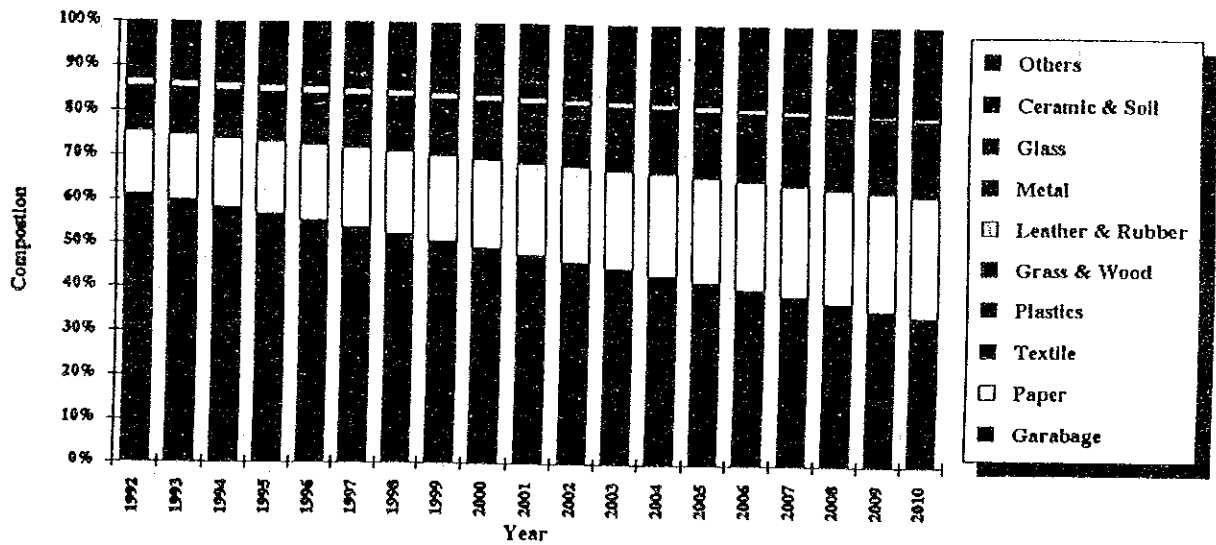


Fig.4.2-2 Forecast on Waste Composition

Table 4.2-6 Forecast on Composition of MSW without Ash, Poznan

Composition	1992	2001	2010
Garbage	61.1	47.6	34.0
Paper	14.2	21.1	28.0
Textile	3.1	4.1	5.0
Plastic	4.4	6.2	8.0
Grass and Wood	2.3	3.2	4.0
Leather and Rubber	2.1	1.5	1.0
Metal	3.3	4.1	5.0
Glass	6.7	8.3	10.0
Ceramic and Soil	2.8	3.4	4.0
Others (Non-combustible)	0	0.5	1.0
Total	100.0	100.0	100.0

Note: MSW here excludes road sweeping and bulky waste.

c. Forecast on calorific value

Table 4.2-7 shows our survey data and the data of the 1984/85 waste study in Poznan.

Table 4.2-7 Comparison of Three Contents and LCV, Lublin

	1992 JICA			1984/85 Waste Study in Poznan
	MSW Without Ash	MSW With Ash	MSW With- out Ash in Poznan	
Moisture content %	49.7	49.3	35.7	41.8
Combustible %	33.1	31.6	38.0	24.1
Ash %	17.2	19.1	26.1	34.1
Lower calorific value (kcal/kg)				
Measured	NA	NA	1,854	856
Estimated	1,213	1,146	1,805	-

Note: MSW excludes road sweeping and bulky waste.

The 1992 JICA data shown above are weighing averages, taking the waste discharge amount by each generation category into account.

The LCV (Lower Calorific Value) of MSW in future is estimated by multiplying the LCV of combustible wastes in the wet base by the ratio of the future physical composition.

Based on the data in Japan, the LCV of separated waste is estimated in Table 4.2-8 assuming a 10% inclusion of non-combustibles into combustible waste.

