Study on Implementation of
Integrated Spatial Plan for
The Mamminasata Metropolitan Area

SECTOR STUDY (10)

SOLID WASTE MANAGEMENT

KRI International Corp.
Nippon Koei Co., Ltd

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1. PRESENT CONDITION OF SOLID WASTE MANAGEMNT

1.1. Waste Generation

1) Waste Quantity and Quality Survey

Solid waste quantity and quality survey was carried out to identify the waste generation source, its quantity and characteristics (physical composition, bulk density, moisture content) by the JICA Study Team in June, 2005.

Sampling points of the survey are selected at households (categorized into high income, middle income, low income levels), markets, hotels, industrial factories, offices and streets.

(1) Waste quantity

The waste quantity survey at generation sources has been conducted at 67 households (12 high income, 43 middle income and 12 low income), 23 commercial sources such as hotels, restaurants and markets, 5 industrial factories, 5 offices and 5 street points for 2 days of weekdays and 2 days of weekends. The unit generation ratio analyzed from the sampled data in each generation source has been used to estimate total quantity of waste in the generation source in Makassar and other regencies. The result of analysis is summarized as shown in the following table.[1]

Table 1.1 Waste Quantity in Each Generation Source [m^3/day]

	Makassar	Maros	Gowa	Takalar
Household	1274	385	416	358
Commercial	178	64	67	41
Industry & Office	164	14	14	12
Others (Streets, etc)	60	14	40	10
Total	1676	477	537	421

Source: JICA Study Team

(2) Waste quality

Physical composition, moisture content and bulk density of the sampled solid waste in Mamminasata area have been measured as shown in the following table. The survey showed that organic waste is relatively high, especially household and market waste in which organic waste occupy approximately 70%. On the other hand, plastic and paper waste in the generation sources are around 10%. Office and hotel are comparatively large generators of paper waste (approximately 24 to 25%). The waste generated in streets includes relatively high rate of plastic (23.4%) and leaves including other waste (26.9%).

[1] Because some of the data might be is not accurate, the additional survey including analyzing is under implementation by the contractor

Table 1.2 Waste Quality by Source

		JICA study in 1996	The survey result of this Study					
		Household	Household	Restaurant	Hotel	Market	Office and industry	Street
Physical composition	Kitchen waste	57.96%	70.7%	73.1%	60.3%	70.9%	47.7%	10.9%
	Textile	0.81%	0.7%	0.0%	1.8%	2.3%	0.1%	6.6%
	Woods	0.96%	0.5%	0.1%	0.0%	0.0%	0.7%	5.2%
	Plastic	11.24%	11.6%	11.7%	9.0%	15.5%	18.6%	23.4%
	Rubber/ leather	0.07%	0.1%	0.0%	0.4%	0.0%	0.0%	5.0%
	Metal	2.49%	1.0%	1.4%	3.3%	1.2%	0.8%	6.6%
	Glass	2.14%	1.6%	2.7%	0.0%	0.3%	1.3%	6.1%
	Ceramics	0.84%	0.1%	0.0%	1.1%	0.0%	0.0%	0.0%
	Soil	0.80%	0.4%	0.0%	0.0%	0.0%	2.5%	0.4%
	Paper	14.71%	10.0%	11.0%	24.1%	7.3%	24.7%	9.0%
	Others	7.98%	3.3%	0.0%	0.0%	2.5%	3.7%	26.9%
Bulk density		0.232[kg/l]	0.46 [kg/l]	0.42[kg/l]	0.21[kg/l]	0.41[kg/l]	0.20[kg/l]	0.29[kg/l]
Moisture content		55.02 %	77 %	81%	79%	78%	82%	-[1]

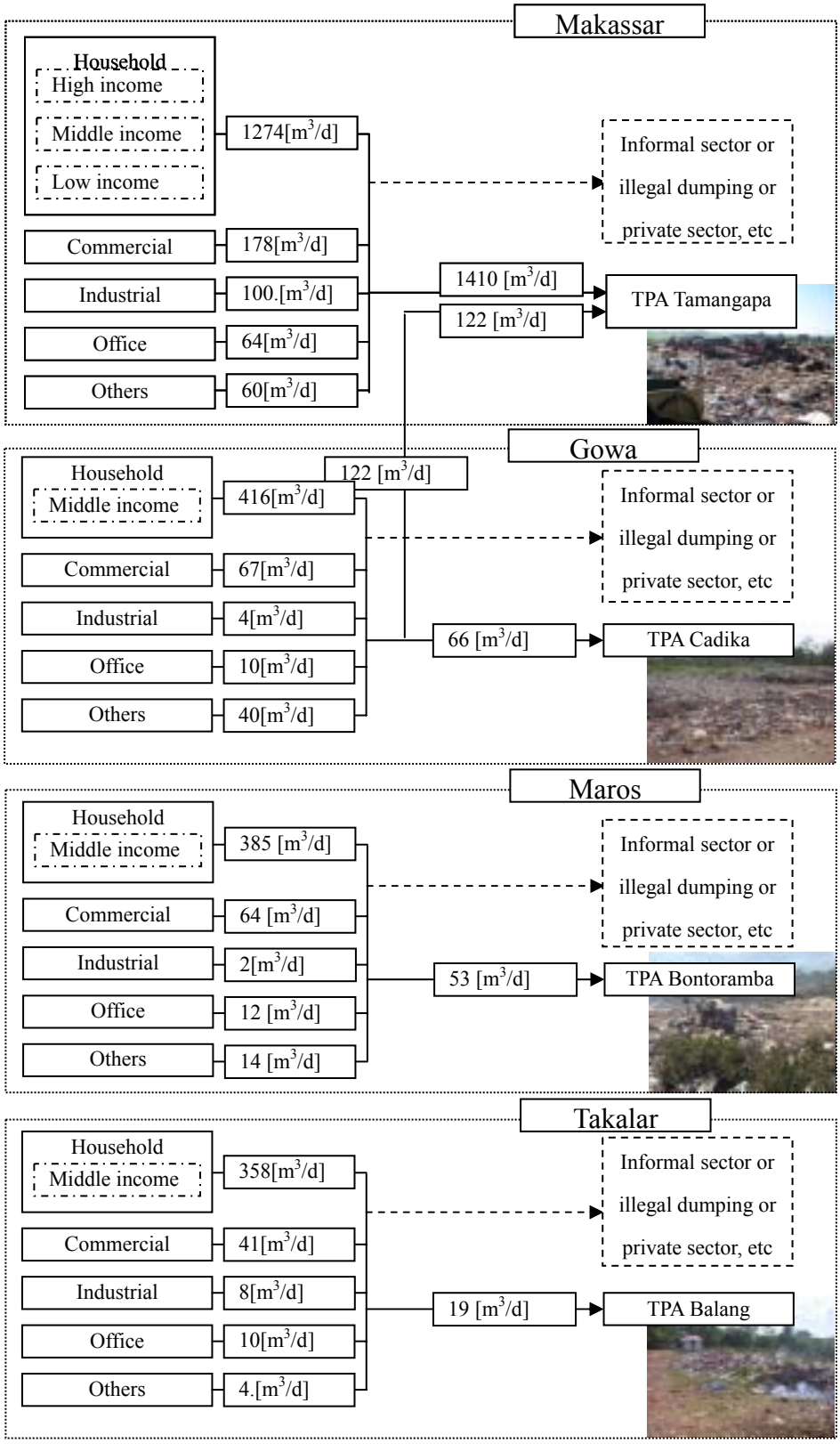
Source: Based on the result of solid waste survey by this JICA Study Team" and the JICA Study in 1996

The moisture contents of the solid waste are approximately 70% to 80% showing a similar value among household, restaurant, hotel, market and office and industry. This implies that the waste contains more water if compared with the value of other developing countries or estimated previous JICA Study in 1996 (hereafter JICA Study (1996)). Bulk density of household waste is approximately 0.46[kg/l] which is larger than the value (0.232 [kg/l]) estimated by the JICA Study (1996). This might be caused by a higher content of kitchen waste and a lower content of paper.

(3) Waste Flow

Makassar, Gowa, Maros and Takalar have their own landfill sites and the solid waste is transported to the landfill sites. Some of waste generated in Gowa is transported to the landfill site in Tamamgapa in Makassar (hereafter TPA Tamangapa). The waste flow in Mamminasata is summarized in the following diagram.

[1] "-" means that there is no data



Source: JICA Study Team

Figure 1.1 Waste Flow in Mamminasata

1.2. Collection and Transportation

A coverage ratio of waste collection service is approximately 85% in Makassar, 88 % in Maros, 75 % in Gowa, 75% in Takalar according to cleansing department in city and each regency. The collection methods or frequencies vary by city and each regency. In case of Makassar municipality, PD Kebersihan (Regional cleansing enterprise) collects solid waste from household, hotel and restaurant in four Kecamatan (Ujung Pandang, Wajo, Biringkanaya and Tamalanrea) and Department of Environment and Beautification (hereafter DK Makassar) collects solid waste in other areas in Makassar and disposes it in TPA Tamamgapa. Industrial waste is collected and transported by the generators to landfill site or disposed there.

Cleansing departments in each regency (including DK Makassar) and PD Kebersihan dominantly apply two kinds of collection systems, i.e., hauled container system using arm roll vehicle and curbside collection. The curbside collection by the tipper with one driver and three collectors is mainly applied for high and middle income areas where access road is sufficiently wide. On the other hand, hauled container collection is mainly applied for market or in front of main road. The number of locations is shown in the following table.

Table 1.3 Number of location for collection

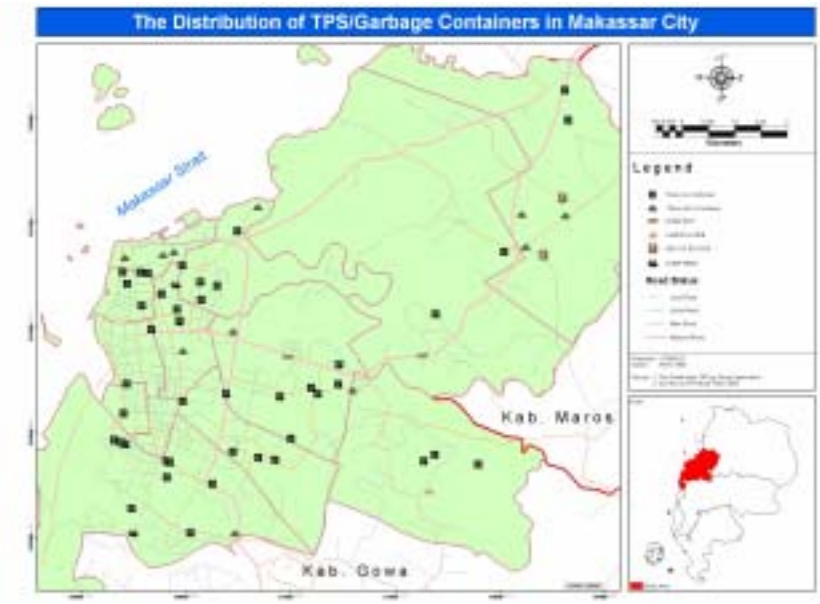
	Makassar	Gowa	Maros	Takalar
Number of TPS location with containers [Number of container]	181 [173(6m^3)] [12(10m^3)]	10 [20 (6m^3)]	10	6
Number of Open TPS location	278	27	4	40
Permanent concrete bin	-[2]	25(1m^3) 75(3m^3)	-	8
Plastic dust bin	-	35	-	20
Others	-	-	100	-

Source : Dinas Kebersihan in each regency and DK Makassar

In some areas, especially in lower income or slum areas, the collection service is not sufficiently carried out because of lack of sufficiently wide road for waste collection vehicle or long distance to the households as generation source from the neighboring collection points. In some of the above areas, community members or NGOs collect the waste from households to temporary disposal sites with containers (hereafter container TPS) or temporary disposal sites without any container (hereafter Open TPS). In that case, the collection service is mostly provided with some charges in addition to the retribution fee collected by the local authorities.

The collected waste in concrete bins or containers is transported by dump truck or arm roll vehicle to landfill sites.

The locations of containers are described in the following figure.



Source : JICA Study Team

Figure 1.2 Identified Distribution of Containers in Makassar

Currently available equipment for waste collection and transportation is tabulated in the following.

Table 1.4 Equipment for Transportation

	Makassar	Gowa	Maros	Takalar
Handcart (1m^3)	299	-	10	0
Tipper truck (6m^3)	64	4	4	4
Arm roll truck (6m^3)	48	3	3	-
Arm roll truck (10m^3)	2	0	0	-
Compactor (6m^3)	4	0	0	-
Motor becak	6	3	0	0
Other vehicle	12	0	1	0

Source : Dinas Kebersihan in each regency and DK Makassar

[2] "-" means that there is no data

1.3. Final Disposal

The collected municipal solid waste is mainly dumped in landfill sites in Mamminasata. Currently each city has its own landfill site. The location and the condition of landfill sites in Mamminasata are presented in the following table and figure.

Figure 1.3 Existing Landfill Sites in Mamminasata Metropolitan Area

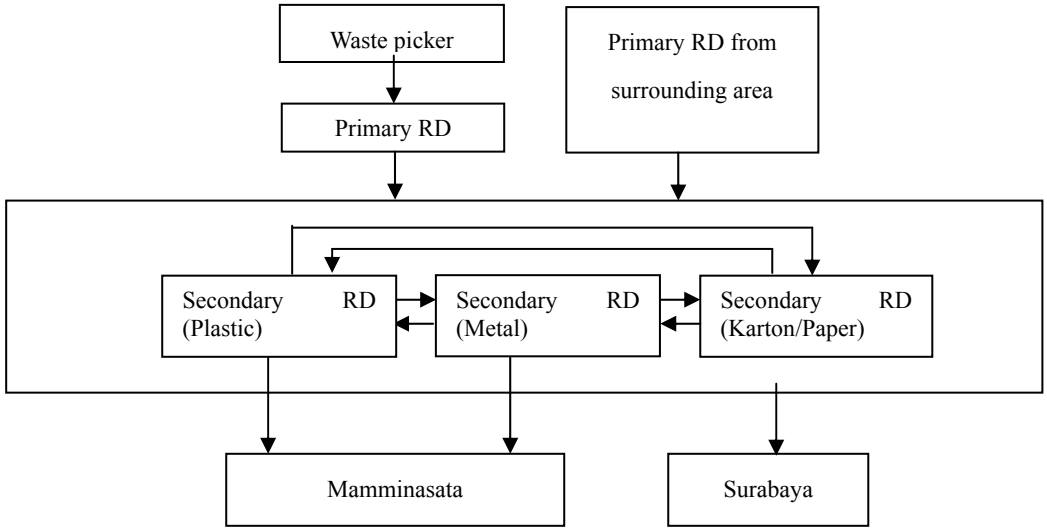
Table 1.5 Condition of Landfill Operation

		Makassar	Gowa	Maros	Takalar
Location		Tammangapa Kec. Manggala	Cadica Kec. Plangga	Bontoramba Desa Bonto Matene Kec. Mandai	Balang Kec. Polombangkeng Selatan
Beginning year		1993	1997	1997	About 1985-
Area		14.3[ha]	2[ha]	2.8[ha]	2.8[ha]
Operation	Soil covering	Covering soil but Not periodically	No soil covering	No soil covering	Covering soil but Not periodically
Equipment	Bulldozer	4	1	0	Rental
	Wheel loader	0	0	2	Rental
	Excavator	1	0	1	Rental
Facility	Office	1	1	1	1
	Leachate pond	1 (not operate properly)	0	0	0
	Gas vent system	1	0	0	0
Activity by waste picker	Number of waste picker	178	10	20	8

Source : Dinas Kebersihan in each regency and DK Makassar

1.4. Recycling Activity

Some of recyclable waste in discharged solid waste is collected by waste pickers[3] in collection points, container TPS, open TPS, TPA and other big supermarkets to sell it to recycling dealers. The recyclable and reusable waste sold to the recycling is sold to recycling factories in Mamminasata or transported to Surabaya through some primary and secondary recycling dealers [4,5]. The following diagram regarding recyclable waste below shows recyclable waste link occurring in TPA locations from the scavengers to manufacturer's level.



Note: RD means recycling dealer

Figure 1.4 General Flow of Recyclable Waste

As shown in the diagram, waste pickers collect the waste to sell it to primary recycling dealers who in turn recycling dealers sell it to the secondary recycling dealers. The secondary recycling dealers handle certain recyclable material such as papers and boxes to Surabaya. They also buy plastics and metals and send them to Surabaya as well as to factories in Mamminasata. Besides that, the secondary recycling dealers also buy several items from outside South Sulawesi and even from

[3] Waste pickers are persons who collect recyclable waste in TPA, the streets and other places.

[4] Primary recycling dealer are persons who collects the recyclable waste from several waste pickers and/or cleaning officers which then sells the waste to the bigger recycling dealers (secondry recylcing dealers).

[5] Secondary recycling dealer is a person who collects the recyclable waste from some primary recycling dealer. This person has packing equipment for paper/boxes and thin metal or plastic compactor machine and sells them to manufacturers in Makassar and/ or in Surabaya.

South East Sulawesi. The prices of recyclable material depend highly on the demand of existing manufactures in Mamminasata or in Surabaya.

Table 1.6 Market Price of Recyclable Material in Each Stage

Material	Waste pickers → Primary recycling dealers [Rp./kg]	Primary recycling dealers → Secondary recycling dealers [Rp. /kg]	Secondary recycling dealers → Recycling factory (Surabaya) [Rp. /kg]
Plastic	50 ～2700	100～3000	3000～3500
Metal(Iron)	400～900	500～1200	2000～2300
Paper/carton	200～700	300～1200	750 ～1500

Source : JICA Study Team

Several factories are dealing with recycling in Mamminasata. The name and activities of factories identified are summarized as follows.

Name of factory	Type of handled recyclable material	Detail explanation
Luhur Plastik	Plastic	Luhur Plastik factory produces was one of factories managing plastic waste by producing pots, hangers, pails, etc. plastic which is discharged as waste is around 10 ton coming from Gowa, Maros and Feri every week. Type of plastic handled was propylene, especially for household. The quantity of product from this factory is approximately 500 kg per day. There were 100 persons working in the factory.
CV Andalas Jaya	Aluminium	CV Andalas Jaya produce pans and kettles from aluminium waste collected through recycling dealers from the waste pickers in Makassar. The targeted markets of this factory were South and Southeast Sulawesi Provinces. The handled aluminium waste are around 1 to 2 ton per week.
PT. Barawaja	Metal	PT Barawaja handles recyclable metal such as scrap metal or aluminium.
PT. ORGI	Organic waste	PT ORGI produces compost from organic waste in the site near Tamamgapa landfill site. Based on hearing from Dinas Spatial Planning (province), the plant is not operated properly because of quality issues and unstable existing organic fertilizer market for agriculture usage. The operational condition such as investment, amount of product, O&M cost or number of staffs has not been identified in detail.

1.5. Public Awareness

A public awareness survey has been carried out to identify the current public participation activity for solid waste discharge, public awareness on the for waste collection service by local government and possibility of public participatory approach to the separate collection or 3R (Reduce, Reuse and Recycling) activity. The survey results are summarized as follows.

Awareness regarding waste collection service

Item	Result
Frequency of Collection service	Waste collection service in high income level in Makassar municipality has been supplied every day or twice a day particularly in housing areas. In the area of middle and low income level , the service generally supply 1-4 times a week. Waste collection in Maros, Gowa, Takalar regency was carried out between 1 to 7 times a week according to the areas.
Quality of collection service	Respondent's answers regarding waste collection service by the operators in general still provided 'insufficient' answer (56.9%). 40.8% stated the service was 'sufficient' and the rest provided no answer (2.3%). Though in high and middle income, more than half of respondents feel sufficient on performance, they feel insufficient for the service in the low income level in Makassar. The respondents feel insufficient regarding waste collection service in the order of Takalar, Gowa and Maros.
Amount of retribution fee	The amount of retribution fee in Makassar for waste collection was various. For low income level, the retribution fee was ranging between 1,500 – 5,000 rupiahs/month. Meanwhile, for the middle income was between 5,000 to 10,000 rupiahs/month. Respondents with high income paid the retribution between 10,000 to 60,000 Rp. per month. For the three regencies, the fee was ranging between 1,500 to 5,000 Rp.
Response of current retribution fee	In Makassar, more than half of the respondents of high and low income level feel current retribution fee cheap, and about 20 to 40% of them feel expensive, but the result regarding low income level show that 42 % of the respondents feel it cheap and 36 felt it expensive. Though most of the respondents did not answer in Takalar, the result of middle income level in Gowa or Maros is almost as same as in middle income level in Makassar.
Retribution fee	Concerning the question on relation between retribution fee and quality of waste collection service, the respondents are willing to pay more than usual fee if they got a better service, not highly related with regional characteristics or income levels.
Discharge method of solid waste	In term of waste temporary disposal places, respondents explained that they mostly disposed their waste/garbage in front of their houses (35.9%) and into the dust bin near their houses (38.2%). There was only 15.4% placed their garbage in TPS. Some disposed their garbage in other places (8.2%) and 2.3% did not provide an answer in Mamminasata area. Respondents generally in Makassar city have placed their garbage near their houses (in front of the house and in the dust bin near their houses) in high and middle income level. However, the rate of respondents utilizing TPS increase for the low income level. Waste placements in the other three regencies in general were still in front of their houses or into the dust bins near their houses.
Condition of TPS	Concerning the TPS availability, most of the respondents (306 respondents) stated that TPS was sufficient (39.2%). 27.1% complained that there was no TPS and 25.8% stated the TPS locations were far from their houses. With higher of income level, the answer of respondents tend to be satisfactory regarding the condition of TPS. In addition, 21% answered that

	there was no TPS found near their houses. Around only 20% of the respondents in Maros feel sufficient but residents in Gowa and Takalar have considered TPS near their houses were sufficient (42% and 45.1%). Regarding cleanness of TPS, the area near higher income level tends to cleaner than lower income level. The respondents in each regency or municipality feel TPS dirty with the order of Makassar, Gowa or Maros, and Takalar.

Awareness regarding 3R activity

Item	Result
Current 3R activity	In general, types of waste that can be used again are plastic, bottle, can, and paper. From 306 respondents, there was 32.7 % of respondents stated that disposed waste was not re-used again. Re-used waste was 28.3% while around 1.3% of the respondents was uncertain and the rest (9.5%) did not answer the question.
Possibility of waste separation discharge	Perspectives on waste separation for Makassar City area in common provided different answers between the categories of income. High level income felt that they had a little bit difficulties in waste separation (51.0%) and 37.7% of respondents from the middle income found difficulties in this process. There was only 36.0% provided answer of a little bit difficulties in separating the waste in low income level.
Willingness to waste separation program	Regarding the willingness of the respondents to follow the waste separation program, More than 61.4% out of 306 respondents stated that they would like to join with the program though 2.2 % were unwilling to participate with the program and other answer given was 8.2% and number of respondent with no answer was 8.2%. Tendency of the willingness in each regency indicate the order of Takalar, Makassar, Gowa, Maros
Possibility of waste storage	The results showed that in general (306 respondents), length of time the waste can be stored in more than 60 % of the households was more than 2 to 3 days. It has been identified that the high income level cannot store longer than middle or low income. In context of regional characteristics, The respondents in Takalar (70%) can store longer than Makassar, Maros and Gowa.
Effort of waste reduction	In accordance with waste reduction, in general all respondents answered that there were some efforts conducted in reducing the waste (>72.5%). Meanwhile, some respondents (23%) stated that there was no effort regarding waste reduction. The significant difference both among each income level and among each municipality and regency has not been identified.

1.6. Issues to be Solved

Based on the surveys, the issues to be addressed in the SWM in Mamminasata have been identified as summarized in the following figure.

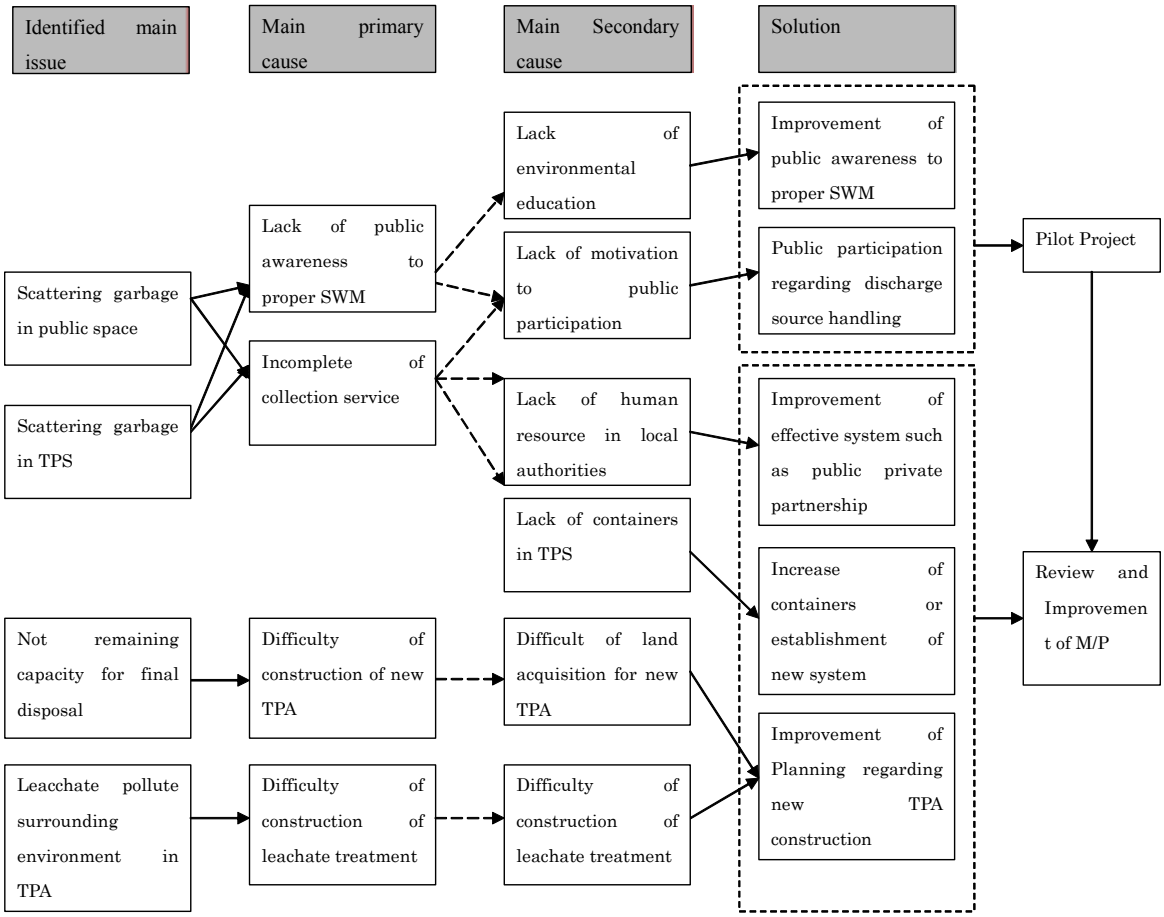


Figure 1.5 Relationship among the Identified Issues

Major issues to be addressed in SWM in Mamminasata are described as follows.