Table 4.2-8 Forecast for Lower Calorific Value

Year	Lower Calorific Value (kcal/kg)	
	Mixed	Separate
1992	1,213	1,320
2001	1,419	1,716
2010	1,628	2,217

Note: MSW excludes domestic ash and road sweeping and bulky waste.

#### 4) Future Waste Stream

The waste stream forecast for the years 2001 and 2010 are shown in Fig. 4.2-3 and 4.2-4 respectively. The detailed calculation sheets are tabulated in Table 4.2-9 to 4.2-16.

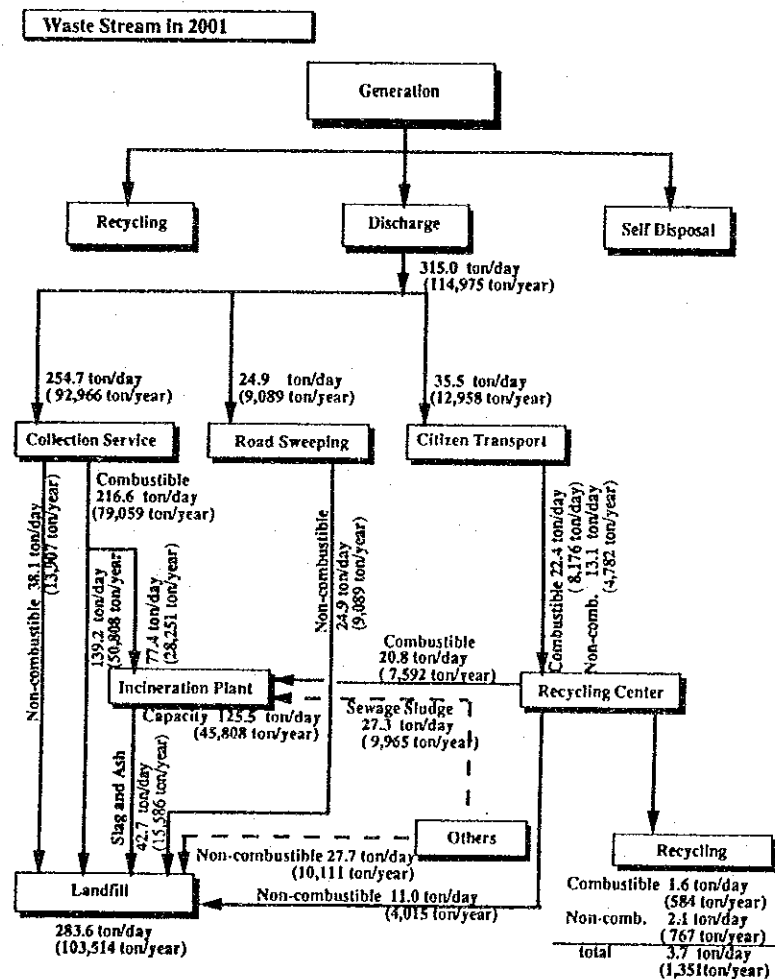


Fig.4.2-3 Waste Stream in 2001

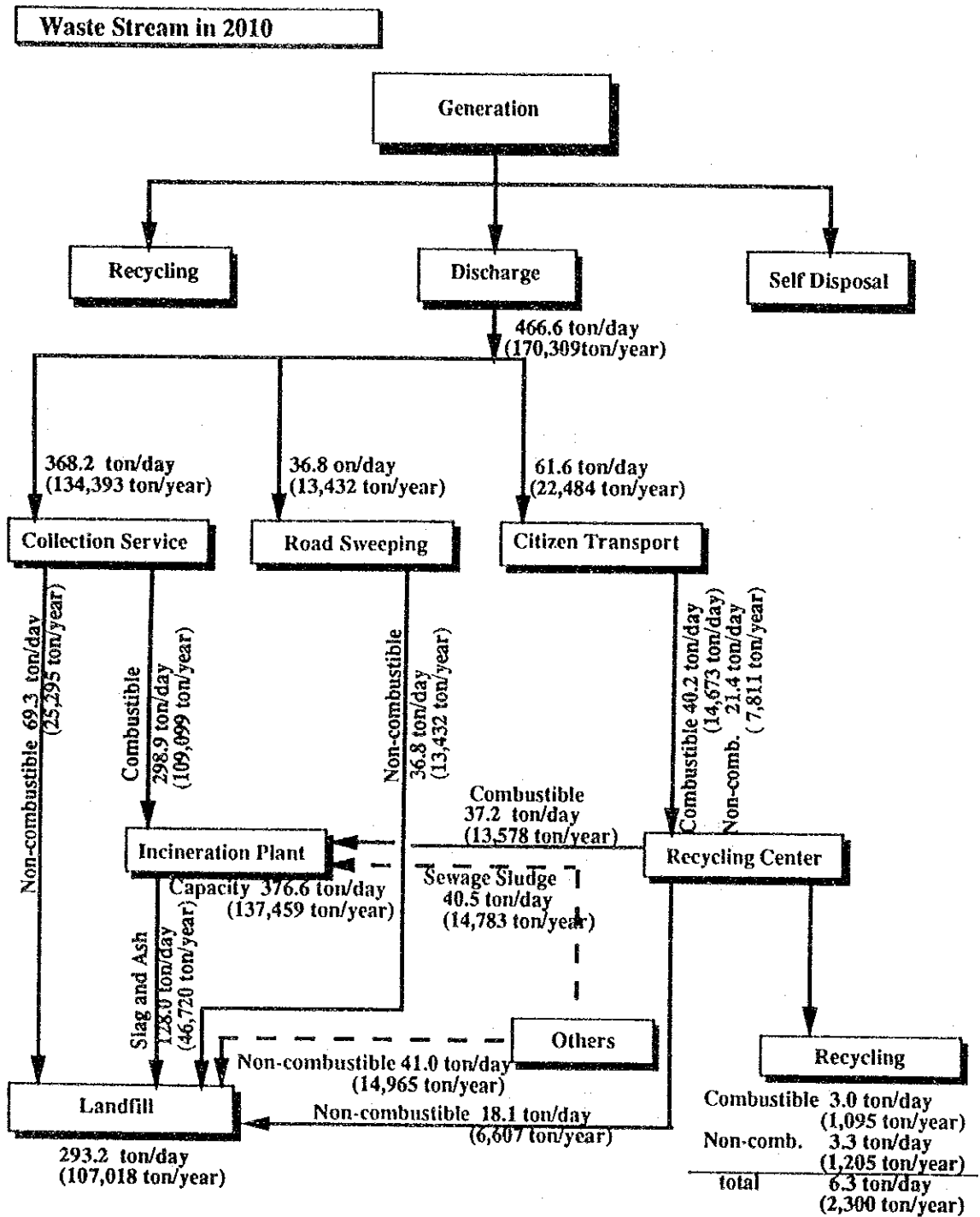


Fig.4.2-4 Waste Stream in 2010





Table 4.2-10 Detailed Calculation Sheet of Waste Stream (2)

Waste Stream (Metric)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Waste Stream (Metric)	1713	1264	1263	1262	1261	1260	1259	1258	1257	1256	1255	1254	1253	1252	1251	1250	1249	1248	1247	1246	1245	1244	1243	1242	1241	1240	1239	1238	1237	1236	1235	1234	1233	1232	1231	1230	1229	1228	1227	1226	1225	1224	1223	1222	1221	1220	1219	1218	1217	1216	1215	1214	1213	1212	1211	1210	1209	1208	1207	1206	1205	1204	1203	1202	1201	1200	1199	1198	1197	1196	1195	1194	1193	1192	1191	1190	1189	1188	1187	1186	1185	1184	1183	1182	1181	1180	1179	1178	1177	1176	1175	1174	1173	1172	1171	1170	1169	1168	1167	1166	1165	1164	1163	1162	1161	1160	1159	1158	1157	1156	1155	1154	1153	1152	1151	1150	1149	1148	1147	1146	1145	1144	1143	1142	1141	1140	1139	1138	1137	1136	1135	1134	1133	1132	1131	1130	1129	1128	1127	1126	1125	1124	1123	1122	1121	1120	1119	1118	1117	1116	1115	1114	1113	1112	1111	1110	1109	1108	1107	1106	1105	1104	1103	1102	1101	1100	1099	1098	1097	1096	1095	1094	1093	1092	1091	1090	1089	1088	1087	1086	1085	1084	1083	1082	1081	1080	1079	1078	1077	1076	1075	1074	1073	1072	1071	1070	1069	1068	1067	1066	1065	1064	1063	1062	1061	1060	1059	1058	1057	1056	1055	1054	1053	1052	1051	1050	1049	1048	1047	1046	1045	1044	1043	1042	1041	1040	1039	1038	1037	1036	1035	1034	1033	1032	1031	1030	1029	1028	1027	1026	1025	1024	1023	1022	1021	1020	1019	1018	1017	1016	1015	1014	1013	1012	1011	1010	1009	1008	1007	1006	1005	1004	1003	1002	1001	1000	999	998	997	996	995	994	993	992	991	990	989	988	987	986	985	984	983	982	981	980	979	978	977	976	975	974	973	972	971	970	969	968	967	966	965	964	963	962	961	960	959	958	957	956	955	954	953	952	951	950	949	948	947	946	945	944	943	942	941	940	939	938	937	936	935	934	933	932	931	930	929	928	927	926	925	924	923	922	921	920	919	918	917	916	915	914	913	912	911	910	909	908	907	906	905	904	903	902	901	900	899	898	897	896	895	894	893	892	891	890	889	888	887	886	885	884	883	882	881	880	879	878	877	876	875	874	873	872	871	870	869	868	867	866	865	864	863	862	861	860	859	858	857	856	855	854	853	852	851	850	849	848	847	846	845	844	843	842	841	840	839	838	837	836	835	834	833	832	831	830	829	828	827	826	825	824	823	822	821	820	819	818	817	816	815	814	813	812	811	810	809	808	807	806	805	804	803	802	801	800	799	798	797	796	795	794	793	792	791	790	789	788	787	786	785	784	783	782	781	780	779	778	777	776	775	774	773	772	771	770	769	768	767	766	765	764	763	762	761	760	759	758	757	756	755	754	753	752	751	750	749	748	747	746	745	744	743	742	741	740	739	738	737	736	735	734	733	732	731	730	729	728	727	726	725	724	723	722	721	720	719	718	717	716	715	714	713	712	711	710	709	708	707	706	705	704	703	702	701	700	699	698	697	696	695	694	693	692	691	690	689	688	687	686	685	684	683	682	681	680	679	678	677	676	675	674	673	672	671	670	669	668	667	666	665	664	663	662	661	660	659	658	657	656	655	654	653	652	651	650	649	648	647	646	645	644	643	642	641	640	639	638	637	636	635	634	633	632	631	630	629	628	627	626	625	624	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608	607	606	605	604	603	602	601	600	599	598	597	596	595	594	593	592	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576	575	574	573	572	571	570	569	568	567	566	565	564	563	562	561	560	559	558	557	556	555	554	553	552	551	550	549	548	547	546	545	544	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464	463	462	461	460	459	458	457	456	455	454	453	452	451	450	449	448	447	446	445	444	443	442	441	440	439	438	437	436	435	434	433	432	431	430	429	428	427	426	425	424	423	422	421	420	419	418	417	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384	383	382	381	380	379	378	377	376	375	374	373	372	371	370	369	368	367	366	365	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288	287	286	285	284	283	282	281	280	279	278	277	276	275	274	273	272	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12</









Table 4.2-15 Detailed Calculation Sheet of Waste Stream (7)