(1) Scattering Solid Waste in Public Spaces

In the city areas, scattering solid waste as well as ditch or drainage causes a number of environmental and sanitary problems, though street sweepers clean main roads in Mamminasata. As one of the reasons, especially in the area along the narrow roads, solid waste collection service cannot be sufficiently provided by the local authorities.

(2) Scattered Solid Waste in TPS

Solid waste is scattered in the surrounding area (TPS) of hauled containers. TPS without hauled containers were some times founded though there are containers in the other times. There is no any container in that place when armroll vehicle transports the collected waste to landfill site. Then,

some people tend to dump in the place because there is not any container in spite of a waste collection point. At the result, the dumped waste is remained in the area.

(3) Over capacity at landfill site

There is no remaining capacity at the existing landfill site in Makassar. Part of received solid waste is disposed in the area where waste has not been protected by embankment.

The daily cover soil for preventing scattering of waste, mitigating offensive odors and minimizing harmful vermin is not carried out at TPA. Leachate infiltrate through solid waste layer to groundwater due to no liner system in the TPAs. It cause environmental problem to the surrounding water system. The improvement regarding leachate collection and treatment is needed.

1.7 Existing Improvement Plan

1) JICA Master Plan (1996)

"Master Plan and Feasibility Study on Wastewater and Solid Waste Management for the City of Ujung Pandang in the Republic of Indonesia" was carried out by JICA in 1996. The study recommended (i) a procurement of equipment for collection and transportation, (ii) construction of new landfill site, and (iii) consulting service regarding SWM and waste water treatment. New landfill site for Makassar is located in the another regency (Gowa) Though the local governments already agreed with basic points of inter-regency cooperation, the demarcation of land acquisition fee and disposal fee collected in operations has not been agreed. Socialization at the landfill site has not been completed yet.

2) Other Plans prepared by external bodies (Technical Assistance for Makassar Metropolitan City Waste Management)

A study on "Technical Assistance for Makassar Metropolitan City Waste Management" was prepared by a Jakarta-based consultant in 2004. The study concept is that inter-regional disposal system should be established to solve the problems in Makassar, as Makassar municipality is growing with high intensity in various activities and the municipality is facing environmental problems. Responsibility between the communities and municipal for SWM has not been accomplished yet. Besides, it is necessary to make a decision on an inter-regional waste management improvement including a regional landfill site that might be jointly used among all regencies in Mamminasata.

3) Other Plans in each Kebupaten Level

Target Area	Type of Plan	Main components of plan
Inter-regency Inter-regency	Comprehensive plan (JICA Study)	Construction of new landfill site (65ha) in Samata in Gowa regency
	Comprehensive plan (Technical Assistance for Makassar Metropolitan City Waste Management)	There is plans about new landfill site construction plan in Samata in Gowa regency (area is variously proposed such as 60ha by JICA Study or 110ha in "Technical Assistance for Makassar Metropolitan City Waste Management". However, the area of landfill is not decided and actually not proceeded now because of difficulty of land acquisition for the land acquisition cost, demarcation of the cost and the concern by surrounding community.
Makassar	Plan of Waste to Energy Plant	Due to lack of future landfill site, Makassar municipality consider the plan of Waste to Energy Plan which construct the Waste to Energy Plant in Tamamgapa TPA. Though Chinese government plan to assist planning the Waste to Energy facility, the detail plan has not decided yet.
	Collection and transportation	Procurement plan of equipment for collection and transportation for each year
Maros	Collection and transportation	Procurement plan of equipment for collection and transportation for each year
Gowa	Procurement plan of collection and transportation equipment	Procurement plan of equipment for collection and transportation for each year
Takalar	Procurement plan of collection and transportation equipment	Procurement plan of equipment for collection and transportation for each year

2. SOLID WASTE MANAGEMENT PLAN

2.1 Development Framework and Target

1) Future Estimation of the Quantity of Solid Waste

Based on the social and economic framework, quantity of solid waste has been estimated as shown in the following table. The household waste and the solid waste generated in street is estimated on the basis of predicted residential population and waste minimization by the effects of promotion of public awareness raising and environmental education. Commercial waste and industrial waste including the generated in office and are estimated by referring to the projected GRDP (Gross Regional Development Product) and in due consideration of such general tendencies as waste minimization by improvement of efficiency of productivity in industry.

Table 2.1 Future Estimation of Solid Waste Quantity in Mamminasata

[m^3 /day]

Regency or municipality	2005	2010	2020
Makassar	1676	2023	2753
Maros	478	558	716
Gowa	538	616	772
Takalar	422	465	535

Source: JICA Study Team

The accumulated quantity of the solid waste to be disposed of in Mamminasata is then estimated as shown in the following table after recycling, reduction ratio will be from 10% in 2005 to 30 % in 2020. It has been revealed that about half of the solid waste in Mamminasta is to be disposed in an area near Makassar.

Table 2.2 Future Estimation of Accumulated Quantity of Solid Waste to be Disposed in Mamminasata

[x 10^6 m^3]

Regency or municipality	2005	2010	2020
Makassar	1.39	4.05	9.93
Maros	0.40	1.15	2.76
Gowa	0.47	1.34	3.14
Takalar	0.31	0.86	1.93

Source: JICA Study Team

2) Target of SWM Service

In JICA Study (1996), several targets for KMUP according to REPLITA VI (1994/95- 1998/99) were proposed and they are found reasonable in general. For the spatial plan in Mamminasata, such targets are basically followed with some adjustment to the existing condition. The following service targets are proposed in

Mamminasata:

<Short Term>

- To provide waste collection service for 90% of urban population by 2010 by improvement in the collection service
- To implement existing landfill site with proper operation
- To study and construct a new inter regional sanitary landfill site
- To close the existing unsanitary and full capacity landfill site and prepare waste separating facility in the area.
- To promote 3R (Reduce, Reuse, Recycle) activity with public participation
- To introduce private sector in SWM with proper system
- To strength of institutional set-up

<Long Term>

- To provide waste collection service for 96% of urban population by 2020 by improvement of collection service by utilizing efficient collection
- To operate new inter-regional landfill site with sanitary landfill
- To invite recycling facilities near the new landfill site.
- To close the existing unsanitary and full capacity landfill site and consider plan of transfer station including waste separating facility in the area to establish effective secondary transportation and recycling system
- To further promote 3R (Reduce, Reuse, Recycle) activity
- To promote environmental education for communities and at school
- To introduce the concept of a sound material-cycle society and of EPR (extended producer responsibility) gradually
- To expand the private sector participation with proper system

3) Basic Strategies for SWM

SWM in Mamminasata will basically follow JICA Study (1996) with some adjustment in line with the existing condition.

(1) Improvement in collection service by utilizing the efficient collection system

Waste collection service is not sufficiently carried out in low income and/or slum areas where the road is too narrow or in the suburban area. In this area, hauled container should be located at suitable place and primary collection by the community or housing developers should be promoted in addition to the service the cleansing department.

(2) Secure of new landfill sites and utilization of sanitary disposal method

Though disposal basically should be carried out in city or each regency considering transportation efficiency, inter-regional landfill site can be promoted due to difficulty of suitable landfill site, especially for Makassar city. In aspect of transportation efficiency, the possibility of extension of current landfill site and current situation regarding collaboration, Makassar and Gowa can utilize common landfill site which should be newly developed instead of current landfill site.

(3) Close the existing unsanitary and full capacity landfill site and consider the use of other purposes

After closure of landfill site, various options of utilization of closured landfill site are considered. Considering current condition of SWM, if the new landfill site is constructed far from the collection service area or existing landfill site, the facility which has the function of transfer station in existing landfill site can be prepared for reduction of transportation cost to new landfill site, which also have the role of waste separating facility to separate recyclable waste.

(4) Promotion of 3R (Reduce, Reuse, Recycling) activity with public participation

To implement the effective waste collection and transportation service, the promotion of 3R activities is indispensable. Reduction of solid waste by the public enlightenment would contribute to reduce a burden on the responsible entity of SWM. Separate discharge for reuse and recycling by the establishment of separate collection system help to reduce the quantity of disposed waste.

(5) Environmental education for communities and future generation

To realize and keep a clean city, environmental education is needed not only for the adults but also for school children. Not only documental education but also education through practices will be incorporated into environmental education in school.

(6) Gradual introduction of concept of a sound material-cycle society and of EPR (extended producer responsibility)

In context of both reduction of quantity of disposed waste and effective utilization of natural resource, establishment of a recycling flow is necessary. Industrial waste and commercial waste should be managed for utilization in each sector or other recycling factories. In addition, industrial sectors basically can carry out waste disposal by themselves but the producer responsibility should be addressed in legal aspect to prevent illegal dumping or illegal discharge.

4) Future Waste Stream

Based on the targets and basic strategies, we briefly considered overall waste stream for city and each regency in Mamminasata. Considering collection area, disposal should be mainly carried out in each regency, except for Makassar and Gowa due to the difficulty of suitable landfill site and not so far from each regency [6](Refer to Fig.2.1). In the future, a solid waste generated in the area in Maros may be transported to new landfill site with sufficient road network. Furthermore, secondary transportation system can be adapted for the areas far from new landfill site. After closure of current landfill sites in Makassar and Gowa, the areas can be possible location as transfer station in the secondary transportation system.

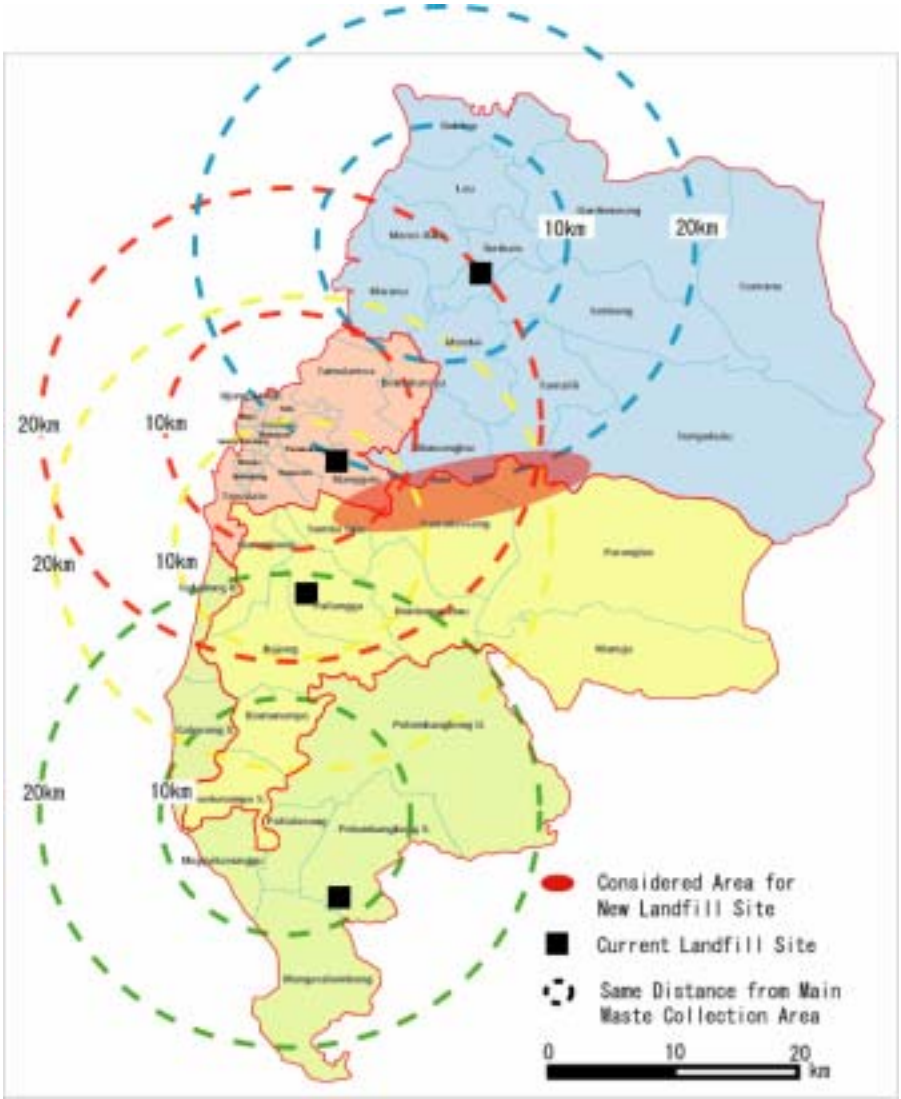
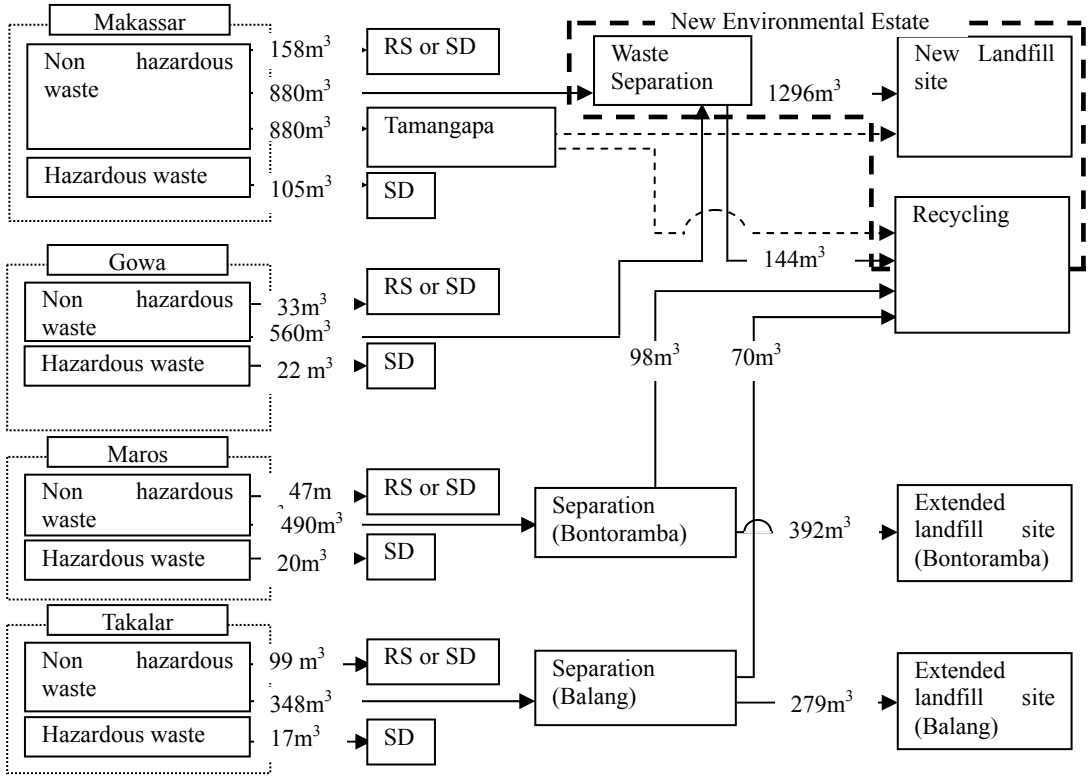


Figure 2.1 Collection Areas and Landfill Sites in Mamminasata Metropolitan Area

[6] The selection scenario is described in the sub section of final disposal more detail.

Waste Stream in Mamminasata (2010)

According to the progress of new landfill site project, the collected waste in Makassar city and Gowa regency will be mainly transported to the landfill site. The extension of landfill areas will be considered until accomplishment of new landfill site. Improvement in the composting facility and establishment of marketing route of recyclable material will be in progress. In the landfill sites in Maros and Takalar, there is available area for extension of landfill site, though the landfill method should be improved. Therefore, the collected waste will be transported to current landfill sites for final disposal there.



Note: (1) "RS": Recycling by Source Separation, "SD" : Self Disposal

(2) Waste separation in new landfill site will be carried out in waste separation area.

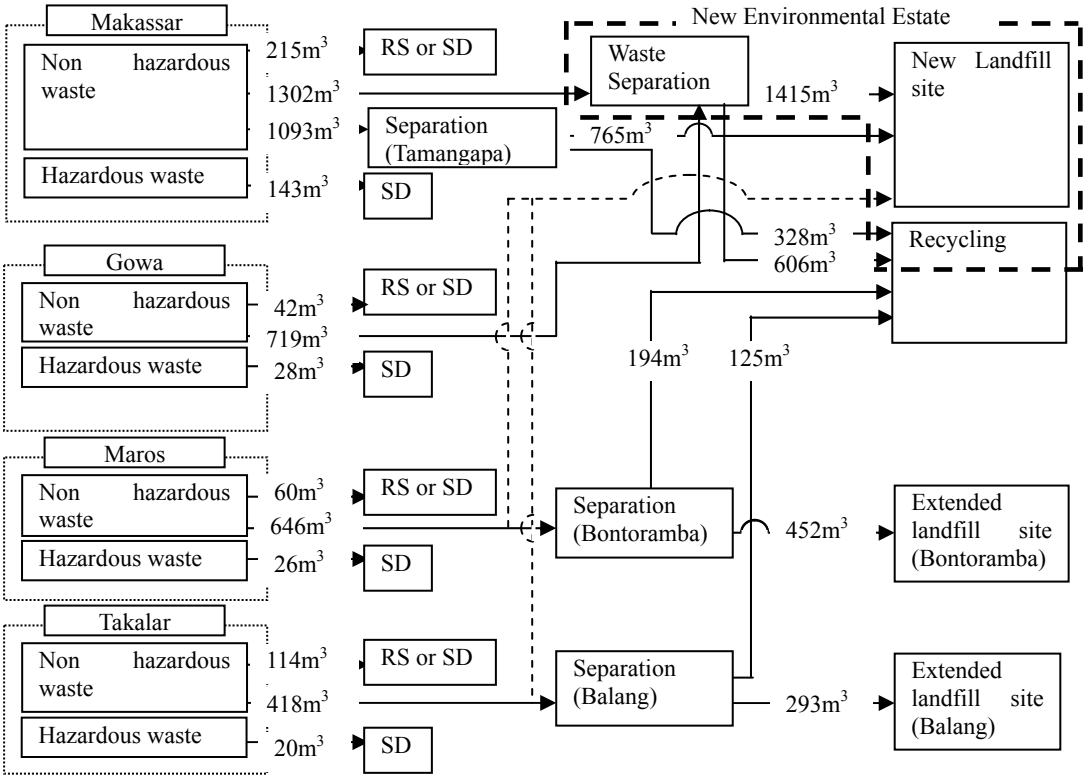
Figure 2.2 Future Waste Stream in Mamminasata towards 2020

Waste Stream in Mamminasata (2020)

After closure of current landfill site in Tamamgapa, the closured landfill site can have the role of a transfer point for effective transportation in comparatively far area from the new landfill site. Therefore, the secondary transportation system with planning of transfer station in Tamangapa can be considered around 2020. The transfer station should include separating facility or composting facility to establish a sound material recycle society and 3R activities.

The future solid waste stream in Mamminasata will be directed towards the flow as

illustrated in the following figure.



Note: (1) "RS": Recycling by Source Separation, "SD" : Self Disposal

(2) Waste separation in new landfill site will be carried out in waste separating facility.

Figure 2.3 Future Waste Stream in Mamminasata towards 2020

2.2 Collection and Transportation

1) Consideration of collection and transportation system

Collection and transportation links the discharge methods of waste dischargers which includes their awareness and specific condition of the collection area such as population density, road condition or type of area use, etc. In short term, the system should be improved with consideration of existing collection and transportation system and current public awareness. In long term, the system should be gradually improved along promotion level of public awareness. In addition, privatization of collection and transportation service is one of the conceivable solutions for establishment of effective and sufficient service provision (Refer to sub-section "2.5 Institutional and Financial System").

Especially, in the area which is far from TPS or other waste collection points such as slum areas, the primary collection can be introduced by the community (with participation of becak drivers or waste pickers) with assistance of local government. Primary collection by private developer in housing estate (if possible secondary collection and transportation to landfill site) can be promoted. Main collection and

transportation methods are summarized as following table.

Type of collection methods	Feature of method
Primary collection by handcart	Handcart can be used in the area of narrow road but collection speed is slow and capacity is small (approximately (1 to 2 m^3). In addition, it needs a collector at least.
Primary collection by becak	Becak can be used in the area of narrow road but collection speed is slow (5 to 10km /hour). The capacity is slightly smaller than becak (less than 1 to 1.5 m3)
Hauled container system	Wastes are put into hauled container which is located in TPS. Periodically, armroll vehicle transport the container to landfill site. This method does not need so man power for operation. However, it needs cooperation of public to keep clean the surrounding area of containers.
Curbside collection	Waste is put in the curbside of roads to be collected by tippers. This methods need to public cooperation regarding the discharge procedure such as the discharge packed by plastic bag or at fixed time.
Door to door collection	Waste collection staffs collect each generation source. This type of collection methods are adopted for commercial areas or business districts. In addition, high income residents will take this service with higher amount of waste collection fee.

2) Selection of collection and transportation system

(1) Primary Collection

As mentioned in the section of present condition, there are some areas where the solid waste collection service is not provided because of lack of roads or sufficient wide roads for armroll vehicles or dump truck. For the area, primary collection by small size vehicles is needed. However, the primary collection by the vehicles needs more human resources or collection time in comparison with armroll vehicles or dump truck. In that area, public participation is needed as well as the sufficient waste collection service by local authorities or private sectors to provide effective and sufficient service. In the Study, the combined system of the primary collection by becak drivers and the transportation by a tipper has been tried in health exchange program in the P/Ps. The result showed a possibility of the system if small finance for participation of becak drivers is supported (Refer to 1.8). This system can be one of useful methods to provide waste collection service for current non service area.

(2) Collection and Transportation

It is recommended that collection and transportation system should be principally designated as current system for the areas. Hauled container system (collection by armroll vehicle) was proposed to be continued in JICA Study (1996). In the result of field survey regarding current situation, it is recommended that it basically should follow current system including the JICA recommendation. However, there are some points to be improved. For example, regarding scattered solid waste near containers, if the container is transported to landfill site, the time of the transportation should be disseminated to public or another empty container should be located in that place. Otherwise, some people tend to dump in that place because of no container. Therefore, number of containers is principally estimated as summation of totals

number of vehicles and locations number of vehicles in this plan. Regarding collection by tippers, as recommended in JICA Study (1996), door to door collection is adopted for large generation source such as commercial areas or business districts. Curbside collection is adopted for the areas where is not densely populated and along sufficient wide road.

3) Proposed collection and transportation system

Based on above discussion, the following collection and transportation system is preliminary proposed though it should be revised based on the change of social and physical conditions.

Target area	System	Collection frequency[7]
For middle or high densely populated area without sufficient wide road for collection vehicles	Introduction of primary collection and hauled container system (with secondary collection by tippers or compactor vehicle)	2 to 3 times per week for primary collection. 2 to 3 times per week for secondary collection by vehicle
For the area along sufficient wide road for collection vehicles (Commercial area, high densely populated area, business district)	Hauled container system	Everyday or every two days according to the area
For middle or low densely populated area with sufficient wide road	Curbside collection by tippers	Every days to 3 times per week
For small commercial area, business district or high income area	Door to door collection by tippers	Every days to 3 times per week

Required equipments are preliminary estimated based on the future estimation of the waste amount to be collected as summarized in following table[8]

i) Target Year : 2010

Table 2.3-1 Required equipment for collection and transportation in Mamminasata

Regency or municipality	Makassar	Maros	Gowa	Takalar
Armroll vehicle	39	23	27	19
Tipper (6m3) (Dump truck)	39	23	27	19
Tipper (3m3)	-	-	-	-
Container	205	95	97	77
Handcart (Becak)	870	100	100	100

Source : JICA Study Team

[7] Actual collection frequency should be frequently revised according to amount of discharged waste, discharge condition and public awareness

[8] Trip numbers of vehicles are assumed as 3 times/day averagely

ii) Target Year : 2020

Table 2.3-2 Required equipment for collection and transportation in Mamminasata

Regency or municipality	Makassar	Maros	Gowa	Takalar
Armroll vehicle	145	63	54	42
Tipper (6m3)	145	63	54	42
Tipper (3m3)	-	-	-	-
Container	626	220	241	171
Handcart (Becak)	1600	200	200	200

Source : JICA Study Team

4) Conceivable effective collection system in long-term

(1) Introduction of separate collection

Separate collection is promoted for effective utilization of recyclable material in the future. The profit obtained from recyclable material is utilized as the profit of community. Gradual introduction of separating discharge system by using different types of dust boxes can be considered. Though separate collection system can be considered with the modification of current collection system in the future, introduction of separate collection by local authority which is different from current collection system can be premature due to the current condition of waste discharge or flow of recyclable waste. According to the progress of separate discharge, the collection system should be gradually changed toward the direction of separate collection. Introduction of the system should be considered in the progress of public participation on 3R activities and with the collection efficiency or the condition of recycling market on the separate collection.

(2) Consideration of secondary transportation System

Considering available location of new landfill site for Makassar and Gowa, secondary transportation system can be considered. The role of transfer station desirably include the function of separating recyclable wastes and other residues, and the residue from waste separating facility will be transported to new landfill sites. One of the conceivable locations of the transfer station is Tamamgapa landfill site for Makassar city and Cadika landfill site for a part of Gowa where is far from new landfill site. The large capacity of collection vehicle can be considered to implement effective transportation.

2.3 Final Disposal

Basically, the final disposal site should better be located near the target collection area for the effective transportation in the range of affecting environmental impacts on residential, commercial and conservation areas.

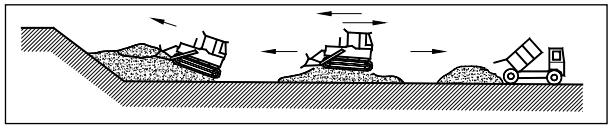
In this context, existing potential future landfill site is summarized as follows.

Item	Proposed Concept
Final disposal	**Short term** (1) Improvement of operation method of existing landfill sites - Implementation of sanitary landfill method such as cover soil or compaction of disposed waste should be considered. (2) Improvement and extension of existing landfill site in each regency - There are some spaces to extend existing landfill sites in some of regencies in Mamminasata such as Maros or Takalar, the extension can be considered regarding the landfill site. (3) Consideration of new landfill site with cooperation among each regency and municipality in Mamminasata by step by step approach - Considering the waste quantity to be disposed, new landfill site, which it may be far from collection service area, should be considered with consideration of secondary transportation system **Long term** (4) Consideration and construction of new landfill site with cooperation among each regency and municipality in Mamminasata - Considering the waste quantity to be disposed, new landfill site, which it may be far from collection service area, should be considered with consideration of secondary transportation system

1) Improvement of operation method of existing landfill site

Improvement of landfill method should be considered for existing landfill sites. Implementation of sanitary landfill method should be adapted as follows.

- Sufficient spreading and compaction by push up method (Refer to the figure)



- Daily cover soil should be carried out to prevent odor or vermin. The source material for cover soil may be difficult to obtain but substitute material such as residue of composting process or construction / demolition waste can be utilized for cover soil.
- Periodical monitoring should be carried out in existing wells of surrounding areas of the landfill sites.