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Total Waste amount (ton/day)	191.2	238.3	284.4	313.3	326.9	329.0	327.3	348.8	364.3	378.0	386.5	393.7	401.6	406.6	408.4	408.2	408.2	408.2	408.2
MSW Total Amount (ton/day)	283.1	351.9	381.8	402.3	414.3	416.0	417.7	431.4	440.4	443.0	444.4	445.4	446.4	446.4	446.4	446.4	446.4	446.4	446.4
77777 Amount (ton/day)	31.4	38.3	41.3	42.7	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
MSW (at R2A) (ton/day)	313.5	328.4	333.5	337.0	340.3	343.0	345.7	348.7	351.5	354.2	356.9	359.6	362.3	365.0	367.7	370.4	373.1	375.8	378.5
Recycling (ton/day)	14.4	18.1	19.8	20.4	21.0	21.7	22.4	23.1	23.8	24.5	25.2	25.9	26.6	27.3	28.0	28.7	29.4	30.1	30.8
Other Waste (ton/day)	41.1	42.4	43.8	45.1	46.4	47.8	49.1	50.4	51.7	53.0	54.3	55.6	56.9	58.2	59.5	60.8	62.1	63.4	64.7
Service Shop (ton/day)	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4	28.4
PEC Ash (ton/day)	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Other (ton/day)	13.3	13.7	14.1	14.5	14.9	15.3	15.7	16.1	16.5	16.9	17.3	17.7	18.1	18.5	18.9	19.3	19.7	20.1	20.5
Collection Rate (%)	98.08	91.11	92.21	93.32	94.44	95.55	96.66	97.77	98.88	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
100% Collection Amount (ton/day)	217.7	238.3	284.4	313.3	326.9	329.0	327.3	348.8	364.3	378.0	386.5	393.7	401.6	406.6	408.4	408.2	408.2	408.2	408.2
Collection Amount (ton/day)	209.3	216.8	231.9	239.9	247.9	255.9	263.9	271.9	279.9	287.9	295.9	303.9	311.9	319.9	327.9	335.9	343.9	351.9	359.9
Non-recyclable Waste (ton/day)	17.4	21.6	23.5	24.4	25.3	26.2	27.1	28.0	28.9	29.8	30.7	31.6	32.5	33.4	34.3	35.2	36.1	37.0	37.9
Recycling (ton/day)	8.0	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.6	9.8	10.0	10.2	10.4	10.6	10.8	11.0	11.2	11.4	11.6
77777 Amount (ton/day)	31.4	38.3	41.3	42.7	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1	43.1
Chemical (ton/day)	14.4	18.1	19.8	20.4	21.0	21.7	22.4	23.1	23.8	24.5	25.2	25.9	26.6	27.3	28.0	28.7	29.4	30.1	30.8
Recycling Amount (ton/day)	14.4	18.1	19.8	20.4	21.0	21.7	22.4	23.1	23.8	24.5	25.2	25.9	26.6	27.3	28.0	28.7	29.4	30.1	30.8
Non-recyclable Waste (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycling Center (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incineration (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compostable Waste (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-compostable Waste (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recycling (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Compostable Waste (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-compostable Waste (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
To Landfill (Non-comb.) (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
To Incinerator or Landfill (Comb.) (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incineration Plant (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Incineration (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
From Collection Service (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
From Recycling Center (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Service Shop (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Others (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
To Landfill (ton/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4.2-16 Detailed Calculation Sheet of Waste Stream (8)

Year	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Landfill Amount (ton/year)	291.4	291.4	291.4	312.4	312.4	312.4	327.1	324.1	342.8	341.1	351.4	359.7	369.2	374.9	382.4	391.5	392.2	391.2	392.3	392.2
Total Amount (ton/year)	291.4	291.4	291.4	312.4	312.4	312.4	327.1	324.1	342.8	341.1	351.4	359.7	369.2	374.9	382.4	391.5	392.2	391.2	392.3	392.2
Total - (slag & Ash)	291.4	291.4	291.4	312.4	312.4	312.4	327.1	324.1	342.8	341.1	351.4	359.7	369.2	374.9	382.4	391.5	392.2	391.2	392.3	392.2
Annual Amount (ton/year)	106.281	106.281	106.281	111.291	111.291	111.291	115.292	115.292	118.131	118.131	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014
Slag & Ash (from incineration)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total - (slag & Ash)	106.281	106.281	106.281	111.291	111.291	111.291	115.292	115.292	118.131	118.131	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014	121.014
Landfill Amount (ton/year)	371.9	371.9	371.9	371.4	371.4	371.4	399.3	398.3	428.1	428.1	438.3	451.4	459.2	464.9	471.1	477.2	477.7	477.2	477.3	477.2
Total Amount (ton/year)	371.9	371.9	371.9	371.4	371.4	371.4	399.3	398.3	428.1	428.1	438.3	451.4	459.2	464.9	471.1	477.2	477.7	477.2	477.3	477.2
Total - (slag & Ash)	371.9	371.9	371.9	371.4	371.4	371.4	399.3	398.3	428.1	428.1	438.3	451.4	459.2	464.9	471.1	477.2	477.7	477.2	477.3	477.2
Annual Amount (ton/year)	138.897	138.897	138.897	138.541	138.541	138.541	145.742	145.742	152.327	152.327	155.941	158.241	160.241	161.842	162.842	163.842	163.842	163.842	163.842	163.842
Slag & Ash (from incineration)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total - (slag & Ash)	138.897	138.897	138.897	138.541	138.541	138.541	145.742	145.742	152.327	152.327	155.941	158.241	160.241	161.842	162.842	163.842	163.842	163.842	163.842	163.842
Approved Annual Amount (ton/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Slag & Ash (from incineration)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total - (slag & Ash)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Recovery (GJ/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heat Recovery (GJ/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Heat Recovery (GJ/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Total Combustible Amount (ton/year)	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	7,527	
Slag & Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Slag & Ash (from incineration)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Annual Heat Recovery (GJ/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	
Total Combustible Amount (ton/year)	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	1,229	
Slag & Ash	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Slag & Ash (from incineration)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Annual Heat Recovery (GJ/year)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

## 5) Economic and Financial Condition

The economy of Poland is being restructured at present. The economic growth rate for the past several years showed a downward trend due to the collapse of the former economic system although rapid growth can be expected if the social economic condition becomes stable after the socio-economic structure is successfully reconstructed.

The following case of economic growth rate is assumed in the study:

- case A:    1995                    same as 1990 level
- 1996 - 2000    3 % increase/year
- 2001 - 2010    6 % increase/year

In this report, the ratio of the GRDP and the financial capability of the municipality is assumed to be in proportion to the GDP.

The changes in income level estimated from GDP per capita are shown in Table 4.2-17.

Table 4.2-17      Changes of Income Level

	1985	1986	1987	1988	1989	1990
GDP            (trillion zl)	8.7	10.7	14.0	25.0	105.0	506.3
Exchange rate    (Zl/USD)	147.2	175.2	265.2	430.6	1446	9500
Population        (million )	37.3	37.6	37.8	37.9	38.0	38.2
GDP per capita    (USD)	1,577	1,624	1,398	1,531	1,910	1,395
Reference:        (USD)						
GNP per capita				1,860	1,790	1,690
WEIS*	(6,470)		(6,883)	(7,270)	(1,560)	

Sources : Rocznik Statystyczny 1991, World Development Report

\* mark WEIS ARC report (CIA,Economic Statistics 1990)



The calculation results are shown in Table 4.2-18.

Table 4.2-18 GDP Estimated in 1990 Constant Price (million USD)

	1990	1993	1995	2000	2005	2010
GDP (bill.USD)						
Case A	63.6	63.6	63.6	73.7	98.7	132.0
*Financial affordability of the Lublin Agglomeration (bill.zl)						
Case A		833	833	965	1,292	1,729

(Note) \* The figure is estimated by simply multiplying the budget of Lublin Municipality in 1993 (596 billion zl) by the ratio of 1.397 (the ratio of the population of Lublin Agglomeration to Lublin City) due to lack of information.

A shift to a post-industrial society in which trade and services will take the lead is assumed to take place. The composition of industries in 2010 will be calculated by extending the changes in the term from 1970 to 1989, as shown in Table 4.2-19.