2) Extension of existing landfill site

There are some areas to extend existing landfill sites in some of regencies in Mamminasata such as Maros or Takalar. In that case, the landfill extension can be considered with introduction of following mitigation procedures on surrounding environment.

- Collaboration and cooperation with surrounding residents through introduction of

periodical meeting or public hearing

- Preparation of buffer zone to attenuate the effect of odor or vermin
- Protection of groundwater or surface water quality by preparation of liner or embankment
- Implementation of daily cover soil
- Introduction of other sanitary landfill operation measure

3) Consideration of Alternatives of the Location of New Landfill Site

Some alternative sites for the new landfill site was compared with consideration of National Standard Indonesia SNI 03 -3241 (1994) "Procedure for Selection of Landfill Site Location". The result of comparison is described as following table.

Table 2.4 Comparison of Alternative Locations of New Landfill Site

Location	Tammangapa	Bajeng	Samata	Pattallassang
Transportation Distance from collection area in Makassar	A Approximately 15 km away from center of Makassar	C Approximately 40 km away from center of Makassar	B Approximately 20 km away from center of Makassar	C Approximately 40 km away from center of Makassar
Location restrictions (Airport)	A (Far away from airport)	A (Far away from airport)	A (Far away from airport)	A (Far away from airport)
Location restrictions (Flood plain)	B (Not so near from flooding area)	B (Not so near from flooding area)	B (Not so near from flooding area)	A (Not so near from flooding area and upper field)
Location restrictions (Faults)	NA	NA	NA	NA
Land capacity (Capacity)	C (Not sufficient)	B (approximately 8ha)	A (approximately 150ha)	A (approximately 50ha)
Site Access	A (there is access road now)	B (there is access road now though the road condition is not so good)	B (There is no access road near the proposed site.)	C (There is no access road near the proposed site and considering transportation distance, new road is required)
Soil conditions	A (paddy clay: permeability 5 x 10^{-5} to 8 x 10^{-6}cm/sec for depth 1.5m to 2m, loose sand layer, black soft clay layer ,etc)[9]	B	A (paddy clay: permeability 5 x 10^{-5} to 8 x 10^{-6}cm/sec for depth 1.5m to 2m, loose sand layer, black soft clay layer ,etc)	B
Topography	A	A	B	A
Hydrology	B	C	B	A
Technical feasibility	B	B	A	B
Natural environment	B	B	B	A
Social environment	C (Opposition from local residents)	C (Though opposition from local residents, explanatory meeting for public is periodically prepared)	D (Opposition from local residents)	B (Not so many residents in near the landfill site and little negative response currently)
Ranking	**2**	**4**	**3**	**1**

Note : A to D mean favorable to less favorable. N.A. means not available.

[9] The information is based on JICA Study "Master Plan and Feasibility Study on Wastewater and Solid Waste Management for the City of Ujung Pandang in the Public of Indonesia " (1996)

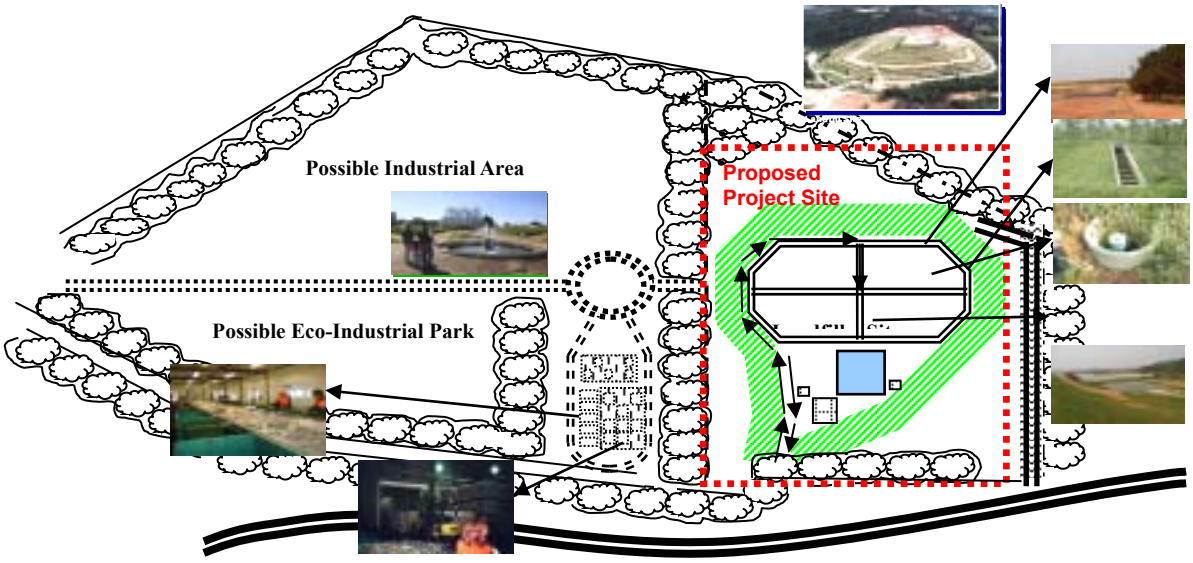
According to above consideration and discussion with Gowa regency, panaikang village in pattallassang district has been selected for location of new landfill site.

If new disposal site near pattallassang (in KIWA industrial estate), following consideration should be carried out.

- Preparation of sufficient buffer zone
- Preparation of the fence of which height is adequate to prevent odor or vermin
- Implementation of daily cover soil
- Periodical monitoring of surrounding water
- Implementation of periodical meeting with people who work at surrounding areas

4) Secure of new landfill site

Secure of new landfill site should be considered with cooperation among each district of Mamminasata Area. Makassar and Gowa consider inter-regional landfill site. The concept regarding final disposal can follow JICA Study (1996) for construction of landfill site in Samata in Gowa regency. If new landfill site is located in other sites, the feasibility study including topographic survey, geological and hydrological survey and soil survey is needed to determine the liner system and leachate treatment system. Panaikang which is the area of the Industrial Estate in Gowa (KIWA) is most conceivable option of alternative sites in aspect of environmental consideration and economic and technical feasibility through the discussion with local authorities though there are some difficulties of land acquisition and awareness raising of surrounding residents. The site is prepared in KIWA planned by Gowa regency.



Note: The picture in the figure is one of examples in another landfill site

Figure 2.4 Conceptual Plan of Landfill Site in Eco Industrial Estate

According to the future estimation of the disposed solid waste, the required landfill area for city and each regency is preliminary estimated as following table.

Table 2.5 Preliminary Estimation of Required Landfill Area

[ha]

Regency or municipality	2005-2010	2005-2020
Makassar	22	71
Maros	7	20
Gowa	7	22
Takalar	4	13

Source: JICA Study Team
Note: The area is preliminary estimated and will be revised according to feasibility study or detail design stage according to the topography, geology and surrounding environment

5) Consideration of utilization of other purposes after closure of existing landfill site

In the planning stage of the new landfill site, it is necessary to consider the utilization of closured landfill site. It has been proposed in JICA Study (1996) that the utilization measure after the closure of landfill site should include playground, sports facilities. In this Study through discussion with relevant local authorities in Makassar city and Gowa regency, conceivable new landfill site has been selected in KIWA in panaikang village in which is proposed as industrial estate in Gowa. In that case, the area can be used for the proposed facilities or green parks for workers to be relaxed or environmental museum which has exhibition of recycling system or eco-products to implement environmental education for visitors.

2.4 Intermediate Treatment Plan (including Recycling or Reuse)

Recycling facility, together with the waste separation system and composting (including improvement of existing composting facility) can be considered in the future. In long-term, a methane fermentation plant might be considered if waste is separated for suitable operation, in due consideration of existing high organic composition and high moisture contents are not so suitable for incineration[10]. The intermediate treatment methods are summarized in following table.

[10] Incineration needs high calorific value and low moisture content and the operation and maintenance cost to be required is too high to operate by existing financial condition in the local government.

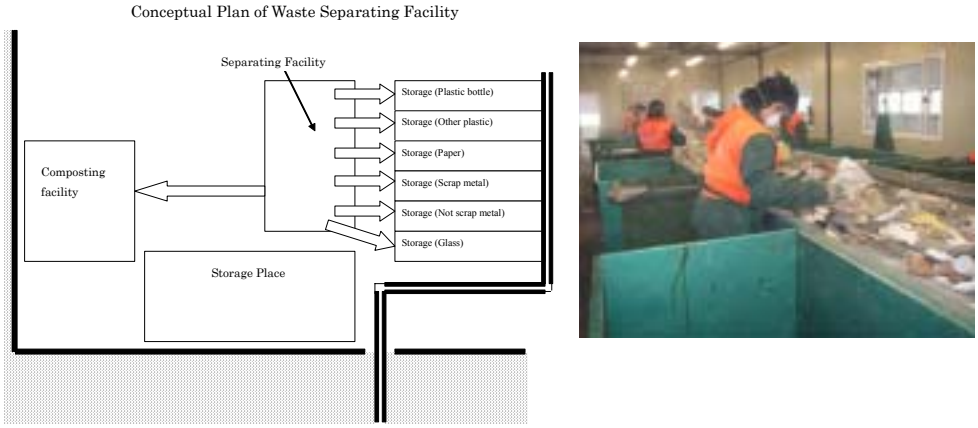
Item	Proposed Treatment
	Short term (1) Improvement and rehabilitation of existing composting plant - Adjustment of composition or mixing of organic waste in composting process is important to improve the quality of compost product and to prevent offensive odour or vermin. (2) Introduction of waste separating facility - To enhance the quality of compost product by removing inorganic waste or other unsuitable waste for composting and to collect recyclable material more easily, separating facility can be considered. The separating facility can separate recyclable and reusable waste, organic waste and residue for landfilling. **Long term** (1) Enhancement of operation capacity of waste separating facility - Operational method or minor revise of facility can be considered such as introduction of press machine for aluminium can.

1) Improvement and Rehabilitation of Composting Plant

The existing composting plant does not operate properly for various reasons (e.g. technical issues, lack of market, comparably low quality of compost product). Technical issues can be solved to get higher quality of compost products. To do so, i) maintaining of aerobic condition, ii) adjustment by adding high nutrient material such as sewerage sludge without toxic material, iii) secure of sufficient curing term and others are some of important factors to produce high quality of compost products. Quality control of the product for each usage purpose is important factor not only to produce compost product but also to select the product which is suitable for each required quality level as for agriculture, planting or soil covering. To promote the utilization of compost product, Local governments such as cooperation between cleansing department and agriculture department can encourage the operation of the facility, disseminating the utilization to farmers and public initiation (e.g. In sugar factory in Takalar, the farmers use sugar juice (by-product of sugar as liquid fertilizer in the sugar factory in Takalar as the result that they have disseminated to farmers to use sugar juice as liquid fertilizer with the demonstration).

2) Introduction of Waste Separating Facility

As mentioned section 1.4, there are some recycling dealers near the existing landfill sites Some of recyclable wastes are separated by collection staff of cleansing department before or under the transportation by the tippers. The wastes which are not separated by the staff are transported to existing landfill site and some recyclable waste in them are separated and collected by waste pickers on unsanitary condition in the landfill sites.



Note: The picture in the figure is one of examples in another waste separating facility

Figure 2.5 Conceptual Plan of Waste Separating Facility

Currently, waste pickers collect recyclable wastes in unsanitary condition with the risk of accidents due to improper operation of the heavy equipment or collection/transportation vehicles. To avoid the risk and work effectively, the some sorting facility can be considered.

Waste Separating Facility (WSF) will be prepared to separate the recyclable waste from mixed waste by workers in the safety and sanitary condition. It can be preferable to pursue strategic employment of the waste pickers in this waste separating facility though awareness raising of waste pickers will be needed for the involvement of the workers at existing landfill sites in the long run in order to incorporate the waste pickers as partners in SWM activities.

2.5 Institutional and Financial System

Institutional system to promote 3R activity or public private partnership to secure financial resource can be considered to carry out solid waste management efficiently and effectively. The proposed institutional and financial systems to be established are described as follows.

Item	Proposed Concept
Institutional System	**Short term** (1) Institutional system of promotion for 3R - Adoption of deposit system for promotion of 3R can be considered. Existing informal recycling flow should be utilized for development to establish a sound material-cycle society **Long term** (1) Institutional system of promotion for 3R - Deposit system for promotion of 3R can be adopted for some material. - Subsidy for recycling dealer or factory can be considered to promote 3R activity. (2) Public private partnership - Private sector can participate solid waste management service which can supply better service with more efficient and effective manner because the private sector usually pursue the better service for customer and most cost effective way according to market theory.

1) Institutional System

(1) Introduction of deposit system or tariff system for package

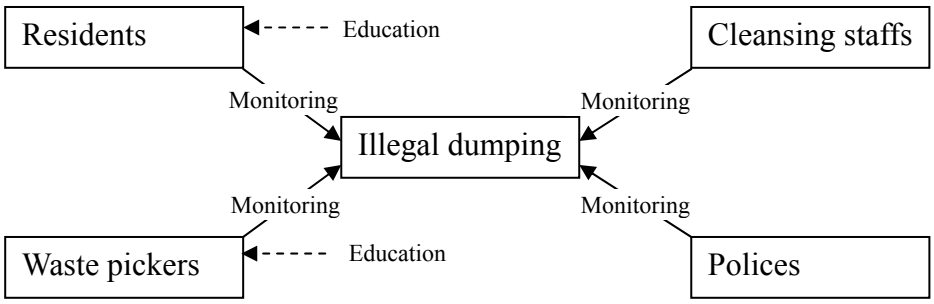
In our survey, package waste such as aluminum or steel can, plastic bag and carton include relatively low rate components, comparing with the organic wage such as kitchen waste or woods. Regarding plastic bottle, carton steel or aluminum can, there are recycling flow though the flow is firmly established. On the other hand, package waste such as the plastic bag does not have recycling flow. To reduce for package waste, tariff system for plastic bag in markets to promote my-bag-use system can be applied as well as returnable bottle system for glass bottle which is currently introduced in a part of dealers. Examples of systems are described as follows.

Item	Contents	Feature of System and consideration
Plastic bag charging system	Consumers must pay some small amount of money if receiving plastic bag while buying something in shops. Collected money will be used for collection and transportation fee or recycling promotion activity. This system might cause promotion of my bag and might reduce the package waste caused by plastic bag.	This system may promote for customer to use my bag, though some people do not care pay small amount of money for plastic disposal bags.
My-bag-use system (Charging)	In principal, this system is similar to above system. It is different that the bags the shops sell are reusable and high price but not disposal bag.	This system can promote for customer to use my bag because there is principally no disposal plastic bags in the shops Because there are plastic bag delivering system in the shops of Mamminasata, if it is introduced, gradual introduction with understanding customer's awareness is needed.
My bag use system (stamp card)	Consumer bring my bag in the shop, the staff of shop provide stamp in the card. If stamp is adequately accumulated, costumer can receive some small gifts. This system also promote customer's bag use.	This system may not affect existing system or customer's awareness conspicuously. Some customers try to use my bags for the beneficiary of stamps
Deposit system	This system can adopt for such as returnable bin for drinking.	This system has been already adapted in some kinds of glass bottles. The other packages such as aluminum or steel can as recyclable can but as not returnable bin.

(2) Preventing unsanitary discharge or illegal dumping

Illegal dumping should be strictly prohibited to prevent environmental pollution and to beautify the Mammininasata area. However, currently there are some illegal dumping sites in Mamminasata area. All the illegal dumping are not only carried out in organization level but also in individual level because of insufficient collection

services, but the illegal dumping even though small scale should be prevented because the dirty area may promote illegal dumping both organizational level and individual one. One of possible countermeasure scheme, which is collaboration system among residents, cleansing staffs of local authorities, polices. In addition, waste pickers may be possible inspectors through their activity because most of their activity is based on landfill sites or waste discharged areas such as the location of hauled containers or temporary disposal site (TPS) or city areas. The registration or formulation of union of waste pickers will contribute to raising motivation and to understand their own work. Inspection system of illegal dumping is described in following diagram as well as establishment of legal system to prevent illegal dumping.



2) Financial System

(1) Introduction of retribution fee system according to service level

According to the question regarding willing to pay for solid waste collection in the public awareness survey, more than half of residents feel that current retribution fee is cheap. almost residents (more than 70% to 80%) answer that if the collection service are improved, they will pay more than now. With careful consideration of income level and regional variety, existing retribution fee can be designated in higher level than now with better service.

(2) Consideration of Public Private Partnership

i) Private sector participation for waste collection service

As proposed in JICA Study (1996), cleansing department consider the contract out to private sectors regarding the work of collection and transportation. Currently, housing estates in some areas such as Panakkukang, the housing developer such as P.T. Asindo provide the collection and transportation service for the residents and it properly operates by receiving additional collection service fee from them who have the capability for the payment such a high income residents. Considering the operation and maintenance cost and the efficiency for collection, transportation and cleansing activity and existing flow of recyclable material, the contract out to private sectors is one of the conceivable solutions to reduce the burden of cleansing department for effective operation and to provide better service for the target beneficiary. Currently, Makassar tries to make the agreement regarding

Memorandum of Understanding (MOU), which has been made in April, 2005. According to the agreement, the Scope of Work cover (Refer to Sector Report Financial Section;

- SWM Service including collection and transportation from the generation sources, landfill management among others done by recycling.
- Suitable operation and maintenance of the existing equipment and additional procurement by the private sector if required
- Human resource management including existing labors owned by Makassar and conducting recruiting for new labors if required

In case of the contract out to private sectors, monitoring and supervising by local authorities is quite important to prevent poor performance in some parts which do not work market principal.

ii) Private sector participation for recycling activity including composting

Currently, P.T. ORGI company operates with the status of the joint venture company with PD Kebersihan. However, operation condition is not so good because of lower quality of compost product and insufficient market which is suitable for the quality. Cleansing department in Makassar also consider the private sector participation for the operation of Waste to Energy plant in a company in Jakarta. They prepared MOU (Memorandum of Understanding) to conclude the contract.

2.6 Public Participation and Environmental Education

Effective and efficient SWM systems require the cooperation of generators of solid waste, especially in the stages of reduction, reuse, storage and discharge. In Mamminasata area public awareness on SWM is comparatively high and the respondents have intention on their cooperation of separating discharge according to public awareness survey. The proposed items regarding public participation to be established are described as follows.

Item	Proposed Plan
Public Participation	**Short term** (1) Cooperation on discharge method - Based on the document to publicize such as leaflet, public cooperate improvement of discharge method to be recommended by municipality or regency. (2) Cooperation on primary collection - Community, becak drives or waste pickers can participates primary collection activities with different levels. **Long term** (3) Cooperation on separate collection - Separate collection to carry out reuse or recycling effectively should be considered. In this case, separating discharge can be promoted to public after the setting of the dust boxes for separating collection.

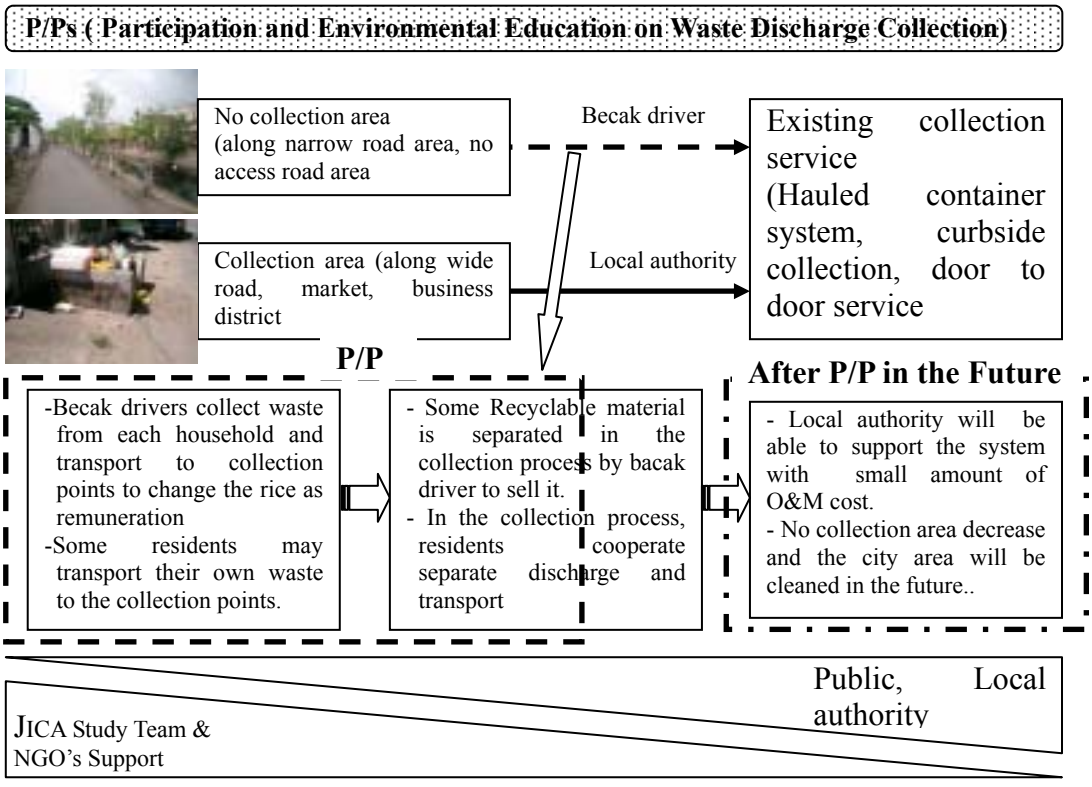
Environmental Education	**Short term and long term** (1) Implementation of environmental education for students - Environmental education regarding SWM such as utilization of recyclable waste or composting process can be carried out for students who compose of future generation. In the education, not only theory or concept about SWM but also implementation is important to educate students. For example, the student study which kind of waste can be recycled through the project that they sell recyclable material to recycle dealer and make some money, and they will try to separate waste in his house so that the waste will be suitably separated for reuse or recycle.

1) Public participation

Public participation for SWM can cover various areas. They can participate in waste discharge including small parts of waste collection or the separate discharge for effective 3R activity.

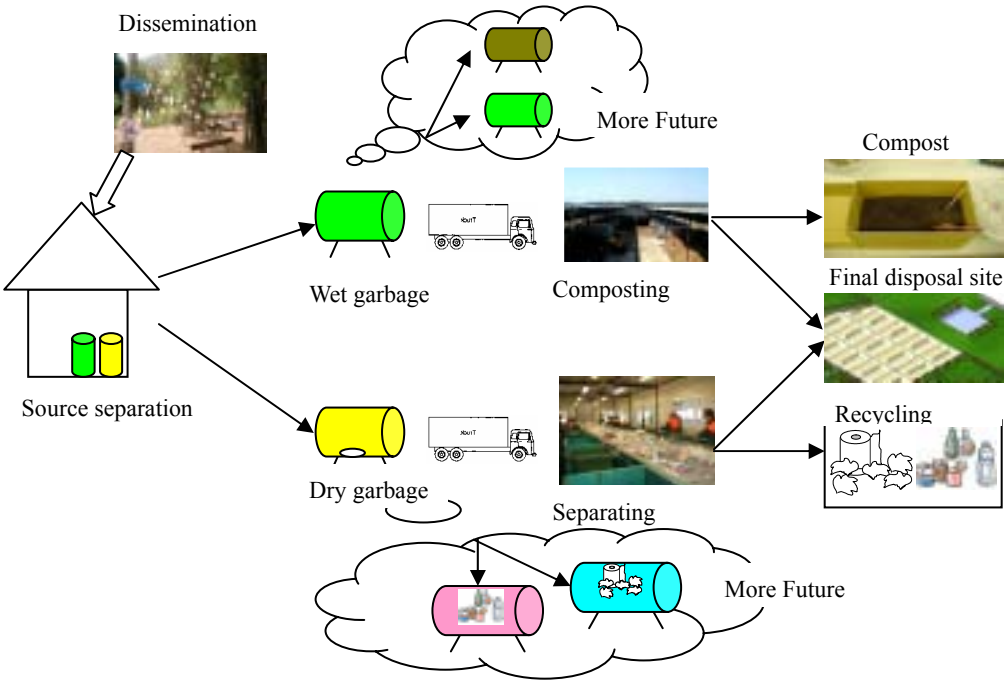
(1) Participation on primary collection

In the area of primary collection, residents might be able to participate collect the waste by themselves with small remuneration. The residents might be able to collect waste in turn with some remuneration. This remuneration can utilize rice, vegetable or other useful daily use material instead of some money. As mentioned the section of P/Ps, this is being carried out in the P/Ps to reflect future plan as described in the following diagram (refer to the section of P/Ps).



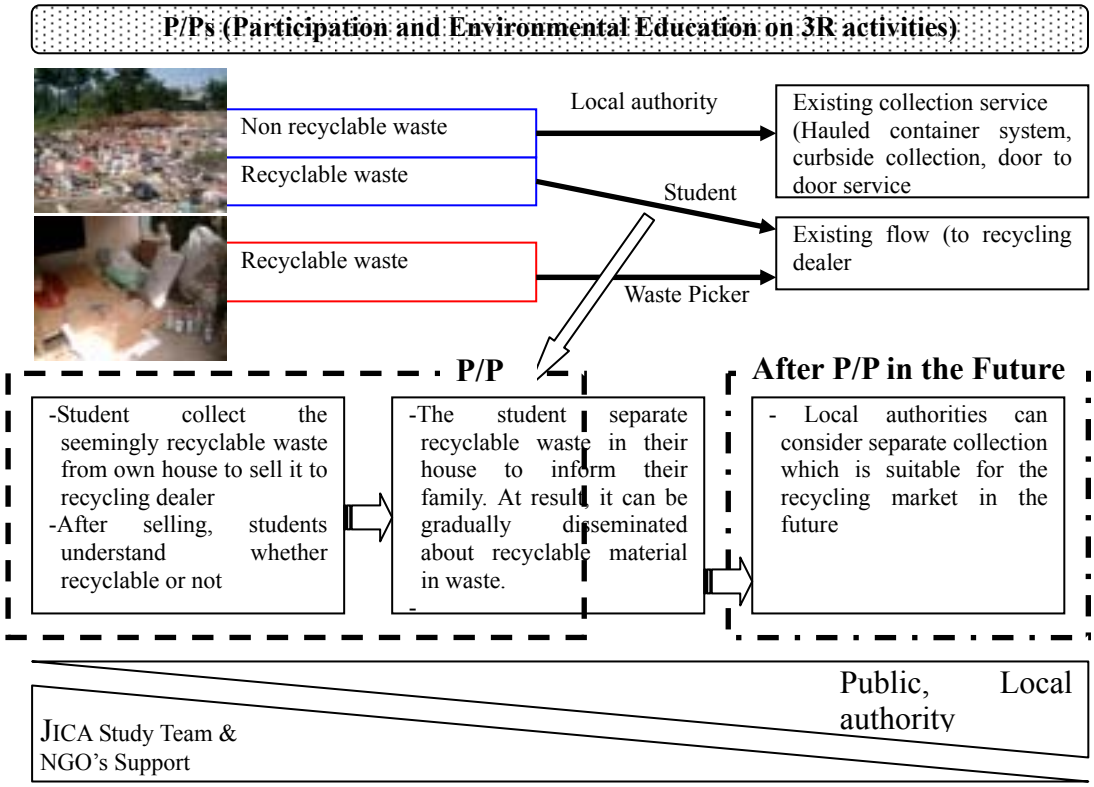
(2) Participation on 3R activity

In the area of 3R activities addition, it is important to inform the recyclable waste for people to participate existing recycling system. According to the P/P for waste separation in communities, it has been identified that separation of only two types such as dry and wet is suitable in current public awareness. Therefore, future schematic diagram regarding waste separation can be proposed as follows.