Table 4.2-19 Change of GDP (%)

Business category	1970	1980	1989	2010
Industry	54.6	52.1	47.9	36.5
Agriculture	17.3	15.8	12.7	9.1
Trade	9.9	12.8	18.5	31.2
Other Industry	18.2	19.3	20.9	23.3

The number of employees in each business category will increase in proportion to the share of GDP, although the ratio of total number of employees to the total population shall be maintained in the present level (about 43%).

## 6) Conditions for Cost Estimation

All design and cost estimates presented are based on the study in Poznan and the assumption that new facilities for Lublin will be designed and constructed to meet prevailing EC standards. However, one must bear in mind that the present economy of Poland cannot realistically afford overnight steps to change the level and standard of the facilities. Improvements can only be obtained gradually.

All cost estimates were conducted based on the following:

- The prices were based on the January 1993 prices.
- Labour costs and investments for constructions and equipment available in Poland reflects Polish price level. These prices are presented in Zloty (Zl). Table 4.2-19 presents information on the January 1993 unit prices in Poznan.
- Prices for equipment not available in Poland reflects price level available in Western Europe. These are presented in CIF prices of USD (1 USD = 15,700 Zl, January 1993).
- Costs for the acquisition of lands as well as for connection fees (electricity, water and sewerage) are not included.
- Costs for preliminary studies and design works for authorities approval concerning the construction of facilities is not included.
- All salaries are net salaries, including 20 % tax and 45 % social security service.
- The inflation rate is not taken into account.

In order to obtain information on price levels available in Poznan, information on typical unit prices for earthworks, concrete works, buildings, etc., were obtained from the following companies:

- AKO-consulting which is an engineering company in Poznan specializing in provision of services for construction works.
- Bud-Eko, a contractor in Poznan mainly involved in earthworks.

Table 4.2-20 presents information on unit prices available in Poznan January 1993.

Table 4.2-20 Information on Unit Prices Available in Poznan

DESCRIPTION	UNIT PRICE INCL. ALL MATERIALS AND WORKS POZNAN, JUNE 1992
<p><i>Salary within construction works including 20 % tax and 45 % social security service:</i></p> <ul style="list-style-type: none"> <li>- manager</li> <li>- engineer and mechanic</li> <li>- driver and operator</li> <li>- worker</li> <li>- clerk</li> </ul>	<p>23.2 mill. Zl/month 22.6 mill. Zl/month 11.6 mill. Zl/month 6.4 mill. Zl/month 4.1 mill. Zl/month</p>
<p><i>Earthworks</i></p> <ul style="list-style-type: none"> <li>- Excavation of soil and 50 m transport to storage heap</li> <li>- Excavation of soil and 500 m transport to storage heap</li> <li>- Excavation of soil, 50 m transport to and compaction in an embankment</li> <li>- Supply of gravel for drainage including laying in a 0.3 m thick layer</li> <li>- D 110 PVC laid in a 1 to 1.5 m deep trench</li> <li>- Supply and laying of stones for a stone drain (1m<sup>3</sup>/m)</li> </ul>	<p>20,000 Zl/m<sup>3</sup> 58,000 Zl/m<sup>3</sup> 35,000 Zl/m<sup>3</sup> 58,000 Zl/m<sup>2</sup> 348,000 Zl/m. 551,000 Zl/m.</p>
<p><i>Pavements</i></p> <p>Consisting of:</p> <ul style="list-style-type: none"> <li>- 3 cm asphalt top layer</li> <li>- 7 cm asphalt bottom layer</li> <li>- 15 cm mechanical stable gravel</li> <li>- 30 cm course gravel</li> </ul> <p>Consisting of 30 cm layer of mechanical stable gravel</p>	<p>406,000 Zl/m<sup>2</sup> 81,000 Zl/m<sup>2</sup></p>
<p><i>Concrete works:</i></p> <p>Formwork, reinforcement, concrete and all works for the following:</p> <ul style="list-style-type: none"> <li>- wall</li> <li>- slab</li> <li>- column</li> <li>- continuous footing foundation</li> </ul>	<p>3,944,000 Zl/m<sup>3</sup> 3,132,000 Zl/m<sup>3</sup> 3,596,000 Zl/m<sup>3</sup> 1,856,000 Zl/m<sup>3</sup></p>
<p><i>Buildings</i></p> <ul style="list-style-type: none"> <li>- Garage from a steel structure with steel cladding, including foundation and concrete floor</li> <li>- Office building of brickwork, including all works</li> </ul>	<p>2,668,000 Zl/m<sup>2</sup> 4,292,000 Zl/m<sup>2</sup></p>
<p><i>Fences</i></p> <ul style="list-style-type: none"> <li>- 2 m high galvanized wire mesh erected on galvanized steel posts each 2.5 m</li> <li>- Gate (8 m wide)</li> </ul>	<p>383,000 Zl/m 8,120,000 Zl</p>
<p><i>Electrical works</i></p> <ul style="list-style-type: none"> <li>- 4 x 95 m<sup>2</sup> (aluminium) including earthwork for trench</li> </ul>	<p>232,000 Zl/m</p>
<p><i>Purchase of Polish equipment</i></p> <ul style="list-style-type: none"> <li>- Dump truck, 3 axle</li> <li>- Dump truck, 2 axle</li> <li>- Tractor (type)</li> </ul>	<p>446,600,000 Zl 371,200,000 Zl 145,000,000 Zl</p>
<p><i>Materials</i></p> <ul style="list-style-type: none"> <li>- Diesel oil</li> <li>- Cement</li> <li>- Steel beams</li> <li>- Energy</li> </ul>	<p>4,900 Zl/l 34,000 Zl/50kg 17,000 Zl/kg 760 Zl/kWh</p>

## 1) Outline of Technical System

The proposed technical system for the MSWM Master Plan is summarized and tabulated in Table 4.3-1.

Table 4.3-1 Outline of Technical System in 2010

Technical Sub-Systems	Contents and
1. Discharge and Storage a. Amount of discharge b. Type of Refuse Bins	170,309 ton/year (466.6 tons/day) In addition to the present system, paper bags will be used for detached houses.
2. Collection and Haulage a. Coverage Ratio b. Collection System Provided c. Amount of Waste Collected (304 days of work a year)	100% - Regular separate collection of combustibles and non-combustibles - Bulky waste collection - Recycling centre collection - Regular collection of combustible : 358.9 tons/day - Regular collection of Non-combustible : 83.2 tons/day - Bulky waste collection : 19.0 tons/day - Recycling centre collection : 55.0 tons/day <hr/> Total : 516.1 tons/day
3. Public Recycling Centres a. Number of Centres b. Waste Amount (304 day/year)	8 places Input: from bulky waste collection : 19.0 tons/day from recycling centre collection : 55.0 tons/day Output: to incineration plant : 44.7 tons/day to recycling : 7.6 tons/day to final disposal : 21.7 tons/day
4. Road Sweeping and Public Area Cleansing	The same as the present system
5. Intermediate Treatment a. Proposed Site b. Received Waste c. Capacity d. Working Hours e. Heat Recovery	Zadcbie, Area 5.0 ha MSW excluding road sweeping and non-combustible wastes, sewage sludge and hospital wastes 8 ton/hour/line x 3 lines and 576 tons/day 24 hour/day and 7,000 hour/year Hot water supply 920 TJ/year
6. Final Disposal a. Proposed Site b. Daily Disposal c. Cumulative Landfill Amount d. Landfill Method e. Landfill Area	Rokitno and site area 38.0 ha 310 cu.m/day and 293.2 tons/day 3,050,000 cu.m from 1994 to 2010 Sanitary landfill and leachate is carried to sewage treatment facility 13.7 ha from 1994 to 2010
7. Recycling a. Recycling Facility b. Others	Non specific facility will be provided except for those in the private sector. Administrative support to private recycling business and introduction of on-site composting.