2) Environmental Education

To promote public participation in the solid waste management inclines of cleansing activity or waste discharge from each household, the environmental education is quite important. Usually, the adult is not easily changed and the opportunity for taking education is restricted if compared with children. The environmental education for children can be effectively carried out, especially through the class of social education in primary school. Therefore, SWM-oriented environmental education is proposed to be implemented for school children in Mamminasata and it might affect the behavior of their family regarding separation, reduction or reuse of solid waste by the role as a moderator of children in the future. As one example of environmental educations, “garbage separate collection and recycling” project for school children is being carried out as a pilot project (refer to the section of P/Ps) to reflect future plan as described in the following diagram.



3) Role of Pilot Project

Pilot project will be implemented for promote participation on solid waste management activities such as waste discharge and collection, and 3R activities for residents and students.

2.7 Preliminary Cost Estimation

The cost of solid waste management project is preliminary estimated based on the project cost of "Master Plan and Feasibility Study on Wastewater and Solid Waste Management for the City of Ujung Pandang" (1996) and of "Explanatory Note on Urban Infrastructure Improvement of the City of Makassar" (2002) and interview from DK Makassar. The preliminarily estimated cost is summarized in the following tables[11].

[11] The preliminary estimated cost will be updated after Pre-F/S.

Collection and Transportation

Table 2.6-1 Preliminary Cost Estimation of Collection and Transportation Equipment in Mamminasata

Item		Short-term Plan (Target : 2010)		Long-term Plan (Target : 2020)	
		(billion Rp.)	(million US$)	(billion Rp.)	(million US$)
Investment Cost	Collection and Transportation	0.8	8	1.6	16
	Street Sweeping	0.05	0.5	0.1	1
Annual O&M Cost[12]		0.085	0.85	0.16	1.6

Note: The cost is preliminarily estimated based on the number of collection equipment.

Final Disposal

Table 2.6-2 Preliminary Cost Estimation of Construction of New Landfill Site in Mamminasata

Item		Short-term Plan (2010)		Long-term Plan (2020)	
		(billion Rp.)	(million US$)	(billion Rp.)	(million US$)
Investment Cost	Civil Work	1	10	4.2	42
	Heavy Equipment	0..1	1	0.4	4
Annual O&M Cost[13]		0.05	0.5	0.28	2.8

Note: The cost is preliminarily estimated based on the area of landfill site.

Waste Separating Facility

Table 2.6-3 Preliminary Cost Estimation of Waste Separating Facility in Mamminasata

	Short-term Plan (2010)		Long-term Plan (2020)	
	(billion Rp.)	(million US$)	(billion Rp.)	(million US$)
Investment Cost	-	-	0.5	5
Annual O&M Cost	-	-	0.025	0.25

Note: The cost is estimated as the assumption that the capacity of waste separating facility is approximately 1000 m3 /day assumed.

Transfer Station

Table 2.6-4 Preliminary Cost Estimation of Transfer Station in Mamminasata

	Short-term Plan (2010)		Long-term Plan (2020)	
	(billion Rp.)	(million US$)	(billion Rp.)	(million US$)
Investment Cost	-	-	1.5	15
Annual O&M Cost	-	-	0.15	1.5

Note: The cost is estimated as the assumption that the transfer station is compacting type and the capacity of 800 ton /day.

2.8 Implementation Schedule

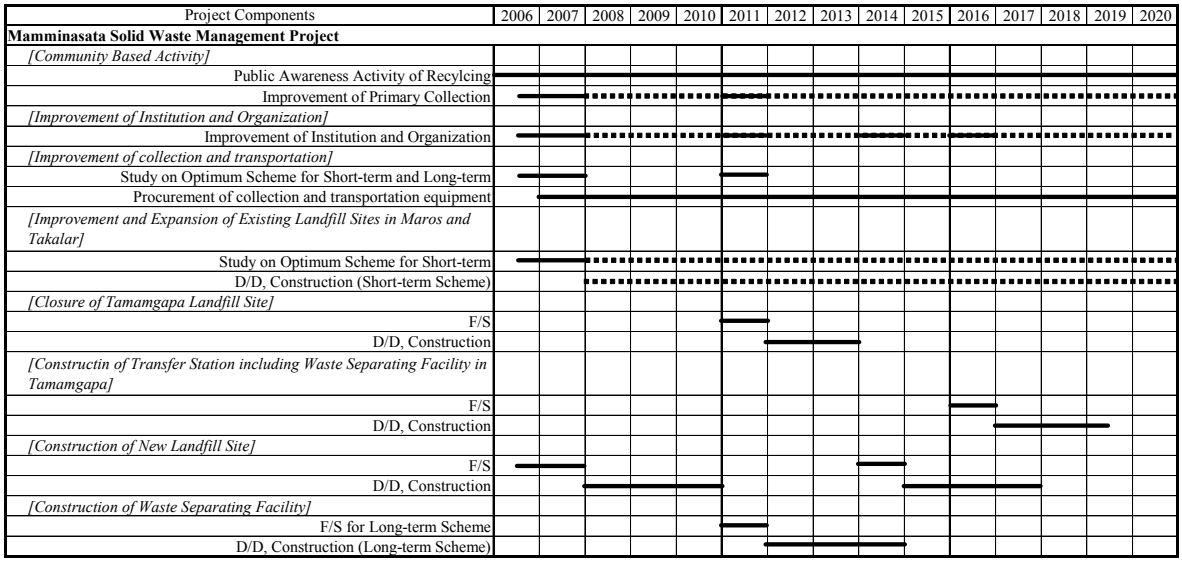
Identified projects are described as following table. The project components including community based activity, improvement of institution, improvement of collection and transportation including procurement of the equipment, improvement

[12] O&M cost is assumed as 10% of investment cost for collection and transportation.

[13] O&M cost is assumed as 5% of investment cost for final disposal activity and waste separating activity.

of landfill sites and construction of new landfill site and waste separating facility.

Figure 2.7 Preliminary Implementation Schedule of the Projects in Mamminasata



ANNEX

PILOT PROJECT OF CANAL CLEANING

This pilot project aims at creating a clean canal environment by exchanging the collected waste with healthy food. This is why the project is also called the Healthy Exchange Program among the community.

Back ground

Mamminasata Metropolitan Area is facing a fundamental problem of sanitation. Beside the problem of limited clean water supply for domestic use, a dirty city environment is another big issue. People is littering garbage bins, and disposal sites are not managed properly. Solid waste is not managed well. The dirtiest places are major drainage canals and markets. In Makassar city, there are four markets located along the main drainage canal. People throw garbage to any open space. The most well-known place to throw garbage is to the water bodies such as swamp areas, rivers, canals and sewers. People's local environmental attitude needs to be changed systematically. There is a need to firstly change the way of thinking and understanding of littering and throwing garbage. How to regain a clean canal environment must be introduced to the community, particularly community living along such canals.

This program is also called the Healthy Exchange Program because cleaning canal is not done directly but indirectly. The clean-canal partners are provided with healthy food to compensate their participation in collecting garbage from houses and other dirty places and their contribution to warning other people not to throw garbage into canals. In this pilot project, the healthy food at the first stage is provided in the form of 2 liters of rice. Kinds of food are to be decided by the local environment partners themselves in their discussion meeting.

Purpose

1. To increase the awareness of community living along the canal on clean canal and garbage management
2. To attain better attitude in not throwing garbage into canals
3. To provide a practical example of a clean canal environment program

Strategy

1. The program is implemented in collaboration with NGO and local community . The selected local communities who agreed to actively participate in the program are called "local environment partners".
2. The program has two dimensional targets, i.e., clean canal and poverty alleviation

3. The compensation is not paid in cash but rewarded in the form of healthy food (rice is chosen by the pilot local environment partners)

4. The method is not to pick garbage directly from canal but avoiding the attitude to throw the garbage, by collecting garbage from house to house or from temporary disposal area.

Target area:

Drainage canal Sinrijala in the city center (Jl. AP Pettarani), close to a market. Since the drainage canal and market are two indicators of dirty places in the city, the target location is selected along the canals close to the market.

Target groups

Main target groups are local environment partners, who need healthy food for better life. The poor groups can be indicated practically from their occupation as Becak drivers. Interview survey also proved that this group is one of the poorest groups. So, 30 becak drivers have been chosen as local environment partners. These "Local Environmental Partners" are ones who scour the neighborhood and canals for waste and garbage, collect and store, then deliver to the scheduled pickup time and place.

Demographic profiles of the Local Environment Partners revealed that the majority came from low educations (20 out of 31 only finished elementary school or its equivalent, 5 had no education whatsoever, and only 6 finished the mandated junior and senior high education). Also, most had to feed a relatively large number of dependants. Twenty out of thirty one interviewees had 5-9 dependants to support. A staggering feat, considering their regular occupations - one street vendor and 30 becak drivers. However, more than half (18 out of 31) claimed to have permanent residences, though the legalities are not ascertained. The rest live in rented rooms/houses/boards.

Photo: List of Local Environment Partners

Activities

The program socialization has been entrusted mainly to NGO. The NGO visited the target location and local leaders by making some hearings from local community before deciding them as local partners for the pilot project.

Formal socialization meeting has been conducted at the beginning of this program for the purpose of socializing the project to the government officials and surrounding community, explaining the details of activities.

Photo: Socialization meeting at the beginning of the pilot project implementation

Procedures

Procedures of garbage collection are as follows

1. Place of colletion in front of Sinrijala ward office
2. Time and schedule: twice a week every Monday and Friday from 16:00 – 17:00

3. Garbage container trucks will stand by at collection point as scheduled.

4. The local environment partners bring the garbage collected from anywhere by becak (pedi cab)
5. The local partners registered or reported to the NGO staff to confirm the amount of garbage

6. The garbage is put onto the container

7. The local partners receive a coupon
8. The coupon is exchange with rice. (2 litres)

Result

1. The program is conducted from October 2005 to February 2006, twice a week. The local environment partners are actively participated in the program. The most interesting result is that at the beginning only man or becak driver himself is actively collecting garbage but wives tends to take over the activities by help of husband collecting garbage every day and also even deliver the garbage to the container truck because women is interest in rice cooking. Based on the interview surveys actually all household member actively contributed to collect the garbage and the surrounding community also admitted that they also contributed by donating their garbage to the local environment partners.

2. Becak is practical and efficient way to deliver garbage along the canal. It is not necessary to provide other vehicles or tools.

3. There is a significant result of no more garbage piles along the canal. The people live in the project site do not throw garbage to the canal.

No	Before	After
1		
2		

Assessment

Interview survey with local environment partners revealed the following.

(a) The motivations of these Local Environment Partners range from selfish to near-altruistic, but the interviews revealed that the rewards were only a gentle push, slight nudges needed to encourage the majority of them to do the right things: cleanliness, sanitation, and the healthier environment. Four out of 31 interviewees (12.9%) admitted that they participated only because of the rice compensations (hence the "selfish" motivation). Six out of 31 were pure gold-hearted volunteers, who claimed that they joined only for the betterment of the environment (the "altruistic" spectrum of the community). The majority (20 out of 31), however, participated both for compensations and the better environment. The remaining one person claimed he participated because he had nothing better to do.

(b) The local environment partners believe that, even though the program is stopped, the people live along the canal will not throw garbage anymore to the canal. They believe that the surrounding community will use the available temporary disposal site for garbage. Most respondents (28 out of 31) are quite optimistic when asked whether the cleanliness would continue, beyond the program's scope and guidance. When asked why, they cited reasons such as "newly awakened sanitary awareness" (4 out of 31), "realizing the benefits for the surrounding health and environment" (2 out 31), and "since the tools, bins, and waste containers etc. are already available anyway" (21 out of 31). The remaining four were not so optimistic, saying that the compensation was the only thing keeping them going.

(c) All of them, however, very highly appreciated the program. 10 praised it for alleviating the chronic affairs of canal misuses and household rice expenditures. 19 claimed to be able to generate savings and additional disposable income. Two were satisfied just by having cleaner canals to live nearby. Five claimed to have learned how even garbage has value; 25 opined that clean canal will lead to more cleanliness, since most would be reluctant to litter a clean area.

(d) Sanitation of canals will need constant support, at least in the form of garbage container trucks and regular collections. Thirteen are more enlightened, claiming that they would seek to find out the next nearest disposal containers/waste management sites and make full use of them. The rest chose disposal by burning. However, eleven of the interviewees said to revert to disposing garbage at nearest convenient site (including canals), if the trucks stop coming.

Interview survey with the surrounding community in the project site:

All respondents appreciated that the surrounding of canal is clean and the canal itself is cleaner than before the program, as the surrounding community do not littering and throw the garbage into the canal. They understand that the main purpose is to attain the clean environment, appreciated the method and admitted their contribution by help of the local environment partners colleting garbage. However, in contrast with local environment partners who are directly involved in the project, only few of surrounding community believe that this clean condition will continue if the program is over. They tend to predict

that the surrounding community will back to previous attitude if the system is not managed well.

Conclusion:

The success of the Healthy Exchange Program relies on:

1. First and foremost, willingness and collaboration of the local inhabitants in the vicinity of the target canals is fundamental. These "Environmental Partners" (as designated by the program) are the ones who scour the neighborhood and canals for waste and garbage, collect and store, then deliver to the scheduled pickup time and place. To encourage the participation of local community, additional motivation should be attracted.

2. The consistency to schedule is important. A garbage truck which is provided by Dinas of Environment and Beautification always comes precisely on time even during holidays

3. Roles of NGO in introducing the program in more familiar and communicative ways is important. However, most NGO staffs do not come from local community in the project site. For continuation of program, most part of NGO roles should be transferred gradually to the local community, for example youth groups or women groups in the local community.

Condition surrounding canal at the end of program

Suggestions:

1. For sustainable implementation, the pilot project is applicable for other similar locations especially for other 3 locations which have same characteristics, market along the canals.

2. Collaboration with other poverty alleviation program is suggested. Rice is used this time for compensation or exchange with garbage and waste. If one of the government existing programs for the poor is collaborated with clean canal activity, the target will be easier to attain.

3. Participation of private enterprises and community must be encourage to support the continuation of the program. One company can select and choose one location to support for some period, for example for one year.

4. Participation and collaboration with university students is suggested for internalization of some roles which have been implemented by NGO.

Newspaper articles (1) on Healthy exchange pilot project (October 31, 2005

To Realize human- friendly and clean metropolitan

Come With Garbage, Return With Rice

Mewujudkan Metropolitan yang Manusiawi dan Bersih

Datang Bawa Sampah, Pulang Bawa Beras

SEBANYAK 30 tukang becak mengisi penuh becaknya dengan sampah. Setelah membuang sampah ke atas truk, mereka mendapatkan dua liter beras. Akhir pekan lalu, masyarakat yang lewat di J. Pettarani tertarik pada program barter sampah dengan beras yang berlangsung pada jam empat sore tersebut.

Laporan
▶ Faisal Syam

Dg Salampe, tukang becak, menilai program pertukaran sampah dan beras sangat bermanfaat. Selama ini hampir setiap hari dia membakar sampah di sepanjang kanal karena tidak tahu harus membuang ke mana. Menurutnya, terangkutnya sampah adalah jauh lebih penting daripada beras yang akan diperoleh.

Hal yang sama juga dikatakan oleh warga sekitar, mereka beramai-ramai membawa sampah meskipun tidak termasuk salah seorang dari 30 tukang becak yang terdaftar.

Selama ini, pada beberapa bagian kota, sampah masih berserakan, utamanya di kanal dan sungai tetap saja menjadi tempat pembuangan sampah meskipun berkali-kali dibersihkan. Dirasakan perlu untuk mengubah pola pikir dan kebiasaan masyarakat membuang sampah ke badan-badan air tersebut.

Tenaga ahli JICA yang bertanggung jawab mengepalai program ini, DR Agnes Rampisela menyebutkan, salah satu tujuan dari Studi Implementasi Tata Ruang terpadu Mamminasata yang dilaksanakan oleh Tim Studi JICA adalah untuk mewujudkan kota metropolitan yang manusiawi dan ramah lingkungan.

Kajian Master Plan telah berusaha mencakup penetapan kawasan terbuka hijau yang perlu dicadangkan untuk konservasi lingkungan yang mencakup pula perbaikan lingkungan pemukiman seperti pengelolaan sampah dan kebersihan.

Baca **Datang** Hal.31

BARTER. Beberapa orang ibu ikut 'mewakili' suaminya membawa sampah untuk dibarter dengan beras.

DATANG .....

Dalam rangka menunjang perencanaan tata ruang perkotaan yang sedang dalam tahap perumusan, studi JICA juga berusaha menemukan solusi-solusi bagi masalah umum perkotaan yang belum terkelola dengan baik. Salah satu proyek percontohan yang dimulai tepat pada hari Sumpah Pemuda 28 Oktober 2005 ini adalah Program Barter Sehat.

Program Barter Sehat tersebut dilatarbelakangi Pemerintah di Mamminasata termasuk Pemkot Makassar telah mencanangkan Kota Bersih. Akan tetapi, usaha pemerintah ini tidak akan berhasil jika partisipasi masyarakat tidak ditingkatkan.

Program ini dilakukan untuk membiasakan masyarakat hidup bersih dan bebas sampah. Program yang bertujuan utama untuk sanitasi lingkungan ini diusahakan juga memberikan dampak ganda pada pemberantasan kemiskinan.

Dari hasil pembelajaran studi banding ke Curitiba Brazil yang disponsori oleh JICA, pertukaran sampah dengan sayur sehat ternyata tidak hanya memberikan peningkatan kualitas kesehatan yang signifikan bagi masyarakat miskin, juga sekaligus meningkatkan taraf hidup mereka.

Untuk menyesuaikan dengan kebutuhan masyarakat Mamminasata, saat ini, sesuai dengan hasil survey, masyarakat lebih membutuhkan beras sehingga program barter sehat ini menggunakan sistem pertukaran setiap 100 liter sampah ditukar dengan dua liter beras.

Dijelaskan, tujuan program ini, menyadarkan masyarakat bahwa kanal dan badan sungai bukanlah tempat pembuangan sampah. Selain itu menunjang usaha pemerintah kota dengan cara meningkatkan kesadaran dan partisipasi masyarakat dalam kebersihan lingkungan, serta membiasakan masyarakat hidup bersih dan sehat, dan menjadi percontohan pengelolaan sampah yang berbasis masyarakat. Juga untuk mengefektifkan kerja truk sampah.

Kerjasama pengumpulan sampah dilakukan bersama 30 orang pencinta lingkungan yang semuanya memiliki pekerjaan utama sebagai tukang becak yang berdomisili di sekitar kanal Sinrijala sekitar Pettarani, di belakang Universitas '45.

Setiap hari Senin dan Jumat pada jam 16.00 Wita, mobil sampah akan menunggu di Jalan Pettarani, depan kanal Sinrijala. Peserta program 30 tukang becak ini akan datang membawa sampah yang telah mereka kumpulkan di dalam wadah yang telah ditentukan.

Volume sampah diukur oleh anggota LSM disaksikan ketua RT atau pegawai kelurahan setempat, peserta diberi kupon untuk ditukarkan dengan beras. Peserta menuju ke tempat penukaran beras yang terletak di sebelah mobil sampah untuk menukar kupon dengan beras.

Dampak positif yang diharapkan dari program barter sehat ini menurut Agnes antara lain kota semakin bersih, utamanya kanal dan sungai serta badan air lainnya. Truk sampah dapat melayani lebih banyak areal, karena untuk satu lokasi hannya memakan waktu satu jam saja.

Biasanya sehari hanya dapat melayani satu lokasi saja, serta diperolehnya suatu metode partisipatif yang menghemat biaya operasional dinas kebersihan. (*)

About 30 becak drivers fully loaded their becak with garbage. After they had loaded the garbage into a truck, they received 2 litres of rice. Last week, people who passed Jl.Pettarani were interested in garbage barter program with rice that would be conducted at 04 o'clock in the afternoon.

Dg.Salampe, one of the becak drivers, thinks that this program is very useful. So far, every day he burns garbage along canal because he does not know where to dispose of the garbage. According to him, transporting the garbage is far more important than the rice obtained.

People around said the same thing. They flocked together to deliver garbage although they were not one of the thirty becak drivers listed.

So far, in several parts of the city, garbage still lies around, mainly in canals and rivers which always become disposal sites regardless these sites are often cleaned. It is necessary to change people's shape of mind and habit concerning with garbage disposal into those sites.

JICA's expert who is in charge of this program, Dr.Agnes Rampisela said that one of the goals of Implementation Study on Mamminasata Integrated Spatial Planning conduced by JICA Study Team is to realize human and eco-friendly metropolitan.

The Master Plan Study has attempted to cover a green-open area as a back-up for environment conservation which also covers settlement-environment recovery such as garbage processing and sanity.

For the sake of supporting urban spatial planning which is being formulated, JICA Study also attempts to find solutions for urban problems which have not been managed well. One of the pilot projects which will start exactly on the Youth Pledge Day, 28 October 2005 is a Health Barter Program.

The program is set up due to Mamminasata Government's program including Makassar that is Clean City. However, the attempt of the Government will not succeed if people'participation does not increase.

This program is held to get the people accustomed with clean life and free of garbage. The program which aims at environmental sanitation is also expected to eliminate poverty.

From the comparison study to Curitiba, Brazil which was sponsored by JICA, garbage barter with clean vegetable does not only give significant-health quality increase for the poor but also increase their life quality.

To adjust with the need of Mamminasata society, presently according to a survey result, society need rice more so that this health-barter program uses barter system of each 100 liters garbage will be exchange with 2 litres rice.

It was explained that the goal of this program is to get the society aware that canal and water body are not for garbage disposal. In addition, it is to support the effort of the Municipal Government by way of increasing the awareness and participation of the society in neighborhood sanity and also to get the society accustomed with clean and healthy life and become example of society-based garbage management. It is also to increase the effectiveness of the garbage truck.

Partnership in collecting garbage is carried out hand in hand with 30 environment lovers whose main job is becak driver that reside in around Sinrijala Canal in Pettarani street behind University 45.

Every Monday and Friday at 16.00, a garbage car will be waiting in Pettarani Street, in front of Sinrijala Canal. The 30 becak driver will be coming to deliver garbage already packed in a container which has been set before.

The garbage volume is measured by members of NGO being witnessed by Head of Neighborhood (Ketua RT) or employees of sub dct office around and the attendants are given coupon to exchange it with rice. Then, the attendants head to the rice exchange which is situated next to the garbage car to exchange the coupon with rice.

It is expected that there is a positive impact out of this program according to Agnes that is, among others a cleaner city, mainly in canal and river as well as other water bodies. The garbage truck can serve more areas because for one location it only takes one hour.

Usually, the garbage truck can only serve one location, and from this program, it achieves a participatory method which spend less operational cost of Dinas of Sanitary.

Newspaper articles (2) on Garbage System in Curitiba

Garbage System of Curitiba

(Source : Fajar, Monday 7 November 2005)

Sistem Sampah Curitiba

BBM naik. Hal yang sepertinya tidak bisa dihindari. Pemerintah telah berusaha mengurangi dampak, dengan mengeluarkan berbagai program untuk menyalurkan dana kompensasi BBM kepada orang miskin. Meskipun demikian seluruh masyarakat tidak percaya bahwa hal tersebut akan benar-benar efektif mengurangi beban orang miskin. Bahkan orang miskin sendiri pun tidak seorang pun yakin apakah mereka berhak menerima bagian dari dana kompenssasi BBM tersebut. Orang miskin yang menjadi target utama sama sekali tidak memahami apa yang akan mereka terima, dalam bentuk apa dana kompensasi itu akan mereka nikmati atau bagaimana hubungannya dana kompensasi BBM itu dalam mengurangi penderitaan mereka.

Hal yang sama telah sering kita lihat. Penyaluran beras raskin hampir tidak memuaskan masyarakat. Ada kecurigaan bahwa dana itu hanya dibagikan kepada orang yang dekat dengan sumber informasi. Di tingkat kecamatan telah diadakan pendekatan yang cukup detail mengenai RT yang berhak menerima raskin atau tanggungan lainnya bagi warga miskin. Namun suara ketidakpuasan masih lebih sayaring terdengar dibanding dengan ucapan terima kasih dan tarikan napas lega keluarga miskin. Masih juga bantuan tersebut tidak tepat sasaran.

Masalah utama yang harus dihadapi adalah bagaimana menentukan siapa saja yang tergolong miskin. Kesulitan utama terjadi karena tidak ada data base yang lengkap untuk penghasilan masing-masing keluarga. Di negara-negara maju, data seperti ini umumnya tersedia, data pajak atau asuransi sudah dapat dijadikan dasar yang cukup reliable untuk menentukan kategori tingkat kekayaan atau penghasilan.

Selama ini kita lebih sering menggunakan data BKKBN. Sistem pendataan yang digunakan oleh lembaga ini sebenarnya cukup memadai dengan adanya jaringan petugas sampai ke tingkat desa. Kelemahannya adalah kriteria orang miskin yang digunakan masih sangat kualitatif meskipun telah ada revisi dengan kategori miskin ekonomi. Metode pengukuran penghasilan petani atau sektor informal lainnya masih juga menjadi kendala utama dalam menilai kemiskinan berdasarkan kriteria.

Ada berbagai teori untuk menentukan kemiskinan, namun beberapa lembaga utamanya LSM lebih memilih cara penilaian yang lebih praktis. Cara yang termasuk cukup cerdik yaitu dengan meminta foto copi rekening listrik. Masih kurang jelas kriteria yang digunakan oleh pemerintah kecamatan dalam pendataan orang miskin. Pertanyaannya adalah apakah penyaluran bantuan orang miskin itu harus didasarkan pada suatu daftar tertentu atau bisakah kita menyalurkannya saja asalkan kita yakin bahwa penerima-nya benar-benar miskin?

Belajar dari Curitiba Brasil

Di Curitiba, sampah bukanlah sampah, di sana sampah dapat diberter dengan bahan makanan berasi. Untuk setiap 60 kg sampah siapa saja yang datang menganterkan sampah akan berhak memperoleh 1 kg bahan makanan dari jenis yang disediakan oleh truk sampah. Dengan sistem ini pemerintah tidak perlu menyediakan gerobak sampah untuk kawasan kumuh yang tidak dapat dilewati truk sampah. Bahkan tidak perlu ada petugas yang digaji khusus untuk mengumpulkan sampah dan menyapu jalan. Masyarakat berbondong-bondong menganterkan sampah sampai ke tempat truk sampah meninggi. Setelah sampahnya ditimbang, mereka akan mendapat kupon bertuliskan jumlah kg bahan makanan yang menjadi haknya.

Pada daerah yang telah tertata baik dan penghuninya sudah sedikit lebih baik pengidupannya, barulah pemerintah menganggkut sampah, tetapi masyarakat masih tetap bisa menukarkan sampah yang bisa didaur ulang dengan bahan makanan. Dengan demikian sampah yang bisa didaur ulang ini dapat dijual ke berbagai pabrik atau pengguna lain, untuk digunakan kembali atau sebagai bahan baku bagi produk lainnya.

Dengan cara ini ternyata pemerintah tidak memerlukan banyak petugas dan pegawai dinas kebersihan, selain itu biaya pengumpulan dan pengangkutan sampah malah dapat dihemat sampai 40 persen. Selain penghematan anggaran pemerintah, dampak lain dari program ini adalah tertolongnya petani yang mengalami over produksi. Pemerintah akan membeli produk pertanian yang diperkirakan akan jatuh harganya akibat melimpahnya panen. Petani tertolong, masyarakat miskin memperoleh sayuran dan buah-buahan sehat, lingkungan bersih dan nyaman.

Program ini telah mendapat penghargaan dari Badan Dunia sebagai kota ramah lingkungan. Aplikasinya di Indonesia? Program sederhana ini sebenarnya akan sangat mudah diaplikasikan di Indonesia. Jika kita jeli maka program barter sampah ini akan merupakan salah satu tolok ukur untuk mendeteksi dan mengidentifikasi orang miskin. Jika mereka sangat harus mengumpulkan sampah untuk diberter dengan beras raskin, siapa pula yang akan meragukan kemiskinan mereka?

Marilah dan bersungguh-sungguhlah kita menyalurkan mereka yang benar-benar miskin dan menyalurkan bantuan yang mereka butuhkan dengan sepenuh hati? Jika kita memulai program barter sampah dengan beras raskin, mungkin barulah kita bisa mengadakan pendataan keluarga miskin yang sebenar-benarnya.

Jika keluarga dan orang miskin ini telah kita kenali maka seluruh program bantuan kemiskinan lainnya akan dapat kita salurkan dan kerjakan dengan efektif.

Solusi yang ditawarkan ini tidak sulit, maukah Kepala Dinas Sosial dan Kepala Dinas lingkungan atau keindahan dan kebersihan duduk bersama dengan para camat untuk membicarakan penerapan cara ini/ atau tetapkah kita bersikukuh pada daftar yang ada walaupun hanya lapisan masyarakat merangkan kesejahteraannya?

Dalam kenaikan dan kelangkaan BBM ini masihkah kita tidak mau secara menyingsingkan lengan baju dan dengan tulus hati menyalurkan kepada yang lebih berhak? Para anggota DPR dan DPRD, para Gubernur, Bupati dan Walikotk, satu solusi sederhana telah ditawarkan. -ee

Fuel rises. It seems unavoidable. The Government has attempted to reduce its impact by issuing several programs to dbute compensation funds of fuel for the poors. However, all societies do not trust that the programs may really be effective to lessen the burden of the poors. In fact, the poors themselves are not convinced whether they are privileged to receive the compensation funds. The poors as the main target do not understand at all what they are going to receive, in what form of the compensation they are going to enjoy or how the compensation is lessening their suffer.

We have seen the other same thing. The dbution of rice for the poor hardly satisfy them. It is suspected that this aid is shared only for near-information persons. At the level of dct (kecamatan), there has been enough-detail approach in terms of respondentss who are privileged to receive the aid or other allowances for the poor. Yet, dissatisfaction sounds more than the expression of thank and relief of the poor. Once again, it misses the target.

The main problem we have to face is how we determine who are supposed to be under the poor level classification. This complexity occurs due to incomplete data base concerning with the revenue of each respondents. In developed countries, this kind of data are normally available, tax or insurance data can be made relatively-reliable foundation to determine the category of wealth level or revenue.

Until recently, we often utilize BKKBN data (BKKBN : The National Family Planning Coordinating Board). The data system used by the Board is actually reliable enough by seeing the fact that their staffs are spread to the level of village. The weak point is the criteria of the poor being used is very qualitative although it has been

revised with the category of economical poor. The method of measuring farmer's revenue or other informal sectors still raises problem in judging the poor level based on criteria.

There are several theories related with determining poor level, but some institutions mainly the NGO, prefer to use a more practical judgment. One of the ways which can be said smart is by asking the people their copy of electricity bill. It is not clear what criteria is being used by the dct officers in collecting data of the poor. The question is, does the dbution of the aid for the poor have to be based on a certain list or can we just dbute it with one condition we are sure that the recipients are really poor?

Learn from Curitiba, Brazil

Curitiba which is the Capital State of Parana, one of the 27 capital states in Brazil, has applied successfully a system of clean environment maintenance along with overtaking poverty problem.

In Curitiba, garbage is not garbage. In this city, the garbage can be traded in with nutritious food materials. For every 60 kilograms of garbage people submit, they will receive 1 kg of food materials from the type provided by garbage truck. By this system, the government does not have to provide garbage tank placed in slump area which is inaccessible for the garbage truck. Even, it does not need a worker who is particularly paid for collecting garbage and sweeping roads. The society flocks to deliver the garbage to the waiting truck. After the garbage is scaled, they are going to receive a coupon saying amount of kilograms of food materials they should receive.

In a well-planned area and relatively-well life managed family, should the government be involved in caring the garbage, however this society can also exchange their recyclable garbage with some amount of food. Thus, the garbage which can be recycled is sold to several factories or other interested consumers for reusage or as raw materials for making other products.

Through this way, the government does not have to require a lot of workers and employees of Dinas of Sanity, in addition, the cost of collection and transportation of garbage can be saved to 40%. In addition to the efficient budget of the government, the other impact of this program is assisting farmers who undergo over-production. The government will buy agro culture products which are assumed their price may fall due to over-loading harvest. The farmers are assisted, the poor gets healthy vegetable and fruits, clean and convenient environment has to be.

This program has been received award from World Organization as eco-friendly city. The application in Indonesia? This simple program is actually very easy to apply in Indonesia. If we are smart, this garbage-barter program will be a standard to detect and identify the poor. If they have to collect garbage to trade in with rice, who will be doubt of their poverty?

Will or are we keen to find those who are really poor and dbute the aid they really need sincerely? If we start the barter program with rice, this is the time we can conduct registration of poor respondentss in the way it is meant.

If these family and poor people have been acknowledged, the other aid programs for poverty can be dbuted and conducted effectively.

The solution offered is not difficult, will Head of Dinas of Social Affairs and Head of Dinas of Environment Affairs or Beautification and Sanity hold a meeting with Heads of Dct to discuss the application of this program or do we still insist on the existing list although all levels of the society are not sure of its reliability?

In case of fuel rise and lackness, are we still unwilling to give our hands and sincerely dbute the aids to the deserved one? To all members of Legislatives and Local Legislatives, Governors, Heads of Regency and Major, one simple solution has been offered.

Manual prepared for environmental education

MANUAL PENDIDIKAN LINGKUNGAN

Ayo Selamatkan Bumi Kita !!!!

10A-13

Pemda Prov. Sulsel

MANUAL PENDIDIKAN LINGKUNGAN

Daftar Isi

Bab 1
Pengelolaan Sampah

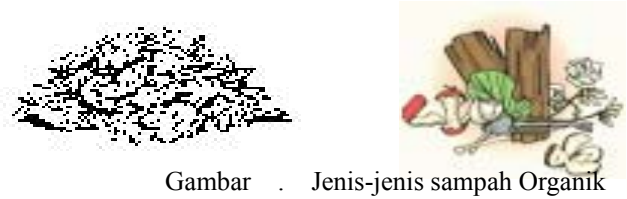
A. Pengertian Sampah

"Sampah adalah suatu bahan yang terbuang atau dibuang dari sumber hasil aktivitas manusia maupun proses alam yang belum memiliki nilai ekonomis." (Istilah Lingkungan untuk Manajemen, Ecolink, 1996)."Sampah adalah sesuatu yang tidak berguna lagi, dibuang oleh pemiliknya atau pemakai semula". (Tandjung, Dr. M.Sc., 1982)

Berdasarkan asalnya, sampah padat dapat digolongkan sebagai:

- Sampah Organik
- Sampah Anorganik

Sampah Organik terdiri dari bahan-bahan penyusun tumbuhan dan hewan yang diambil dari alam atau dihasilkan dari kegiatan pertanian, perikanan atau yang lain. Sampah ini dengan mudah diuraikan dalam proses alami. Sampah rumah tangga sebagian besar merupakan bahan organik. Termasuk sampah organik, misalnya sampah dari dapur, sisa tepung, sayuran, kulit buah, dan daun.



Gambar . Jenis-jenis sampah Organik

Sampah Anorganik berasal dari sumber daya alam tak terbarui seperti mineral dan minyak bumi, atau dari proses industri. Beberapa dari bahan ini tidak terdapat di alam seperti plastik dan aluminium. Sebagian zat anorganik secara keseluruhan tidak dapat diuraikan oleh alam, sedang sebagian lainnya hanya dapat diuraikan dalam waktu yang sangat lama. Sampah jenis ini pada tingkat rumah tangga, misalnya berupa botol, botol plastik, tas plastik, dan kaleng.

Gambar . Jenis-jenis sampah anorganik

Kertas, koran, dan karton merupakan perkecualian. Berdasarkan asalnya, kertas, koran, dan karton termasuk sampah organik. Tetapi karena kertas, koran, dan karton dapat didaur ulang seperti sampah anorganik lain (misalnya gelas, kaleng, dan plastik), maka di buku ini dimasukkan ke dalam kelompok sampah anorganik.

Tugas: siswa: membuat daftar jenis sampah yang mereka ketahui berdasarkan jenisnya

B. Sumber sampah

- **Sampah dari Pemukiman**: Umumnya sampah rumah tangga berupa sisa pengolahan makanan, perlengkapan rumah tangga bekas, kertas, kardus, gelas, kain, sampah kebun/halaman, dan lain-lain.

- **Sampah dari Pertanian dan Perkebunan:** Sampah dari kegiatan pertanian tergolong bahan organik, seperti jerami dan sejenisnya. Sebagian besar sampah yang dihasilkan selama musim panen dibakar atau dimanfaatkan untuk pupuk. Untuk sampah bahan kimia seperti pestisida dan pupuk buatan perlu perlakuan khusus agar tidak mencemari lingkungan. Sampah pertanian lainnya adalah lembaran plastik penutup tempat tumbuh-tumbuhan yang berfungsi untuk mengurangi penguapan dan penghambat pertumbuhan gulma, namun plastik ini bisa didaur ulang.

- **Sampah dari Sisa Bangunan dan Konstruksi Gedung:** Sampah yang berasal dari kegiatan pembangunan dan pemugaran gedung ini bisa berupa bahan organik maupun anorganik. Sampah Organik, misalnya: kayu, bambu, triplek. Sampah Anorganik, misalnya: semen, pasir, spesi, batu bata, ubin, besi dan baja, kaca, dan kaleng.

- **Sampah dari Perdagangan dan Perkantoran:** Sampah yang berasal dari daerah perdagangan seperti: toko, pasar tradisional, warung, pasar swalayan ini terdiri dari kardus, pembungkus, kertas, dan bahan organik termasuk sampah makanan dan restoran. Sampah yang berasal dari lembaga pendidikan, kantor pemerintah dan swasta biasanya terdiri dari kertas, alat tulis-menulis (bolpoint, pensil, spidol, dll), toner foto copy, pita printer, kotak tinta printer, baterai, bahan kimia dari laboratorium, pita mesin ketik, klise film, komputer rusak, dan lain-lain. Baterai bekas dan limbah bahan

kimia harus dikumpulkan secara terpisah dan harus memperoleh perlakuan khusus karena berbahaya dan beracun.

- **Sampah dari Industri:** Sampah ini berasal dari seluruh rangkaian proses produksi (bahan-bahan kimia serpihan/potongan bahan), perlakuan dan pengemasan produk (kertas, kayu, plastik, kain/lap yang jenuh dengan pelarut untuk pembersihan). Sampah industri berupa bahan kimia yang seringkali beracun memerlukan perlakuan khusus sebelum dibuang.

Gambar . Jenis Sampah Industri

C. Sampah dan permasalahan lingkungan

Jumlah sampah rumah tangga yang dihasilkan telah meningkat dua kali lipat sejak 20 tahun terakhir. Hal ini tentu saja disebabkan oleh pertumbuhan penduduk yang terus meningkat dan ditunjang oleh perubahan gaya hidup masyarakat saat ini.

Dari segi kesehatan lingkungan, terdapat 3 masalah besar yang disebabkan oleh sampah, yaitu:

1. Tempat berkembang dan sarang dari serangga dan tikus
2. Menjadi sumber polusi dan pencemaran tanah, air dan udara (lepasnya gas-gas beracun akibat efek rumah kaca seperti metan dan karbondioksida)
3. Menjadi sumber dan tempat hidup kuman-kuman yang membahayakan kesehatan.

Semakin meningkatnya tumpukan sampah setiap harinya juga telah menyebabkan menurunkan daya tampung Tempat Pembuangan Akhir (TPA), yang pada akhirnya akan mengakibatkan meningkatnya kebutuhan akan lokasi TPA baru dan biaya pembuangan sampah. Padahal lahan semakin sulit didapat karena pertumbuhan kota yang sedemikian pesat dan kebutuhan akan lahan untuk tempat tinggal juga meningkat. Oleh karena itu partisipasi kita sangat dibutuhkan untuk bersama-sama mengurangi tumpukan sampah setiap harinya.

D. Apa yang dapat kita lakukan?

Ada banyak hal yang dapat kita lakukan untuk turut berpartisipasi dalam menurunkan jumlah sampah yang menumpuk setiap harinya di Tempat Pembuangan Sampah Sementara (TPS) atau pun di TPA, yaitu dengan cara:

1. Pemilahan Sampah (Waste Separation)

Salah satu cara termudah dalam penanganan sampah adalah dengan memisahkan sampah berdasarkan jenisnya dari setiap sumber sampah. Pemilahan sampah dilakukan secara langsung di sumber, misalnya untuk sampah rumah tangga, kita bisa langsung memisahkan sampah organic (sisa makanan, sayuran, buah-buahan) dan anorganik (botol, plastic pembungkus, kardus) ke dalam wadah yang berbeda. Jika proses pemilahan ini dapat dilakukan oleh setiap rumah tangga dan sumber sampah lainnya, hal ini akan secara tidak langsung:

- mengurangi volume sampah yang menumpuk di TPS/TPA
- mengurangi beban kerja petugas/pemungut sampah
- sampah yang dapat didaur ulang dapat langsung dikumpulkan oleh pemungut untuk selanjutnya dijual ke dealer-dealer untuk didaur ulang
- sampah organic dapat langsung diolah di TPA atau di tempat pembuatan kompos
- sampah-sampah beracun yang dapat mencemarkan lingkungan terpisah dari sampah lainnya
- mengurangi polusi air, udara, dan tanah

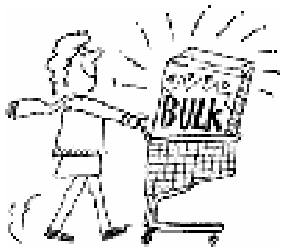
2. 4 ‘R’ (Reduce, Reuse, Recycle, Respond)

Selain dengan cara memisahkan sampah dari sumbernya, cara sederhana lain yang dapat kita lakukan adalah dengan menerapkan prinsip 4 ‘R’ yaitu *Reduce* (=mengurangi), *Reuse* (=menggunakan kembali), *Recycle* (=mendaur ulang), dan *Respond* (=merespon).

A. Mengurangi jumlah kemasan/pembungkus yang tidak penting

Tips:

- Ketika memilih dua produk yang sama, pilihlah produk yang memiliki kemasan yang paling sedikit
- Belilah produk yang masih segar (tanpa pembungkus) seperti jamur, bawang putih, ikan segar daripada membeli dalam bentuk kalengan.
- Pertimbangkanlah untuk membeli produk dalam jumlah banyak yang dikemas dalam satu kemasan yang bisa digunakan berulangkali.
- Jika memungkinkan, pilihlah toko/supermarket yang menyediakan produk yang dikemas dalam jumlah yang banyak
- Bawalah makanan yang dibuat di rumah daripada membeli makanan cepat saji dengan banyak kemasan.



- Usahakan selalu untuk memesan/mengambil makanan sesuai dengan porsi yang mampu dihabiskan sehingga tidak banyak/ada makanan yang tersisa untuk dibuang

B. Mengadopsi praktik-praktik yang dapat mengurangi sampah beracun

Tips:

- Gunakanlah produk yang aman (tidak/kurang mengandung zat-zat yang beracun)
- Belajarlah untuk mencari alternative/pengganti alat rumah tangga yang memiliki fungsi yang sama namun lebih aman
- Jika terpaksa harus menggunakan produk yang beracun/berbahaya, gunakanlah sesuai jumlah yang diperlukan
- Untuk produk yang mengandung zat-zat beracun/berbahaya, bacalah petunjuk penggunaannya dengan baik dan ikuti petunjuknya dengan benar
- Pisahkanlah sampah yang mengandung zat-zat beracun dari jenis sampah lainnya.

C. Pertimbangkan untuk menggunakan produk yang dapat digunakan kembali

Banyak produk yang didesain untuk digunakan lebih dari satu kali. Produk-produk seperti itu menghasilkan sampah yang lebih sedikit dan sangat membantu dalam usaha pengelolaan sampah, melestarikan sumberdaya dan material.

Tips:

- Bawalah tempat air minum/gelas sendiri daripada membeli minuman kaleng/kemasan baru

- Bawalah perlengkapan makan dari rumah yang terbuat dari bahan yang kuat daripada membawa/membeli alat makan yang sekali buang
- Di tempat kerja/sekolah lihatlah apabila tinta printer/cartridgenya dapat diisi ulang
- Gunakanlah saputangan kain/spons yang dapat dicuci berulangkali daripada menggunakan tissue yang sekali buang
- Carilah barang yang tersedia dalam bentuk isi ulang

- Jika memungkinkan, gunakanlah baterai yang dapat diisi ulang untuk membantu mengurangi sampah utamanya sampah beracun/berbahaya
- Jika terpaksa harus menggunakan barang-barang sekali pakai, ingatlah untuk selalu mengambil dalam jumlah yang diperlukan.
- Ingat, jika tujuan kita adalah untuk mengurangi sampah padat, berpikirlah untuk menggunakan barang-barang yang dapat digunakan kembali

D. Pelihara dan perbaikilah barang-barang yang memiliki usia pakai panjang

Tips:

- Pertimbangkanlah untuk menggunakan barang yang berusia pakai panjang dengan garansi yang baik

- Bacalah selalu petunjuk pemakaian dan pemeliharaan yang baik
- Perbaikilah barang-barang yang dapat diperbaiki daripada membuangnya sehingga bisa digunakan kembali

Aktifitas siswa:

Usia 6-8 tahun mewarnai (lihat materi 2)

Usia 9-12 tahun membuat prakarya dari

E. Gunakan kembali tas/kantongan plastic, container, dan barang lainnya

Tips:

- Gunakan kembali kertas dan kantongan plastic serta barang lainnya yang bisa digunakan ulang. Jika memungkinkan simpanlah kantongan tersebut dan gunakan kembali pada saat berbelanja.
- Cuci dan gunakan kembali gelas atau botol bekas selai, susu, kopi. Barang-barang ini dapat digunakan untuk menyimpan barang-barang sisa seperti kancing, paku, dll.

- Ubahlah potongan-potongan kayu yang tidak dapat dipakai menjadi rumah burung, tempat surat, atau barang lainnya.
- Gunakan kembali kertas dan amplop bekas. Gunakan dua sisi kertas untuk mencatat sebelum mendaur ulang kembali.

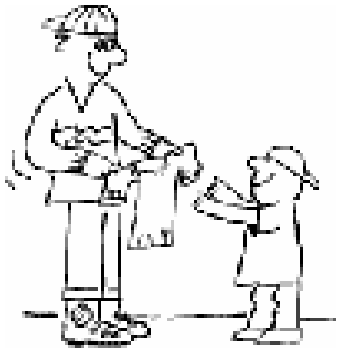
Ingat!!: ***Jangan gunakan kembali botol/container yang***

digunakan untuk menyimpan oli motor atau pestisida, ini berbahaya bagi kesehatan.

F. Jual atau sumbangkan barang-barang yang sudah tidak digunakan daripada membuangnya

Tips:

- Jual kembali atau sumbangkan barang bekas ke took barang loak
- Jual barang bekas di bazaar, melakukan pertukaran dengan teman



- Berikan baju-baju yang sudah tidak dapat dipakai lagi ke anggota keluarga lain, tetangga, atau saudara yang membutuhkan.

3. Belanja Hijau

Pernahkah kamu mendengar istilah 'belanja hijau'? Belanja hijau didefinisikan sebagai belanja cerdik lingkungan yang berarti membeli produk-produk yang turut membantu melestarikan sumberdaya alam, menghemat energi, dan mencegah penambahan sampah. Belanja hijau juga dapat berarti tidak membeli sesuatu yang tidak diperlukan. Apa pun yang kita beli akan berpengaruh terhadap lingkungan, namun terdapat beberapa produk yang dari segi lingkungan lebih baik dibandingkan produk lainnya.

Belanja hijau berarti:

- membeli produk yang hemat energi
- membeli produk yang bisa digunakan ulang
- membeli produk yang bisa dibuat oleh bahan-bahan yang daur ulang atau yang dapat didaur ulang
- membeli produk yang tidak memiliki kemasan atau memiliki kemasan yang sangat minim atau hindarilah produk yang memiliki kemasan yang berlebihan
- membeli produk-produk yang memiliki usia pakai panjang

4. Pembuatan Kompos (Composting)

Jumlah sampah padat yang berasal dari sisa-sisa makanan telah memenuhi 23% dari keseluruhan sampah yang dihasilkan. Ini merupakan jumlah yang cukup banyak untuk diangkut ke Tempat Pembuangan Akhir (TPA) walaupun sebenarnya ternyata bisa bermanfaat dan memiliki keuntungan positif bagi lingkungan apabila diolah menjadi kompos yang kemudian dapat berguna sebagai pupuk yang ramah lingkungan.

Pembuatan kompos adalah percepatan proses dekomposisi (pembusukan). Sampah yang berasal dari sisa makanan disebut sebagai materi hijau dan daun-daunan dan potongan-potongan kayu disebut sebagai materi coklat.

Proses pembuatan kompos tidaklah sulit namun memerlukan waktu yang lama (2-3 bulan).

Manfaat Kompos:

- dapat membantu pertumbuhan tanaman
- dapat mengurangi atau menghilangkan kebutuhan akan pupuk kimia
- dapat menjadi salah satu komponen yang digunakan dalam usaha rehabilitasi hutan, pemulihan hutan, dan perbaikan habitat.

Peralatan yang digunakan:

- Tempat kompos

- Cangkul
- Garpu Tanah
- Sarung tangan
- Termometer kompos
- Timbangan
- Tally sheet
- Suplai regular bahan (daun-daunan, potongan-potongan kayu)
- Tempat sampah makanan yang telah diberi label
- Larutan Bakteri Penghancur (EM4)

Hal-hal yang dilakukan dalam pembuatan kompos:

- mempersiapkan area yang teduh, dekat dengan sumber air, dan terbuka untuk tempat pembuatan kompos
- mempersiapkan tempat penampungan sampah organik yang akan dijadikan kompos
- mempersiapkan bahan-bahan yang akan dijadikan kompos (materi hijau dan materi coklat)
- setelah semua bahan berupa sampah organic terkumpul, sampah kemudian ditimbang dengan menggunakan timbangan dan beratnya dicatat
- Sampah organic lalu dituangi larutan EM4 sesuai dengan dosis yang diperlukan
- Dilakukan pengadukan yaitu dengan membolak-balik sampah supaya proses pengomposan berjalan merata. Hal ini dilakukan 2-3 minggu sekali untuk mendapatkan kualitas kompos yang baik.
- Pencampuran harus diulang 2-3 kali selama proses pembusukkan. Proses pembusukan biasanya berlangsung selama 3 bulan. Tambahan air diperlukan jika bahan-bahan kompos yang digunakan terlalu kering.

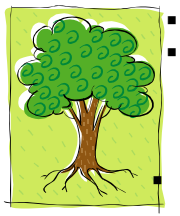
Bab 2
Peran Pohon sebagai Penyelamat Bumi

A. Fungsi Pohon

Indonesia adalah salah satu negara yang dulunya terkenal sebagai paru-paru dunia dan merupakan negara diurutan kedua di dunia yang memiliki hutan hujan tropis terbesar. Namun sangat disayangkan, laju pertumbuhan penduduk yang tinggi, konversi lahan hutan menjadi lahan pertanian ataupun pemukiman, pelaksanaan pembangunan kehutanan yang semakin pesat (pembabatan hutan), pencurian kayu (*illegal logging*) telah menghilangkan hampir lebih dari setengah luas hutan yang ada di Indonesia. Secara menyeluruh, kerusakan hutan telah menimbulkan berbagai masalah seperti:

- Bertambahnya lahan kritis dan lahan kering (gurun) di daerah tropis
- Menurunnya curah hujan
- Meningkatnya suhu iklim global sebagai akibat dari meningkatnya kadar karbon di atmosfer yang menyebabkan meningginya permukaan air laut
- Punahnya sejumlah besar spesies tumbuhan dan hewan termasuk hilangnya spesies margasatwa serta tumbuhan pangan dan obat yang mempunyai potensi penting
- Merosotnya sejumlah populasi fauna
- Meningkatnya erosi tanah
- Hilangnya potensi lk tenaga air
- Punahnya masyarakat dan kebudayaan yang cara hidupnya bergantung pada hutan

Hutan terdiri dari pepohonan. Hilangnya komunitas pepohonan dari hutan akibat aktivitas manusia secara langsung juga menghilangkan fungsi dan hutan terhadap lingkungan. Dapat dikatakan bahwa pohon memiliki fungsi dan peranan yang besar terhadap lingkungan baik di dalam maupun di luar kawasan hutan seperti meminimalkan polusi udara, mencegah terjadinya bencana alam seperti longsor dan banjir.



- Fungsi dan peran pohon secara umum:
- menyerap karbondioksida (CO_2)
  mengeluarkan oksigen (O_2)
  mencegah erosi dan banjir/tsunami
  menahan air
- sebagai peneduh/tempat berlindung
  bernilai estetik
  sebagai tempat hidup satwa

B. Apa yang dapat kita lakukan?

Udara bersih adalah salah satu kebutuhan vital manusia yang merupakan sumberdaya alam yang tidak tergantikan. Dengan meningkatnya jumlah penduduk, kegiatan ekonomi dan aktifitas penduduk yang semakin pesat secara tidak langsung mengakibatkan tingginya tingkat polusi di daerah perkotaan. Hal ini berpengaruh terhadap kualitas udara yang kita hirup. Saat ini jumlah pohon yang berperan dalam meminimalkan polusi udara di daerah perkotaan sangatlah sedikit jumlahnya, demikian pula ruang terbuka hijau.

Apa yang dapat kita lakukan untuk memperbaiki kondisi lingkungan saat ini utamanya di daerah perkotaan? Salah satu cara adalah dengan menggalakkan program penghijauan di daerah perkotaan atau yang biasa kita kenal dengan gerakan 'hijau' yaitu dengan turut berpartisipasi dalam melakukan penanaman di beberapa daerah terbuka seperti pinggir jalan, taman kota, taman perumahan, taman/pekarangan sekolah, jalur sempadan sungai, jalur kereta api, dan sebagainya.

Tipe penghijauan yang akan dilakukan tentu saja harus disesuaikan dengan fungsi kawasan seprti permukiman, industri, rekreasi, dan sebagainya. Hal ini akan berpengaruh terhadap pemilihan jenis pohon yang sesuai untuk di tanam pada kawasan-kawasan tersebut. Misalnya kawasan permukiman haruslah ditanamai jenis-jenis pohon yang memiliki fungsi sebagai penghasil oksigen, penyerap karbondioksida, peresap air, penahan angin, dan peredam kebisingan. Untuk itu pemilihan jenis pohon yang sesuai dengan fungsi dan kegunaannya juga adalah sangat penting sebelum kita melakukan penanaman pohon.

Untuk menciptakan lingkungan yang asri, teduh, hijau, dan bebas polusi, sangatlah dianjurkan bagi setiap rumah untuk memiliki paling sedikit satu pohon di pekarangannya dan menanami lahan kosong di sekitarnya dengan pohon-pohon peneduh atau pun jenis pohon yang menghasilkan buah seperti rambutan, alpukat, nangka, dan sebagainya.

Pengaktif (Aktivator)
Dedaunan
potongan rumput
Kotoran Ayam dan Burung

Barang lain yang dapat dijadikan kompos
potongan kayu
karton
tas kertas
tempat/boks telur

Bahan Penyeimbang
Bekas sayuran dan buah-buahan
Kantong teh
Bubuk kopi
Bunga yang layu
tanaman bawah
potongan-potongan pagar
hasil/bekas pangkasan tanaman

bahan yang sangat lambat membusuk
potongan-potongan tanaman pagar yang keras
bekas pangkasan berkayu
Serbuk gergaji

Bahan yang harus dihindari dalam pembuatan kompos
Daging
Ikan
Kertas Koran
Makanan masak

Bahan yang tidak dapat dijadikan kompos
bekas serpihan batu bara/arang
Kotoran kucing dan anjing
kertas majalah yang mengkilap

Fungsi dan Manfaat Pohon	Jenis-jenis Pohon yang digunakan	Lokasi Penanaman
Penyerap partikel limbah	*Agathis alba* (dammar) *Swietenia macrophylla* (mahoni daun lebar) *Podocarpus imbricatus* (Jamuju) *Myristica fragrans* (Pala) *Pithecelebium dulce* (asam landi) *Cassia siamea* (johar) *Polyalthea longifolia* (glodogan) *Baringtonia asiatica* (keben) *Mimusops elengi* (tanjung)	Kawasan industri
Penyerap/ penepis bau	*Michelia champaka* (cempaka) *Pandanus sp* (pandan) *Murraya paniculata* (kemuning) *Mimusops elengi* (tanjung)	Kawasan permukiman, industri, rekreasi
Mengatasi Penggenangan	*Artocarpus integra* (nangka) *Paraserianthes falcataria* (albizia) *Acacia vilosa* *Indigofera galegoides* *Dalbergia spp.* *Swietenia mahagoni* (mahoni) *Tectona grandis* (jati) *Samanea saman* (Ki hujan) *Leucaena glauca* (lamtoro)	Kawasan permukiman, industri

Leaflet prepared
for program dissemination

BERSIH LINGKUNGAN DENGAN EFEKTIF, EFISIEN DAN MURAH

Pemerintah Daerah Prov. Sulsel

Bagaimana menciptakan Lingkungan yang Bersih?

Adalah anggapan yang salah jika lingkungan yang bersih berarti membutuhkan biaya yang tinggi serta peralatan yang memadai. Dalam kehidupan sehari-hari ada banyak hal yang dapat kita lakukan untuk turut berpartisipasi dalam menciptakan lingkungan yang bersih dan menurunkan jumlah sampah yang menumpuk setiap harinya di Tempat Pembuangan Sampah Sementara (TPS) atau pun di TPA dengan cara yang sangat sederhana, yaitu dengan memilah sampah rumah tangga anda dan melakukan 4 'R' (Reuse=menggunakan kembali, Recycle=mendaur ulang, Reduce=mengurangi, Respond=merespon).

Untuk dapat memilah sampah kita perlu mengetahui jenis-jenis sampah.

- **Sampah Organik** terdiri dari bahan-bahan penyusun tumbuhan dan hewan yang diambil dari alam atau dihasilkan dari kegiatan pertanian, perikanan atau yang lain.
- **Sampah Anorganik** berasal dari sumber daya alam tak terbarui seperti mineral dan minyak bumi, atau dari proses industri. Beberapa dari bahan ini tidak terdapat di alam seperti plastik dan aluminium. Sebagian zat anorganik secara keseluruhan tidak dapat diuraikan oleh alam, sedang sebagian lainnya hanya dapat diuraikan dalam waktu yang sangat lama.

Jenis Sampah	Sampah Organik	Sampah Anorganik
Sampah dapur	√	
Sisa tepung	√	
Sisa Makanan	√	
Sayuran	√	
Kulit buah	√	
Daun	√	
Ranting	√	
Hasil potongan rumput	√	
Botol plastic		√
Botol kaca		√
Tas/kantong plastic		√
Kaleng		√
Barang yang terbuat dari Alumunium		√
Besi		√

Apa keuntungan dari pemilahan sampah?

- mengurangi volume sampah yang menumpuk di TPS/TPA
- mengurangi beban kerja petugas/pemungut sampah
- sampah yang dapat didaur ulang dapat langsung dikumpulkan oleh pemungut untuk selanjutnya dijual ke dealer-dealer untuk didaur ulang
- sampah organic dapat langsung diolah di TPA atau di tempat pembuatan kompos
- sampah-sampah beracun yang dapat mencemarkan lingkungan terpisah dari sampah lainnya
- mengurangi polusi air, udara, dan tanah

Bagaimana Memilah Sampah secara Sederhana di Rumah?

- Kelompokkanlah sampah di rumah ke dalam 3 jenis, yaitu sampah organic, sampah kering (botol,plastik, kertas) dan sampah lainnya (besi, dan sampah lain).
- Sediakanlah 3 wadah sampah di rumah dan berilah masing-masing wadah label nama (sampah organic, sampah kering, dan sampah lainnya)
- Pisahkanlah selalu sampah rumah tangga anda sesuai dengan jenisnya ke dalam wadah tersebut

- Pisahkanlah sampah-sampah yang mengandung racun dan gas berbahaya seperti kaleng pembasmi serangga, wadah penyimpan oli, pestisida, dan lainnya, di tempat yang berbeda

Apa itu Prinsip 4 'R'?

Pernahkah anda mendengar prinsip 4 'R'? 4 'R' adalah singkatan dari *Reuse* (=menggunakan kembali), , *Recycle* (=mendaur ulang), *Reduce* (=mengurangi) dan *Respond* (=merespon). Jika kita menerapkan prinsip ini

dalam kehidupan sehari-hari kita akan secara tidak langsung turut menjaga kebersihan lingkungan dan mengurangi jumlah sampah yang dihasilkan.

Prinsip 4 ‘R’ menekankan pola pengelolaan sampah rumah tangga yaitu pada penggunaan/pemanfaatan kembali barang-barang yang telah dibuang, melakukan proses daur ulang terhadap sampah yang dapat didaur ulang, mengurangi jumlah sampah yang dihasilkan per harinya dengan melakukan ‘belanja hijau’, serta partisipasi dalam menyebarkan dan menerapkan prinsip ini di lingkungan sekitar.

Keterangan:

A : Sampah yang dapat digunakan kembali dan didaur ulang

Contoh: botol kaca, botol plastic, kertas, Koran, majalah, kaleng,ban bekas, pakaian bekas, kantongan kertas.

B : Sampah yang beracun dan berbahaya

Contoh: baterai, aki, bekas semprotan nyamuk, botol-botol bekas bahan kimia

C : Sampah yang dapat dijadikan kompos Contoh: sisa makanan, daun-daunan, ranting pohon, sampah dapur (sayuran, buah-buahan).

Tips Hidup bebas sampah

Pertimbangkan untuk menggunakan produk yang dapat digunakan kembali (Reuse)

- Carilah barang yang tersedia dalam bentuk isi ulang

- Jika memungkinkan, gunakanlah baterai yang dapat diisi ulang untuk membantu mengurangi sampah utamanya sampah beracun/berbahaya
- Ingat, jika tujuan kita adalah untuk mengurangi sampah padat, berpikirlah untuk menggunakan barang-barang yang dapat digunakan kembali

- Gunakan kembali kertas dan kantongan plastik serta barang lainnya yang bisa digunakan ulang. Jika memungkinkan simpanlah kantongan tersebut dan gunakan kembali pada saat berbelanja.
- Cuci dan gunakan kembali gelas atau botol bekas selai, susu, kopi. Barang-barang ini dapat digunakan untuk menyimpan barang-barang sisa seperti kancing, paku, dll.
- Gunakan kembali kertas dan amplop bekas. Gunakan dua sisi kertas untuk mencatat sebelum mendaur ulang kembali.

Pelihara dan perbaikilah barang-barang yang memiliki usia pakai panjang

- Pertimbangkanlah untuk menggunakan barang yang berusia pakai panjang dengan garansi yang baik

- Perbaikilah barang-barang yang dapat diperbaiki daripada membuangnya sehingga bisa digunakan kembali

Ingat!!: jangan gunakan kembali botol/container yang digunakan untuk menyimpan oli motor atau pestisida, ini berbahaya bagi kesehatan

- Usahakan selalu untuk memesan/mengambil makanan sesuai dengan porsi yang mampu dihabiskan sehingga tidak banyak/ada makanan yang tersisa untuk dibuang

Study on Implementation of
Integrated Spatial Plan for
The Mamminasata Metropolitan Area

SECTOR STUDY (11)

POWER AND TELECOMMUNICATIONS STUDY

KRI International Corp.
Nippon Koei Co., Ltd

Table of Contents

1. POWER SECTOR STUDY

1.1 Power System of South Sulawesi

1) System Configuration

The Study area receives electric power from the grid electric power system in South Sulawesi (called the System SULSEL or the System). The backbone of the System is composed of 150 kV, 70 kV and 30 kV overhead transmission lines (see the figure 1.1-1). Primary distribution lines are consisting of 20 kV, 13.8 kV and 6.3 kV middle voltage lines depending on the voltage levels of step down transformers at substations.

The total length of 150 kV transmission line is 967.0 km, forming a backbone of the system. The total length of 70 kV is 150.7 km, and that of 30 kV lines is 11.2 km (as of December 2004). The load dispatching center (AP2B) is located in Makassar City, and is responsible for supervising the power system conditions, controlling substation and issuing an operational order for each power station. AP2B has introduced a SCADA system (System Control And Data Acquisition system) since 2002, in order to improve the power system operations.

Figure 1.1-1: Grid Map of South Sulawesi

The total capacity of 150 kV transformers within the system is 653.5 MVA, and that of 70 kV and 30 kV are 237.5 MVA and 118.0 MVA, respectively (as of December 2004).

While the entire Study area is receiving electricity from the System, the southern and northern area of South Sulawesi province (such as Palopo, Bulkumba, Mamuju and Jenepont) are currently receiving electricity from scattered diesel engine generators with 20 kV distribution system.

Transmission and distribution loss of the System was 5.2% and 10.8%, respectively. Distribution loss of 10.8% is comparable with that of Java Island (10.2%), and it may be judged as reasonable. However, since the biggest demand center of Makassar is considerably

far away form the major power stations (such as Bakaru and Sengkang[*1], located in the northern area), transmission loss of 5.2% is bigger than the PLN average of 2.5%.

2) Daily Load Curve and Power Generation

There are 58 power generating units with a total generating capacity of 551.1MW within the System (as of the end of 2004). Of these units, 43 are small scale diesel generators with a total capacity of 140.6MW. Except for 6 units owned by Independent Power Producer (PT. MP. Suppa having 6.0MW x 6 units), most of other diesel units owned by PLN are not in operation because of deterioration of facility and high generation cost.

Table 1.1-1: Operational Conditions of Power Plants in 2004

Name		Type	Installed Capacity (kW)	Available Capacity (MW)	Peak Load (kW)	Energy Production (MWh)	Plant Load Factor (%)
PLN	Bakaru	Hydro	127,620	118,170	116,000	778,341	69.62%
	Tello	ST	25,000	18,500	6,000	20,761	9.48%
	Others	GT	122,716	93,000	70,000	131,128	12.20%
		Diesel	78,572	46,780	12,090	60,570	8.80%
PLN Total			353,908	276,450	-	990,801	31.96%
PT. Energi Sengkang		CCGT	135,000	135,000	139,000	1,002,974	84.81%
PT. MP. Suppa		Diesel	62,200	62,200	56,000	231,663	42.52%
IPP Total			197,200	197,200	-	1,234,637	71.47%
System Total			**551,108**	**473,650**	**399,090**	**2,225,438**	**46.10%**

*Note: ST= Steam Turbine, GT= Gas Turbine, CCGT= Combined Cycle Gas Turbine

PLN's Bakaru Hydropower Plant and Sengkang IPP Gas Combined Cycle Power Plant[*2] play an important roll in the System. During 2004, Bakaru and Sengkang generated 35.0% and 44.5% of energy in the System. Plant load factor[*3] of those plants are much higher than the average plant load factor of other power plants (Bakaru was 69.6%, and Sengkang was 84.8%, while others were 17.6% in 2004).

The figure 1.1-2 and 1.1-3 illustrate typical daily load curve of the System and generation pattern of the power plants in dry and wet seasons.

Power demand in the System rapidly increases from 17:00, and reaches the peak over 19:00 to 20:00 then progressively decreases till 00:00. The system recorded its peak demand of 399.9MW on 3 December 2004. During the off-peak, power demand ranges from 200 MW to

[1] The Bakaru hydropower station and the Sengkang gas combined cycle power station generated about 80% of energy of the System SULSEL in 2004.

[2] The power station is owned and operated by the PT. Energi Sengkang. The Australian energy company "Energy Equity" owns the 47.5% stake while another 47.5% stake owned by the United State's energy company of "El Paso Energy International". The rest of the stake is owned by the Indonesian company "Triharsa Sarana Jaya Purnama".

[3] Plant Load Factor: The ratio of the electric energy produced by a generating unit for a year to the electrical energy that could have been produced at continuous full-power operation during the year. Higher value indicates higher utilization.

300MW.

In the Study area since where conditioners are not prevailing yet in most residential consumers and energy consumption in the industrial sector is less, a significant daytime peak is not observed.

Since the Bakaru hydro and the IPP Sengkang play a major roll in the System, the roll of each power station is different.

The Sengkang power station has two gas turbines and one steam turbine. All three units are supplying stable power and energy in the System throughout a year serving as a base load power station.

Figure 1.1-2: Typical Load Curve in Dry Season (19 Jun. 2004)

The Bakaru hydropower station has two generating units. During the wet season (November - January), both units are fully operated for base/middle load utilizing available water. On the other hand, during the dry season (February - October), while one unit is operated continuously to fulfill base/middle load, the other unit is operated only for peak load.

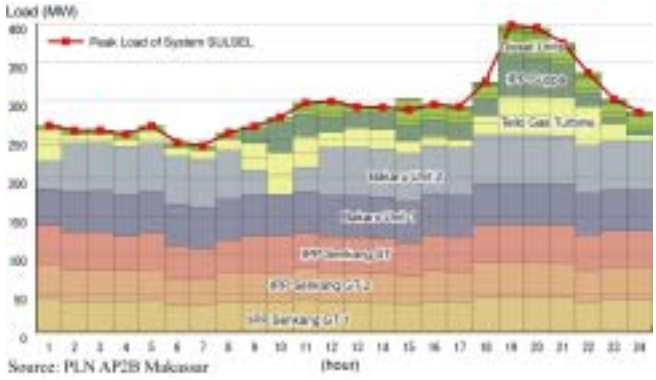


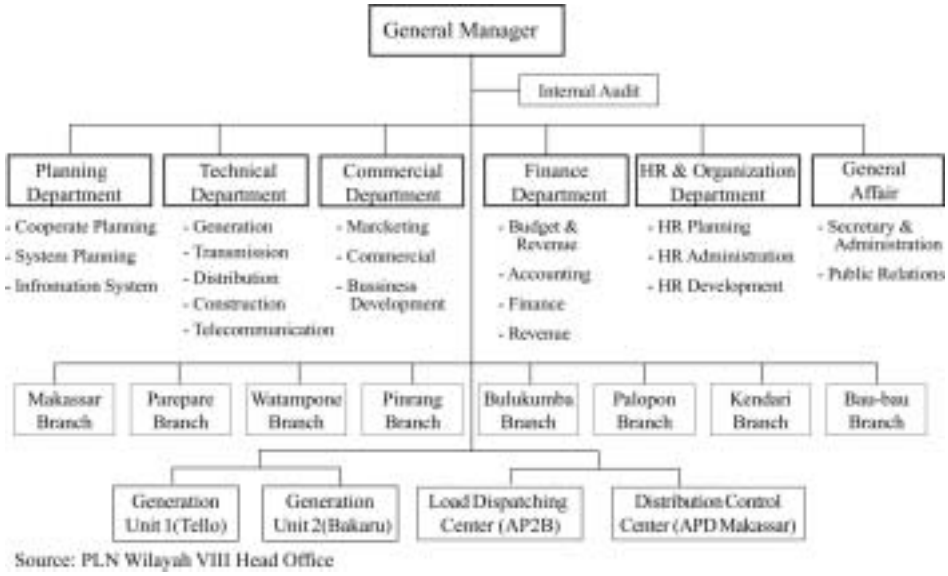
Figure 1.1-3: Typical Load Curve in Wet Season (17 Dec. 2004)

The IPP Suppa diesel power station is operated for base/middle load in the dry season and for peak load in the rainy season. However, due to high operation cost and deterioration of the equipments, an average plant load factor of other PLN's units was only 8.8% in 2004.

3) Organizational and Institutional Issues

Electric business in Indonesia has been executed by the vertically integrated monopoly PLN, a state-owned energy corporation. PLN is responsible for electricity generation and is a monopolized provider of transmission, and distribution services under the Electricity Law of 1985. The corporation has been a single buyer and seller of electricity in the power market.

PLN has two wholly owned power generation subsidiaries in Java; one power transmission unit and four power distribution units in Java; 16 regional operational units outside Java. Electricity in South Sulawesi, West Sulawesi and Southeast Sulawesi provinces has been supplied by the regional operational unit VIII (called Wilayah VIII).



Source: PLN Wilayah VIII Head Office

Figure 1.1-4: Organization Chart of PLN Wilayah VIII

Figure above shows an organization chart of Wilayah VIII. Head office of Wilayah VIII is located in Makassar City. Under the head office, there are two generation units (Unit I Tello in Makassar and Unit II Bakaru in Parepare), one load dispatching center (AP2B) in Makassar, and eight distribution units (Makassar, Parepare, Watampone, Bulukumba, Pinrang, Palopo, Kendari, and Bau-Bau). Of these distribution units, the whole Study area is supplied by Makassar branch[*4]. Number of customers of Makassar Branch is 415,126 (as of the end of 2004).

Table 1.1-3 compares manpower efficiency under Makassar Branch, the distribution units in Outside Java and the distribution units in Java Island.

Table 1.1-3: Number of Employee and Manpower Efficiency by Distribution Office

Unit	No. of Employee	No. of Customers	Energy Sold (GWh)	Customer / Employee	kWh Sold / Employee
Wilayah VIII Average**	1,914	1,347,356	2,154.6	1,184	1,891.7
Makassar Branch**	294	417,126	1,312.2	1,419	4,463.4
East Java Distribution*	4,122	5,785,856	13,941.2	1,404	3,382.1
Central Java Distribution*	2,910	5,252,598	8,888.1	1,805	3,054.3
West Java Distribution*	4,095	5,980,715	23,614.2	1,460	5,766.6
Jaya & Tangerang Distribution*	3,855	2,729,212	19,854.6	708	5,150.3
Outside Java*					

Data Source: PLN Statistics * Data as of the end of 2002, **Data as of the end of 2004

As of the end of 2004, total number of employees of Makassar Branch was 294. Since the management territory of Makassar Branch is densely populated (466.6 person/km^2 as of December 2003), manpower efficiency of the branch is better than the other branch offices and comparable with four distribution companies in Java Island.

[4] Makassar Branch is responsible for supply electricity to Makassar City, Maros, Gowa, Takalar, and Pangkep.

1.2 Power System in Mamminasata and its Operational Conditions

1) Power Stations in Mamminasata

In the Study area, there are two major power stations, namely the Tello steam in northern part of Makassar City and the Bilibili hydropower station in Gowa province. The Tello power station is composed of coal-fired steam turbines (12.5 MW x 2 units), diesel engines (21.4 MW x 1 unit, 20 MW x 1 unit, 14.5 MW x 1 unit, and 12.5 MW x 4 units) and HSD fired gas turbines (33.4 MW x 2 units). The total installed capacity of this power station is 197.7 MW, but 116.5 MW or 58.9% of generating capacity was available at end April 2005. In addition, due to high operation costs and deterioration of the equipments, plant load factor of Tello power station was only 10.3% in 2004.

Figure 1.2-1: Grid System in Maminasata

The Bilibili hydropower station is situated about 20 km upstream of the Jeneberang river mouth. The power plant of 20 MW in generating capacity is being installed with a loan of US$21 million from the Japan Bank for International Cooperation (JBIC). The power station will commence its commercial operation in December 2005. It is, however, noted that a landslide occurred in the upstream of the reservoir in March 2004, causing a large sediment discharge. Without proper counter measures, the runoff of sediments will reduce the lifetime of the reservoir and the power station.

2) Transmission and Distribution System in Mamminasata

The figure 1.2-1 above illustrates 150 kV, 70 kV, 30 kV transmission lines and 20 kV distribution line in Mamminasata. The 150 kV transmission lines form a backbone of the System, and runs from north to south. As of May 2005, there are five 150 kV substations; i.e., Bosowa Substation (S/S) in Maros, Tello S/S and Tello-Lama S/S in Makassar, Tallasa S/S in Takalar, and Sungguminasa S/S in Gowa. With the financial assistance of KfW[*5], a 150 kV transmission line and related substations are being expanded from Sungguminasa to Tanjung

[5] KfW Entwicklungsbank (KfW development bank) finances investments and accompanying consulting services in developing countries.

Bunga, and from Tallasa to Jeneponto. These lines will be made operational from 2006.

The 70 kV lines runs in the major demand centers in Mamminasata. Five 70 kV substations are located in Bontoala, Daya, and Panakkukang in Makassar, Mandai in Maros, and Borongloe in Gowa. The 30 kV and 20 kV trunk distribution lines encompass the center of Makassar City and are extended to the KIMA industrial estate.

3) Operational Conditions of Substation Transformers in Mamminasata

Table 1.2-1 below shows installed capacity and load factor[*6] of 70kV and 150kV transformers in Mamminasata.

Table 1.2-1: Capacity, Peak Load and Load Factor of Transformers in Mamminasata

Name of Substation	Location	Capacity (MVA)	Voltage (kV)	Peak in April 2005		Cumulative	
				Peak Load (MVA)	Load Factor (%)	Peak Load (MVA)	Load Factor (%)
Bosowa	Maros	90.00	150/20	41.00	45.56%	49.75	55.28%
Mandai	Maros	20.00	70/20	14.75	73.75%	21.50	107.50%
Daya	Makassar	20.00	70/20	21.25	106.25%	21.50	107.50%
Tello	Makassar	30.00	150/20	30.25	100.83%	32.50	108.33%
Panakkukang I	Makassar	20.00	70/20	22.50	112.50%	21.13	105.65%
II	Makassar	20.00	70/20	22.50	112.50%	23.13	115.65%
III	Makassar	20.00	70/20	0.00	0.00%	22.00	110.00%
Bontoala I	Makassar	20.00	70/20	11.25	56.25%	22.50	112.50%
II	Makassar	20.00	70/20	11.25	56.25%	22.50	112.50%
III	Makassar	30.00	70/20	27.50	91.67%	28.50	95.00%
Tallo Lama I	Makassar	30.00	150/20	24.38	81.27%	27.50	91.67%
II	Makassar	30.00	150/20	25.63	85.43%	27.50	91.67%
Borongloe	Gowa	10.00	70/20	5.88	58.80%	7.75	77.50%
Tallasa	Takalar	16.00	150/20	9.50	59.38%	15.88	99.25%
	Takalar	20.00	150/20	15.38	76.90%	24.25	121.25%
Sungguminasa	Gowa	30.00	150/20	30.38	101.27%	34.38	114.60%

Source: PLN Load Dispatching Center South Sulawesi

Overloading of transformer will shorten the facility's durability, increase transformation loss, and cause a drop in voltage. If the overload conditions continue, brownout/blackout of surrounding areas or breakdown of the transformer would occur. Thus, PLN postulates that the allowable load factor is 80%, in view of the stability of the grid condition and the forced outage of other transformers.

The figures 1.2-2 and 1.2-3 illustrate load factor of transformers in Mamminasata in April 2005. Horizontal axis indicates days in April, vertical axis indicates maximum load factor recorded during a day. As shown in the figures, transformers in Daya, Tello, Panakkukang, and Sungguminasa substation are frequently over loaded.

For example, the only one transformer in Daya substation receives electricity from the grid at

[6] Load Factor: A ratio of maximum load levied on a transformer to rated capacity of the transformer.

70 kV. The transformer steps down to 20 kV, and then supplies to the KIMA Industrial Estate and surrounding area. The load factor of transformer exceeds 100% frequently.

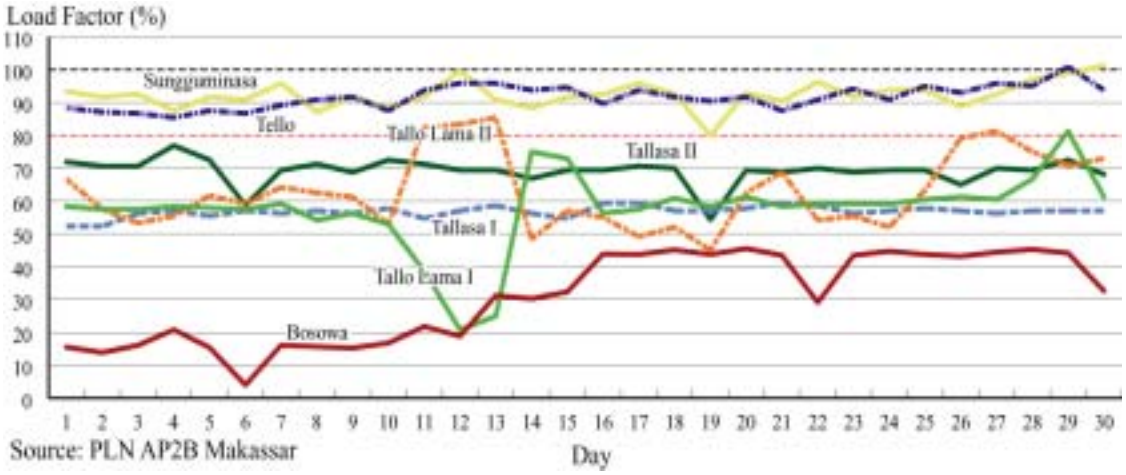


Figure 1.2-2: Load Factor of 150 kV Transformers in Mamminasata (April 2005)

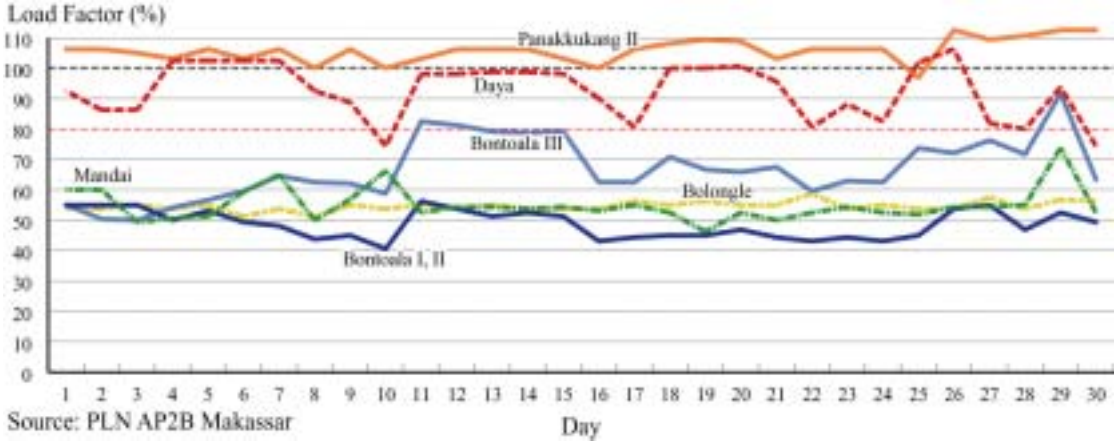


Figure 1.2-3: Load Factor of 70 kV Transformers in Mamminasata (April 2005)

The figure 1.2-4 shows an hourly load levied on the transformer on 20 April 2005 (Wednesday). The load on the transformer starts to increase at 08:00 or starting time of operation of each factory in the KIMA, and then exceeded 80% of load factor soon. Except for lunch time at factories (12:00), the load factor exceeds 90% till 15:30. The transformer is eventually overloaded from 13:00 to 14:00. Judging the data, energy consumption in KIMA factories has been depressed due to lack of sufficient transformer capacity in the Daya substation[*7].

[7] According the power development plan of Wilayah VIII, to coop with the demand, a 20 MVA transformer will be installed in the substation during 2005.

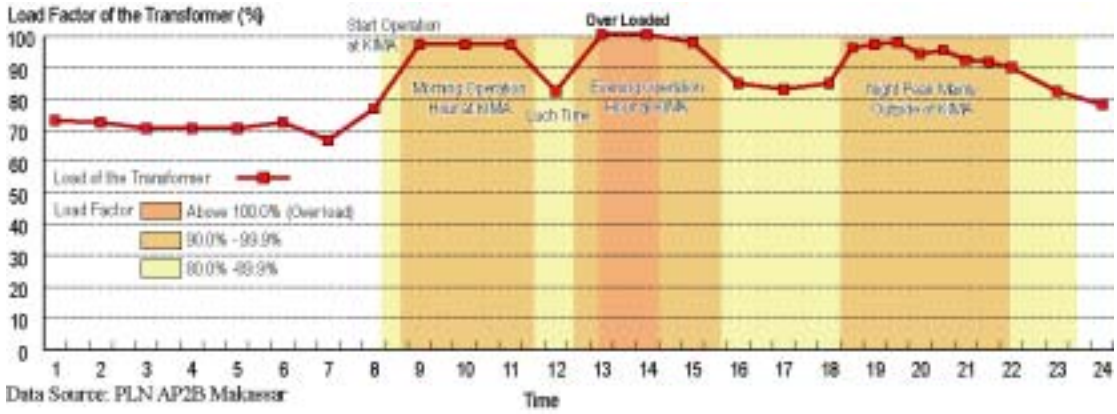


Figure 1.2-4: Hourly Load of the 20 MVA-transformer in the Daya Substation (20th April 2005)

In order to avoid such hindrances, timely expansion of the transformer capacity is required at each substation. Particularly, urgent expansion of the transformer capacity is indispensable for the Daya, the Panakkukang, the Sungguminasa and the Tello substation.

4) Energy Consumption and Electrification Ratio in Mamminasata

Historical Trend of Energy Consumption and Peak Load

The energy consumption, peak load and growth rate from 1995 to 2004 in PLN Region VIII (South and Southeast Sulawesi) are shown in the following tables.

Table 1.2-2: Historical Energy Consumption and Peak Load in PLN Region VIII

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Energy (MWh)	857.0	1044.5	1194.1	1311.0	1451.4	1633.5	1846.7	1877.0	1949.4	2066.0
Residential	415.1	470.8	562.9	649.1	707.4	830.9	939.4	965.1	974.5	1090.4
Commercial	105.0	127.8	138.2	170.9	188.6	215.0	232.6	229.1	231.2	266.6
Public	105.9	122.8	143.8	147.2	139.4	147.0	148.4	149.5	158.2	183.3
Industry	231.1	323.1	349.2	343.8	416.0	440.5	526.2	533.3	585.5	525.8
Peak Load (MW)	226.6	260.1	296.2	334.6	379.1	419.7	444.6	463.0	478.0	489.5

Source: PLN Wilayah VIII

Table 1.2-3: Growth Ratio of Energy Consumption and Peak Load in PLN Region VIII

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	Average 1995-04
Energy	11.4%	21.9%	14.3%	9.8%	10.7%	12.5%	13.1%	1.6%	3.9%	6.0%	9.2%
Residential	14.3%	13.4%	19.6%	15.3%	9.0%	17.5%	13.1%	2.7%	1.0%	11.9%	10.1%
Commercial	19.8%	21.7%	8.2%	23.7%	10.4%	14.0%	8.2%	-1.5%	0.9%	15.3%	9.8%
Public	10.8%	16.0%	17.1%	2.3%	-5.3%	5.4%	1.0%	0.7%	5.8%	15.9%	5.6%
Industry	3.6%	39.8%	8.1%	-1.5%	21.0%	5.9%	19.4%	1.4%	9.8%	-10.2%	8.6%
Peak Load	18.2%	14.8%	13.9%	12.9%	13.3%	10.7%	5.9%	4.1%	3.2%	2.4%	18.2%

Source: PLN Wilayah VIII

Energy consumption and peak load in Mamminasata has grown dramatically over the past 10 years with an average growth rate of 9.2% per annum. Particularly, during the period from 1995 to 1997, energy demand had increased sharply. Expansion of the gird system and construction of new power stations (such as Sengkang Gas Combined Cycle) might have stimulated potential demand in the area.

A growth rate of energy consumption was decreased from 14.3% in 1997 to 9.8% in 1998 due to the economic crisis. The growth rate was progressively recovered from 1998 to 2001. However, the subsequent tariff increase has affected a power demand growth since 2002.

Bulk Consumers

As of 1 June 2005, there are 150 bulk consumers (connected capacity above 200 kVA) in Mamminasata. Of these consumers, 135 bulk consumers are located in Makassar City, 21 are located in the KIMA industrial estate, followed by 7 each in Maros and Gowa, and only 1 in Takalar. Table 1.2-4 shows the major bulk consumers (exceeding 800 kVA of connected capacity) in Mamminasata.

Table 1.2-4: Major Bulk Consumers in Mamminasata

Name of Costumer	Type of Business	Tariff Category	Capacity (kVA)	Area
PT. Rodamas Baja Inti	Steel Factory	Industrial	1,730	Makassar
PT. Semen Bosowa	Cement Factory	Industrial	30,000	Maros
Pry Penge Air Bersih	Unknown	Industrial	1,730	Makassar
PT. Katingan Timber C	Timber Factory	Industrial	2,770	Makassar
PT. Multi P. Agri M	Unknown	Industrial	1,110	Makassar
PT. Indofood Sukses M	Instant Noodle Factory	Industrial	1,110	Makassar
PT. Effem Indonesia	Chocolate Factory	Industrial	1,730	Makassar
PT. Rante Mario	Ebony Factory	Industrial	1,110	Makassar
SAHID JAYA Hotel	Hotel	Commercial	1,110	Makassar
SEDONA Hotel	Hotel	Commercial	865	Makassar
Marannu City Hotel Tower	Hotel	Commercial	1,110	Makassar
Proyek Pdam Makassar	Water Supply	Commercial	865	Makassar
PT. TELKOM	Telephone Company	Commercial	865	Makassar
PT. TELKOMSEL	Mobile Phone Company	Commercial	865	Makassar
PT. PLN Region VIII	Electric Power Supply Company	Commercial	1,385	Makassar
Pasar Sentral	Central Market	Commercial	1,385	Makassar
PT. Matahari Putra Pr	Shopping Mall	Commercial	1,110	Makassar
Mall Ratu Indah	Shopping Mall	Commercial	3,000	Makassar
PT. Tosan Permai Lestari	Shopping Mall	Commercial	2,180	Makassar
Global Trade Center	Shopping Mall	Commercial	1,730	Makassar
PT. Semen Tonasa	Cement Factory (Head Office)	Commercial	1,730	Makassar
PT. Bakti M Investama	Unknown	Commercial	2,180	Makassar
PT. K Putra Celebes	Unknown	Commercial	2,180	Makassar
PT. Marga Mas Indah	Unknown	Commercial	2,180	Makassar
Hasanuddin University	University	Special	1,110	Makassar
RS. Pelamonia	Hospital	Special	2,180	Makassar
Rsup Dr Wahidin S	Hospital	Special	1,385	Makassar
Governor's Office	Office Building Complex	Public	1,110	Makassar
Balai Manunggal	Convention Center	Public	830	Makassar
State Finance Office	Office Building	Public	2,180	Makassar

Source: PLN Cabang Makassar

The biggest consumer in Mamminasata is "Bosowa Cement Factory" in Maros regency. The factory has started its operation since 1997, and has production capacity of 5,500 ton/ day. The factory has a connected capacity of 30,000 kVA, which is ten-times larger than the second biggest consumer (Ratu Indah Shopping Mall) of 3,000 kVA.

Electrification Ratio in the Study Area

Table 1.2-5 shows a ward/village electrification ratio (=number of ward/village ÷ number of electrified ward/village) in Mamminasata as of end April 2005.

172 wards are completely electrified, and most of villages (98.0%) are electrified. Only 6 villages (3 in Gowa, 1 in Takalar and 2 in Maros) in the remote area are not receiving electricity yet.

Table 1.2-5: Ward/ Village Electrification Ratio

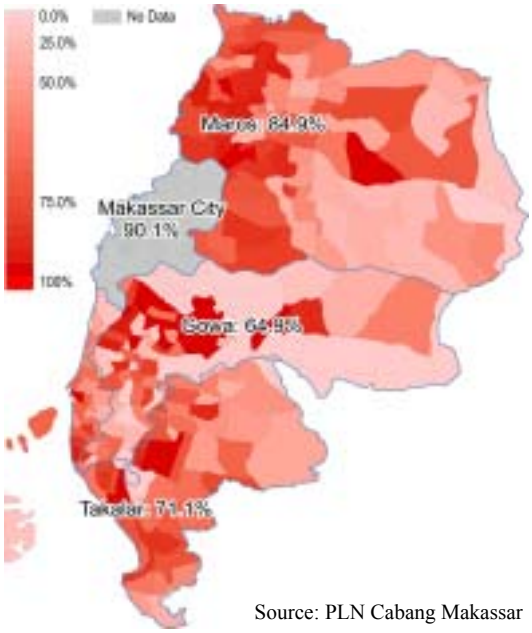
	Number of Ward/Village			Electrified Ward/Village			Electrification Ratio		
	Ward	Village	Total	Ward	Village	Total	Ward	Village	Total
Makassar	143	0	143	143	0	143	100.0%	-	100.0%
Gowa*	14	137	151	14	134	148	100.0%	97.8%	98.0%
Takalar	8	65	73	8	64	72	100.0%	98.5%	98.6%
Maros**	7	96	103	7	94	101	100.0%	97.9%	98.1%
Total	**172**	**298**	**470**	**172**	**292**	**464**	**100.0%**	**98.0%**	**98.7%**

* Including Bungaya, Tompobulu, and Tinggimoncong, ** Including Mallawa and Camba
Source: PLN Cabang Makassar

Figure 1.2-5 illustrates a ward/village wise household electrification ratio (=number of H/H ÷ number of electrified H/H) in Mamminasata as of end April 2005. Deep red color indicates a higher electrification ratio, and whitish red indicates a lower electrification ratio.

An average electrification ratio in Mamminasata is 80.7%, which is much higher than that of Java Island (58.0% in 2002). The average electrification ratio in Makassar City exceeds 90% (desa/ward wise data is not available). However, the ratio in Gowa regency is still remains to be 64.9%.

Since the eastern part of Mamminasata is mountainous, a household electrification ratio is lower than the other area. In the case of Gowa regency, while the most households living on the flatlands along the Jeneberang River is electrified, the other areas sill remain at a lower electrification ratio.



Source: PLN Cabang Makassar

Figure 1.2-5: Household Electrification Ratio

5) Stability of Electricity Supply in the Study Area

Frequency and Duration of Interruptions

Table 1.2-6 below indicates a "System Average Interruption Duration Index" (SAIDI) and a "System Average Interruption Frequency Index" (SAIFI) of PLN Makassar Branch[*8] and other area in 2004. SAIDI indicates a cumulative length of power interruption, in hours. On the other hand, SAIFI indicates the average number of times that each customer has experienced interruption per a year.

Table 1.2-6: SAIDI and SAIFI of the Study Area and Other Area

	SAIDI (hours/customer)	SAIFI (times/customer)
Cabang Makassar*	**2.23** (in 2004)	**29.81** (in 2004)
Wilayah VIII*	6.69 (in 2004)	14.63 (in 2004)
Outside Java**	35.12 (in 2001)	29.85 (in 2001)
Java**	8.50 (in 2001)	12.34 (in 2001)
Indonesia**	17.48 (in 2001)	18.24 (in 2001)

Source: * PLN Statistics 2004, ** PLN Statistics 2001

While the duration of the interruptions in Mamminasata in 2004 was considerably shorter than the Indonesian average, the frequency of interruption was much higher than the Indonesian average. During 2004, there were 9,037 times of interruptions within the system SULSEL. Of these interruptions, 8,679 times (96.0%) were caused by troubles of on distribution lines, followed by generation problems (272 times: 3.0%), substation and/or transformers problems (64 times: 0.7%) and transmission line problems (22 times: 0.2%). Owing to these interruptions, 3,338.7 MWh of energy were lost in 2004. In order to stabilize the electricity supply, rehabilitation/upgrading of distribution facilities and strengthening of operation and maintenance capability will be required.

Energy Crisis at South Sulawesi Province in 2005

The electricity supply in Mamminasata had been generally stable. However, Mamminasata has experienced frequent load shedding (rolling blackouts or scheduled blackouts) since 22 July 2005. PLN has been executing load shedding to compensate an energy supply shortage. Load shedding is executed in accordance with the predetermined scheduled at timed intervals, i.e., 2 - 4 hours blackout, two to four days a week on an average.

If compared with and without load shedding using an averaged daily load curve during the period from 1 – 30 June (without load shedding case) and 1 – 30 August (with load shedding case), it is estimated that 486.8 MWh per day or 7.5% of energy was un-served in August due to load shedding (see the figure below).

[8] Franchise area of the PLN Makassar branch consists of the Makassar, Maros, Takalar, Gowa and Pangkep.

Such frequent load sheddings are attributable to a "lack of fuel oil resulting from a surge in international oil prices". In addition, low energy production of the Bakaru hydropower station has aggravated the problem.

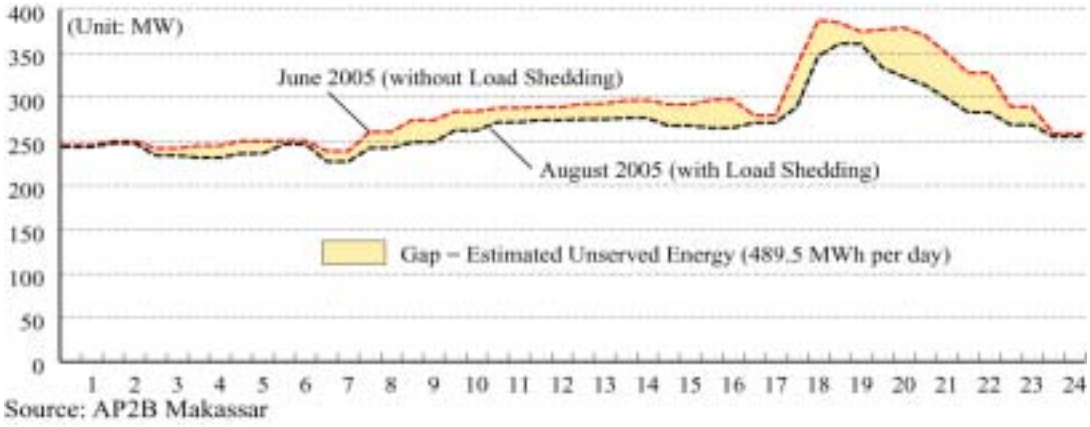


Figure 1.2-6: Estimated Un-served Energy due to Load Shedding

Surge in International Oil Prices and Subsequent Fuel Oil Crisis

Soaring of International Oil Prices

After the Gulf war in 1990, international Oil prices had been more or less stable. During the period from 1 January 1992 to 31 December 2002, an average sport FOB price of the Europe Brent and the West Texas Intermediate (WTI) was US$ 21.2 and 19.8 per barrel. However, the international oil prices have strongly elevated since the commencement of the Iraqi war, constantly creating new highs. The spot prices have been soaring since mid-September 2004. The Europe Brent spot price exceeded a historic high of $ 41.1 (once recorded during the Gulf war) on 13 May 2004, and further exceeded US$ 50 per barrel on 1 October 2004, US$ 60 on 6 July 2005, and even US$ 70 on 2 September 2005 (see the following figure). It can be said that the trend of oil price and its possible impacts become a major concern around the world. Particularly, such soaring of oil prices has serious negative impacts on the energy sector and the Indonesian economy.

Figure 1.2-7: Trend of the International Spot Oil Prices

Increase in the Government Subsidy for Oil Products

In order to keep prices of domestic oil products low, the central government has been providing a subsidy for oil products, covering a gap between international prices and domestic prices. The government originally allocated Rp 76.5 trillion for fuel subsidies for the fiscal year 2005, based on a full-year consumption of 59.6 million kiloliters, assuming an oil price at US$ 45.0 per barrel and a Rupiah exchange rate of Rp 9,300 /US$. However, the amount of subsidy has sharply increased along with the hike in international oil prices.

The central government is determined to reduce the fuel subsidy by increasing domestic fuel prices. Along with this policy, prices of oil products were increased by 29% on an average in March 2005. Price of oil for power generation was also increased by 70.8% (MFO: Rp. 1,560 /liter to Rp. 2,665 /liter) and by 33.3% (HSD: Rp. 1,650 /liter to Rp. 2,200 /liter).

Even after the increase in the oil prices, the government would have to provide Rp 150 trillion (US$15.3 billion) in subsidies for the consumption trend, catching up with the continuous increase in the crude oil price. Such an estimated amount of subsidy is equivalent to 6% of GDP or one-third of the national general expense, pushing a budget deficit up to nearly Rp 70 trillion.

Decrease in the Allotment of Fuel Oil for Generation

Given conditions, fuel stocks in the country become only sufficient for 18 days as of 2nd July 2005, less than the perceived safe level of 22 days. The government urged the nation in June 2005 to lessen their use of oil-based fuels.

In the case of Southeast Sulawesi province, fuel oil allocation for PLN Wilayah VIII was modified to 85,500 kilo liter per annum, which is 29% lower than original proposal of 120,000 kilo liter. To minimize fuel oil consumption, PLN has been executing load shedding since 22nd July 2005. In spite of the effort, since the energy production of the Bakaru was lower than usual, PLN Wilayah VIII had already consumed 82% of allocated fuel oil as of the end of August.

Because the fuel oil crisis in the country is resulted from structural problem, solving of the problem is economically and politically difficult in the short term. In case that the international fuel oil price will hover at high price, likelihood of lack of fuel oil allotment in the future is considered to be high.

Decrease in Energy Production at the Bakaru Hydropower Station

Besides the fuel oil problem, lower electric generation of Bakaru hydropower station has aggravated the problem. As mentioned previously, the Bakaru hydropower station supplies approximately 35 - 40% of electricity to the South Sulawesi System. However, the energy output from the power station from January to August in 2005 was 26.2% lower than the average (1998 – 2004). This is attributable to the shutdown of generating unit for rehabilitation and to the lower availability of water (inflow to the reservoir from 1 January to 30 August was 17.3% lower than the average).

View from the Upper Stream of Bakaru Reservoir

The power station generates electricity using water from its reservoir with an original gross capacity of 6,919,900 m^3. However, 95% of the reservoir capacity has already been filled by unexpected sedimentations (see the figure 1.2-8).

When the reservoir filled with sedimentation, water of a high sand content[*9] has eroded turbine blade by abrasion.

Rehabilitation of the turbine was executed twice in 2004, which resulted in shutdown of generators. Without proper measures for protection of the sedimentation flow, such damages of equipments and subsequent rehabilitation will be further required in the future.

Figure 1.2-8: Sedimentation in Bakaru Reservoir

1.3 Review on PLN's Future Plan

1) PLN's Demand Forecast

Demand Forecast of the System SULSEL is made annually by PLN Wilayah VIII using "Model DKL 3.01" which has been developed by PLN headquarter. A growth ratio of GDP in 2005-2015 was assumed to be 7.7% per annum on an average. An elasticity of energy demand to GDP is assumed to be 1.58 for residential, 1.45 for commercial, 1.35 for public, and 1.38 for industrial use. In addition to these assumptions, various indicators (e.g.

[9] If there is enough reservoir capacity, sand will deposit in the reservoir

electrification ratio, capacity of the captive power plant, load factor of the system, number of incremental consumers, and population of the area) have been used for the forecast.

According to the forecast of PLN's medium scenario, a peak demand of the System and energy demand will be increased by 11.6% and 12.6% per annum from 2010 onward, respectively. In view of the recent low GDP growth ratio (1.6 – 6.0% in recent 3 years), the PLN's forecast appears to rather optimistic.

Table 1.3-1: Energy and Peak Demand Forecast of the System SULSEL

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Peak Demand (MW)	399	405	452	493	542	605	676	755	843	941	1,050	1,173
Growth (%)	2.5	1.5	11.6	8.9	10.1	11.6	11.7	11.7	11.6	11.6	11.6	11.6
Energy Demand (GWh)	2,182	2,221	2,411	2,636	2,912	3,262	3,674	4,138	4,660	5,247	5,908	6,653
Growth (%)	4.2	1.8	8.6	9.3	10.5	12.0	12.6	12.6	12.6	12.6	12.6	12.6

Source: PLN Wilayah VIII

2) Power Development Plans (Candidate Power Projects)

In order to cope with the increasing demand, PLN plans to construct eight power stations by 2015 as shown on the figure 1.3-1. All the planned power stations are not oil-fired power stations, but coal-fired, gas combined cycle and hydropower stations.

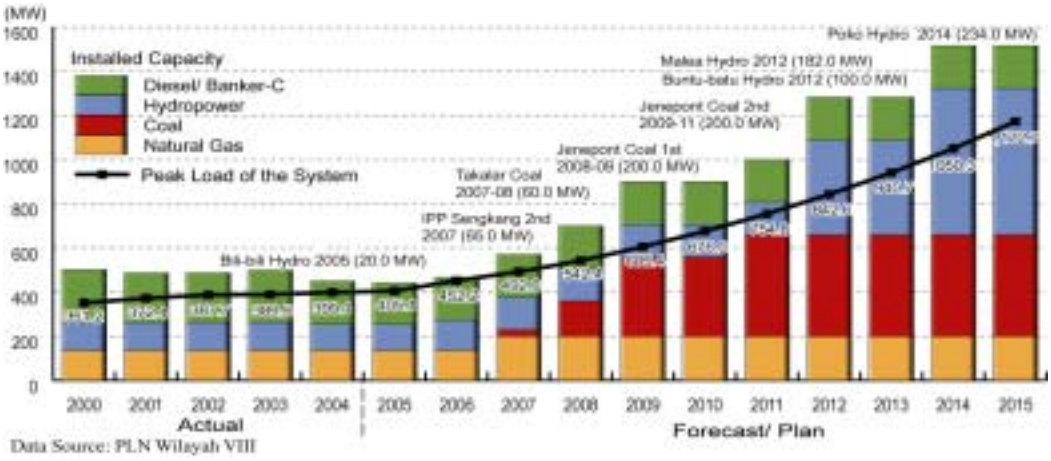


Figure 1.3-1: Peak Demand and Power Development Plans in the System SULSEL

In December 2005, the Bili-bili hydropower station (20 MW) will start its commercial operation. The power station is expected to ameliorate a demand-supply balance and dependency on fuel oil to some extent.

Profiles of other candidate power stations are summarized as follows:

Expansion of the Sengkang Gas Combined Cycle Power Station (2007)

The existing Sengkang gas-fired combined cycle power station is the first Independent Power Producer (IPP) power station in Indonesia, and is owned by PT. Energy Sengkang. The power station is located in Wajo Regency, South Sulawesi province. The power station has a total installed capacity of 135 MW (two gas turbine: 42.5MW each, and one steam turbine: 50 MW). The first phase operation in simple-cycle mode came into service in August 1997, with full combined-cycle operation in August 1998.

The power station is using natural gas from the Sengkang gas field. The gas field has surplus potential for providing additional gas for power generation. Given such a situation, additional installation of a new gas turbine generator with the installed capacity of 65 MW is planned by PT. Energy Sengkang. The project is awaiting for approved by the central government, and is planned to be completed by January 2007.

Takalar (Kassa) Coal Fired Power Station (2007-08)

The Takalar coal-fired power station will be constructed in Punaga, Takalar regency by the IPP scheme. PT Kassa Listrindo[*10] with invest US$60 million for power plant (60 MW). The project will be implemented in 2 phases, each phase with a capacity of 30 MW. The project is scheduled to commence its commercial operation in 2007 and 2008. The construction of jetty for coal unloading and ground leveling of the project site is in progress. The energy will be sold to PLN at a price of Rupee 464 per kWh.

Jeneponto (Punagaya) Coal Fired Power Station-1 (2008-09)

A coal-fired power plant with a capacity of 200 MW will be built in Jeneponto regency. A feasibility study of this project was conducted by NEWJEC in 1999 under the name of the Ujung Pandang coal-fired power station project. This project is currently planned for construction by using a supplier's credit from Spain. PLN is expected to obtain an approval of the central government by the end of 2005. The project will be implemented in 2 phases, each phase having a capacity of 100 MW. At present, the power station is scheduled to start operation in 2008 and 2009 (the time required to complete the project is 36 months).

Jeneponto Coal Fired Power Station-2 (2009-11)

The Jeneponto-2 is planned to locate beside the Jeneponto-1. The plant will be scheduled to start commercial operation in 2009 (100 MW x 1 unit) and 2011 (100 MW x 1 unit).

The Jeneponto-2 is implemented by IPP scheme. Bosowa group has concluded a MOU for investment of around Rupee 1.6 trillion (US$ 178.9 million) for this project. The energy will

[10] PT. Kassa Listrindo is subsidiary of MOSESA Group which has core business specialty in energy development in Indonesia.

be sold to PLN at a price of 4.4 US cents per kWh.

Malea Hydropower (2012)

The Malea hydropower project is located on the upper reach of the Sadang Rive in Tanatraja regency. The maximum power and firm discharges are estimated to be 51.2 m^3/sec and 23.0 m^3/sec, respectively. The installed capacity will be 191 MW, with the annual energy production of 1,465 GWh. Review of the project viability was executed by Nippon Koei Co. Ltd., and PT. Singgar Mulia in 2003. Subsequently, the Bukaka group (PT Haji Kalla) has obtained a MOU for implementation.

Bonto-Batu Hydropower (2012)

The Bonto-Batu hydropower project (100 MW) is planned on the lower catchment area of the Matallo River which is a tributary of the Sedang River. By diverting the water from the Matallo River to the Sedang River, a gross head of about 300 m will be utilized. The available maximum discharge will be 44.0 m^3/s, and the firm discharge is estimated to be 8.6 m^3/s. The power station will be equipped with 2 generators having 50 MW in install capacity each. Annual energy output is estimated to be 552 GWh.

Poko Hydropower (2014)

The Poko hydropower project (234 MW) is a reservoir type power station with active storage capacity of 219 million m^3 on the Mamasa River, upstream of the existing Bakaru hydropower station. This project is expected to function as a sedimentation pocket for the downstream Bakaru hydropower station which is currently suffering from serious sedimentation problem. Feasibility study of the project was conducted in 1997.

3) Transmission line Expansion Plan

150 kV East Coast Trunk Line Project (2005-06)

Currently, power transmission from major power stations to Makassar City is heavily dependent on 150 kV transmission line between Pare-pare and Tello. Thus, if trouble is occurred on this line, energy supply to Mamminasata would cause catastrophic damages.

In order to ameliorate such situations, the East Coast Trunk Line (Watampone (Bone) - Bulukumba - Jeneponto - Takalar) is now under construction. The project implementation started in January 2005 by using a KfW loan, and it will be completed by May 2006. When the planned transmission line is completed, 150 kV double circuit transmission lines will form a ring network. This will substantially contribute to the stabilization of power supply in and around Mamminasata.

150 kV West Coast Trunk Line Project (2008)

To strengthen the transmission capacity for the planned hydropower projects in the northern area (such as Bakaru, Malea, and Poko), an additional 150 kV transmission line is planned to run in parallel with the existing transmission lines (i.e., Sidrap – Pare-Pare – Maros – Sungguminasa). The project will commence in 2006 and complete in 2008. The project will also contribute to stabilize the regional power supply system.

150 kV Tie Lines for Jeneponto and Takalar Coal-fired Power Station (2006-07)

To transmit electric power from the coal- fired plants in Takalar and Jeneponto in the southern region to the System, transmission facilities are to be developed from the Takalar coal-fired power station to the Tallasa substation, as well as from the Jeneponto coal-fired power station to the Tower 57 of Jeneponto – Tallasa line. The former will be completed in December 2005 and the latter in March 2006.

Figure 1.3-2: The System SULSEL Future Plan

New 70 kV and 150 kV Lines for Tanjung Bunga (2006-07)

The, Tanjung Bunga area located to the south of Makassar City is receiving electricity through 20 kV distribution line. In order to cope with the increase demand, construction of a 150 kV transmission line from Sungguminasa substation and 70 kV transmission line from Bontoala substation will be completed in 2006 and 2007, respectively.

Since the existing 70 kV line between Tallo Lama substation and Bontoala substation has reached at a life time of 25 years, the line will be abolished. A new 70 kV line will be constructed from Tanjung Bunga substation to Bontoala substation for completion in 2007. Then, Bontoala – Sungguminasa – Tanjung Bunga will form a ring network.

Extension of 150 kV Line toward the North (2006 -)

Construction of a 150 kV transmission line towards the northern region (Sidrap – Makale – Palopo), and the northwest region (Majene – Mamuju) are being planned by PLN.

Table 1.3-2: Transmission Development Plan

Section	Voltage	Conductor Size	Length	Progress	Completion
Watampone - Bulukumba	150 kV	1 x 240 mm DC	137 km	88.9%	Oct. 2005
Bulukumba – Jeneponto	150 kV	1 x 240 mm DC	46 km	87.2%	Dec. 2005
Jeneponto – Takalar Section 1	150 kV	1 x 240 mm DC	19 km	6.7%	Mar. 2006
Jeneponto – Takalar Section 1	150 kV	1 x 240 mm DC	25 km	59.0%	Dec. 2005
Sidrap – Makale	150 kV	1 x 430 mm DC	105 km	55.8%	Jun. 2006
Makale – Palopo	150 kV	1 x 240 mm DC	37 km	35.2%	May 2006
Sungguminasa – Tanjung Bunga	150 kV	1 x 430 mm DC	25 km	4.36%	May 2006
Tanjung Bunga – Bontoala	70 kV	2 x 300 mm DC	15 km	0.0%	2008
Sengkang P/S – Siwa	150 kV	2 x 240 mm DC	65 km	0.0%	2008
Sidrap – Maros – Sungguminasa	150 kV	2 x 430 mm DC	165 km	0.0%	2008
Polmas – Mamuju (Circuit II)	150 kV	1 x 240 mm SC	49 km	0.0%	2008
Tower 57 – Jeneponto P/S	150 kV	2 x 240 mm DC	10 km	0.0%	2009
Takalar – Takalar P/S	150 kV	2 x 300 mm DC	8 km	0.0%	2009
Siwa – Palopo – Wotu – Malili	70 kV	2 x 240 mm DC	230 km	0.0%	2009

Source: PLN Wilayah VIII Headquarter (SC: Single Circuit, DC: Double Circuit)

1.4 Alternative Development Option

1) Revised Demand Forecast and Power Development Plan

According to the PLN's power development plan, three coal-fired power stations with a total installed capacity of 460 MW are planned for construction in Takalar and Jeneponto regency in near future. However, the coal-prices are rapidly increasing as shown below, and financial viability of these coal-fired power stations has to be thoroughly reviewed.

Figure 1.4-1: Change in Coal Prices

In addition, a conventional coal-fired power station will lead to an increase in pollution and environmental destruction. The burning of coal will produce a large volume of gaseous atmospheric pollutants (e.g., SO_2, CO_2, NO_x, and various metal vapors), as well as other waste materials.

As discussed among stakeholders at the Seminars and Workshops, such environmental elements as ocean, forest green, culture, and history in the Mamminasata area should be preserved, not only for the present generation but also for the future generations.

From these financial and environmental viewpoints, hasty development of large-scale coal-fired power stations will not be recommendable. Thus, to meet the increasing demand, we basically recommend to develop more hydropower plants as an environmentally friendly energy source.

Since the PLN's demand forecast appears to be rather optimistic with more than 11.9% of energy demand growth per annum, an alternative development option is proposed with the revised demand forecast.

Revised Demand Forecast

Residential Demand

The energy consumption in the residential sector is a sum of demands for existing customers and new customers. For the existing customers, the forecast is made on the basis of the energy sales of the last year and the elasticity of energy sales for GDP.

The elasticity is estimated from the relationship between the energy sales and the GDP growth. An energy sale in the year t is calculated with the following formula:

$$ERDt = ERDt\text{-}1 \times (1 + e \times Gt/100) + Pel.RT \times UR$$

where,

ERDt	=	Energy consumption in the residential sector in year t.
ERDt-1	=	Energy consumption in the residential sector in year t-1.
e	=	Elasticity for Existing Consumers (0.61)
Gt	=	Growth rate of GDP in year t.
Pel.RT	=	Numbers of new customer in year t.
UR	=	Unit consumption of new customer per year.

To determine the unit annual energy consumption of new customers, who are mostly connected to PLN's system with the contracted kVA less than 500 VA (namely R1 category), actual household consumption of R1 customers have been collected and analyzed. As a result, the unit consumption of new customer is assumed to be 599 kWh/ year. A target electrification ratio is estimated to be 75% in 2010, 85% in 2015, and 95% in 2020.

Industrial Demand

The total energy sale in the industrial sector is modeled as a function of industrial GDP with the estimated income elasticity, considering taking over of additional captive power. Total energy sale of PLN to the industrial sector is expressed by the following formula:

$$EISt = EISt\text{-}1 \times (1 + eI \times GI/100) + ECTt$$

$$ECTt = ECTt\text{-}1 \times PTOt$$

where,

EISt	=	Energy sales to the industrial sector in year t
EISt-1	=	energy sales to the industrial sector in year t-1
eI	=	Elasticity (1.26)
GI	=	Growth rate of GDP in the industrial sector
ECTt	=	Captive power energy which is shifted to be supplied by PLN system in year t
PTOt	=	Percentage of captive power energy to be shifted to PLN supply in year t

According to the PLN statistics, the installed capacity of captive power in South Sulawesi was

85.2MVA in 2004. In this study, it is assumed that all the captive power in this region is used for only industries. For forecasting industrial demand, the capacity of pure captive is only taken into account. It is assumed that 2.0% of the captive power energy in base year 2004 will be taken over by PLN supply system every year. Captive power energy in the base year is calculated in the following:

ECDd = VACd x 0.8 x 2,500

where,
ECDd = Energy consumption of captive power in base year
VACd = Installed capacity of captive power

Commercial, Public/Social Demand

The forecast of energy sale in the commercial and public/social sector is derived from the estimated future GDP growth in the commercial sector with the following formula:

Ekt = Ekt-1 x (1 + ek x Gkt /100)

where,
Ekt = Energy sales to the commercial sector in year t
Ekt-1 = Energy sale to the commercial sector in year t-1
ek = Elasticity (1.56)
Gkt = Growth rate of GDP in the commercial sector

Ept = Ept-1 x (1 + ep x Gkp /100)

where,
Ept = Energy sales to the public sector in year t
Ept-1 = Energy sale to the public sector in year t-1
ep = Elasticity (1.10)
Gk = Growth rate of GDP in the public sector

Peak Demand

The peak demand forecast is determined by applying a load factor to the energy production. The actual load factor in July 2005 for the South Sulawesi system was 69.3%. In this study, a load factor of the system is assumed to gradually increase and would reach 75.0% in 2020.

Result of Demand Forecast

According to the methodology described above, peak load and energy consumption are predicted up to year 2020 based on the actual system data from January 1998 to July 2005. The energy and load demand forecast in South Sulawesi are summarized in Table 1.1-12 and summarized below:

Table 1.3-3: Revised Power and Energy Demand Forecast

Index		2004	2005	2010	2015	2020	Ave. Growth
Energy Demand (GWh)	Residential	933.4	990.7	1,337.2	1,859.2	2,561.8	6.54%
	Industrial	540.6	580.0	936.2	1,566.8	2,763.0	10.97%
	Commercial	284.3	318.3	544.2	949.1	1,703.3	11.83%
	Public	176.2	189.0	274.8	405.6	613.3	8.16%
	Total	1,934.5	2,077.9	3,092.4	4,780.8	7,641.4	9.07%
Peak Demand (MW)		399.1	402.0	576.6	859.7	1,320.0	7.48%

Source: JICA Study Team

The revised demand forecast is more conservative than PLN's forecast. The total energy sale would be increase from 1,934.5 GWh in 2004 to 7,641.4 GWh in 2020 with an average annual increase rate of 9.07%. The peak load is predicted to increase from 399.1 MW in 2004 to 1,320.0 MW in 2020 with an average annual increase rate of 7.5%.

2) Alternative Power Development Option

A revised power development option is tentatively proposed to cope with the above demand forecast, with a minimum reserve margin of 20%.

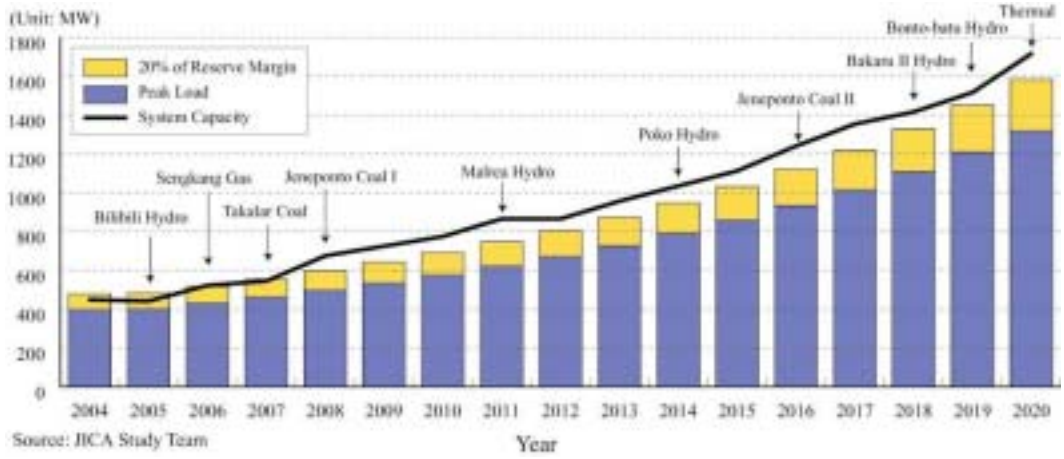


Figure 1.4-2: Alternative Power Development Option

To prevent an immediate energy shortage in 2006 and 2007, it is recommended that expansion of the Sengkang gas-fired power station and construction of Takalar coal-fired power station be executed at the earliest.

Although two coal-fired power plants (200 MW each) have been planned for implementation in Jeneponto from 2008 to 2011, construction of one power station could be postponed, if the Malea hydropower station will be start its commercial operation in 2011.

As the hydropower stations need longer construction period, development of such hydropower stations should better be started soonest. Construction of the Malea and the Poko hydropower stations recommended to start in 2006 and 2009, respectively.

The above power development option is proposed tentatively. Detailed optimum scale and schedule of power station development is to be determined by a long-term system cost analysis using software, such as EGIAS and WASP III. Because the coal and oil prices have drastically increased, priority of thermal power stations are considered to be lowered in Mamminasata and South Sulawesi.

3) Implementation of Hydropower Projects under Private-Public-Partnership (PPP)

As previously noted, construction of hydropower stations should better be started soonest. Since PLN and the private sector are less capable of solely investing in large-scale

hydropower projects, it is advisable to implement these hydropower projects under the scheme of Private Public Partnership (PPP).

Proposed Financing Scheme Option under PPP

The following figure illustrates a possible financing scheme option under PPP. There are five main player, i.e., the private investors, PLN, international doner agency, exporter of equipments, and Special Purpose Company (SCP).

The private investors and PLN will set up a Special Purpose Company (SPC) in order to isolate risks of the project implementation (the cash flow will also be isolated). The SCP will obtain a concession from the Governemtn of Indonesia.

To reduce financial burden of investment, international doner agency is expected to provide a loan on concessional terms to PLN throught the Government of Indonesian (GOI), and to provide a export credit to exporters of electronical and mechanical equipments. Private investors and PLN invest the project, and will receive dividends from the SPC during the concession period. Exporters will provide equipments for the project, and receive amotization payments from the SPC. Exporters are responsible for repayments (principal and interests) to international doner agency. Except for the part of electronic and mechanical equipments, capital cost will be covered by the investmetns from PLN and privete investors.

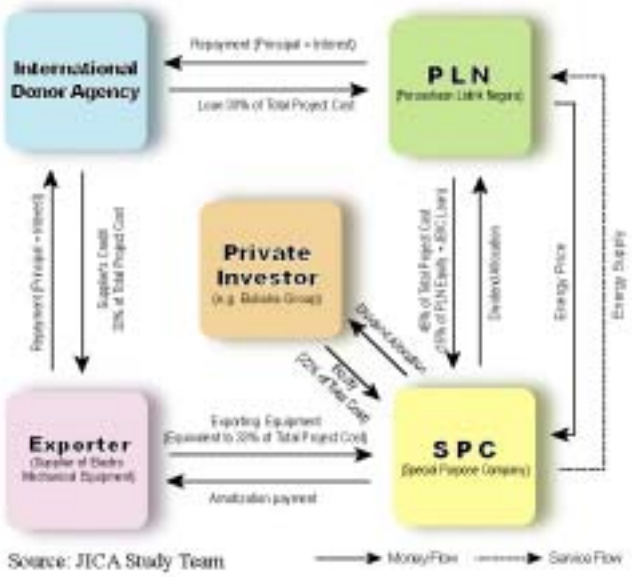


Figure 1.4-3: PPP Scheme for the Hydropower Projects

The SPC will own and operate the project facilities during the concession period (e.g. 25 - 30 years). During this period, the SPC will get revenues from the sale of electricity to PLN, and will pay operation and maintenance costs, as well as sales tax and concession fee to GOI and amortization to exporters. Most of profit after tax will be paid to private investors and GOI as dividends.

Financial Analysis for the Proposed Scheme

To preliminarily evaluate financial viability of hydropower development under PPP, financial analysis is made for the case of Malrea hydropower project (installed capacity of 191 MW, annual energy production of 1,365 GWh, and project cost of US$ 282,987 million by appling following rough assumptions.

PLN will invest 45% of total project cost through equity (15%) and debt (30%) using a

concessional loan from internationa doner agency. Private investors will invest 25% of total cost through equity. Remaining 30% of the project costs (cost for electronica and mechanical equipments) will be used for procurement of as equipments from exporters, geting export credits.

The SPC will gain incom from sales of electricity to PLN. The annual constant operation and maintenance cost is assumed to be 0.75% of capital cost, and the variable O&M cost is assumed to be 20 US¢ per kWh. The SPC will pay 5.0% of revenue from electricity to GOI as a concession fee. After decuting these expenditure, as well as depreciation and sales tax, the SPC will obtain proft after tax. Then, SPC will allocate 80% of the profit after tax to private investors and PLN as dividend.

Table 1.3-4: Major Assumptions of Financial Analysis

Items	Values
Infration Ratio of US$	1.813% per annum
Unit price of the whole sale electricity to PLN	US¢ 4.40 per kWh
Concession Fee	5.0% of revenue from sales of electricity
Operation and Maintenance Cost	Annual Constant Cost: 0.75% of capital cost Variable Cost: US¢ 20 per kWh of generation
Depreciation on Fixed Assets	25 years straight-line base
Depreciation on Financial Cost	5 years straight-line base
Loan from International Doner Agency (received through the GOI)	Interest Rate: 10.0% per annum Repayment Period: 20 years, Grace Period: 5 years Front-end Fee: 2.0%, Commitment Fee: 0.8%
SPC's Amotization Payment for the Exporter	Interest Rate: 12.0% per annum Repayment Period: 12 years Front-end Fee: 1.5%, Commitment Fee: 0.75%
Sales Tax levied on the profit	First 5 years of concession period:15% From 6 years onwards: 30%

Source: JICA Study Team

Given such assumptions, ROI (Return on Investment) of private investor and the GOI is calculated to be 18%. ROE (Return on Equity) of the SPC will be 17%. PLN's average cost of electricity is estimated to be 3.14 US¢ per kWh[*11], which is cheaper than the current average generation of the grid system (3.72 US¢ per kWh).

4) Application of Clean Development Mechanism (CDM)

To improve financial feasibility of investments in hydropower projects, it is conceived to apply for the Clean Development Mechanism (CDM).

Large-scale hydropower projects have advantages in ensuring clean energy sources in developing countries with investments from Japan, securing large units of Certified Emission Reduction (CER) for Japan.

[11] Average cost of electricity for PLN

The government of Japan established a Japan Kyoto Acceleration Program (JKAP) which supports not only project participants but CDM organization to facilitate CDM in May 2005.

Prospective Emission Reduction (Case Study on the Malea Hydropower)

For the Malea Hydropower, for instance, a emission reduction is calculated with the following equation.

(Emission reduction) = (Baseline emission) – (Project emission) – (Leakages)

a. Baseline Emission

After commencement of the Malea HPP, its electricity will replace the existing fossil fuel plants. Normally, a baseline emission is calculated on the basis of the baseline emission factor in the following 3 steps.

a-1: Calculate the Operating Margin (OM) emission factor

The OM emission factor is defined as the generation-weighted average emissions per electricity unit [t-CO_2/MWh] of all generating sources serving the grid system. As a provisional calculation, the OM is estimated to be 0.361 t-CO_2/MWh.

Table 1.3-5: Basis of Calculation of the Operating Margin

Type	Name	Energy (MWh/year)	CO_2 Emission Rate (ton/GWh)	CO_2 Emission (ton/year)
Hydropower Plant	Bakaru	773,057.5	0.0	0.00
	Swaitto	4,777.2	0.0	0.00
Steam Power Plant (MFO)	Tello Steam	20,716.2	668.0	13,838.42
Gas Turbine Plant (MFO)		131,128.0	668.0	87,593.51
Diesel Power Plant (HSD)	PLN Diesel	60,562.10	668.0	40,455.51
	Suppa	231,663.0	668.0	154,750.87
Gas Combined Cycle	Sengkang	1,002,973.9	506.0	507,504.78
Grand Total		2,224,877.8		804,143.09

Source: JICA Study Team

a-2: Calculate the Build Margin (BM) emission factor

The BM emission factor is defined as a generation-weighted average emission factor of either the five most recent generating units or the most recent 20% of power plants built, whichever is greater in annual generation. As a provisional calculation, a BM emission factor is estimated to be 0.668 t-CO_2/MWh.

Table 1.3-6: Basis of Calculation of Build Margin

	Type	Capacity (MW)	Energy (MWh/year)	CO_2 Emission Rate (ton/GWh)	CO_2 Emission (ton/year)
Suppa (1998)	HSD	33.0 MW x 2	231,663.0	668.0	154,750.87
Tello Gas Turbine (1997)	MFO	10.4 MW x 6	122,824.0	668.0	82,046.43
Total		128.2 MW	354,487.0		236,797.30

Source: JICA Study Team

a-3: Calculate the baseline emission factor

ACM0002 stipulates that a default baseline emission factor is a weighted average of the OM emission factor (50%) and the BM emission factor (50%). Thus, a baseline emission factor is estimated to be 0.515 ton-CO_2/MWh ([OM: 0.361 + BM: 0.668] ÷ 2). With the above emission factors, baseline emission is calculated as follows:

Baseline emission = (Electricity produced by the Project) * (CM emission factor)
= 1,365,000 [MWh/yr] x 0.515 [ton-CO_2/MWh] = 702,588 [ton-CO_2/year]

b. Project Emission

Generally, run-of-river type hydropower produces clean energy without GHG emission. Therefore, project emission is ignored.

c. Leakages

The project will use a considerable volume of cement in construction of dam and structures. This volume is deemed to be more than that required to build a thermal power plant with a similar installed capacity. Thus, emissions associated with cement production, as well as the electricity used in its production process, must be determined. At this moment, leakages relating to the Malea hydropower is estimated as follows: a) CO_2 emissions due to production process of cement, and b) CO_2, CH_4 and N_2O emissions due to transport of cement. It is necessary to study and analyze the leakages at the designing stage of the project.

Availability of CDM credit

Accordingly, CDM emission reduction can be calculated tentatively with some assumptions.

Emission reduction = Baseline emission – Project emission – Leakages
= 702,588 [ton-CO_2/year]

With the application CDM to the Malea hydropower, the project expects to acquire CER (CDM credit) of approximately 14,754,341 ton-CO_2 in 21 years. As a conservative estimate, credit of GHG emission reduction can be converted into US$ 5 per ton-CO_2. With such a CDM scheme, the Malea hydropower project would acquire US$ 3,512,940 per annum or US$ 73,771,740 during the CDM period of 21 years.

1.5 Recommendations for Implementation

1) Short-term Action Programs

Earliest Implementation of the Sengkang and Takalar Power Plants

The system's short-term generation reserve margin is inadequate. If the peak demand of the System increases as predicted by the PLN's medium scenario and even if the envisaged power plants are completed on schedule, the reserve margin will be lower than 10% by 2008. Under such conditions, construction of a new coal-fired power plant in Takalar and expansion of the Sengkang Gas-fired Combined Cycle Power Station should be implemented at the earliest.

Implementation initiative: Private Sector
Indicative costs: Sengkang: n.a., Takalar coal-fired: US$ 60 million

Energy Conservation Campaign

Even if the planned power stations and related facilities are completed as planned, the reserve margin of the system will be far below 20%. Under such conditions, fuel oil shortage, as well as planned outage (such as periodic maintenance and overhauling) and forced outage of large generating units will easily result in serious energy shortage.

To cope with the energy shortage at the supply side, demand side management (such as energy saving campaign for consumers) should be promoted more vigorously.

Implementation initiative; Public & Private sector
Indicative costs: n.a.

Urgent Expansion of Transformer Capacity in the Study Area is Indispensable

Most of transformers within the Study area recorded more than 80% of load factor on the peak time and even exceeding 100% during the period from January 2005 to May 2005. Particularly, transformers in Daya, Tello, Panakkukang, and Sungguminasa substation are frequently over loaded. In order to stabilize electricity supply, urgent expansion of the transformer capacity is essential.

Particularly, transformers should be reinforced in Daya (from 20MVA to 40MVA), Tello (from 30 MVA to 60 MVA), Panakkukang (from 70 MVA plus 60 MVA minus 20 MVA (transferred to Daya) minus 20 MVA (transfer to Mandai), and Sungguminasa (from 30 MVA to 60 MVA) substations, with a total expansion of 140 MVA.

Implementation initiative: Public sector (PLN)
Indicative costs: $5 million

2) Mid/Long-term Action Programs

Construction of the Ring Transmission Networks

Currently the system SULSEL depends heavily on the Bakaru hydropower and Sengkang gas combined cycle (80% of energy was generated by these power stations). Energy transmission from these power stations is completely relying on the 150 kV transmission line between Parepare and Tello. If trouble is happened on this line, energy supply to Mamminasata will suffer from catastrophic damages.

In order to ameliorate such conditions, 150 kV transmission line between Sidrap - Pare-Pare - Maros - Sungguminasa and the East Coast Trunk Line (Watampone - Bulukumba - Jeneponto - Takalar) are under construction. These projects are scheduled for completion in 2006-08. To secure stable energy supply in Mamminasata, these projects should be completed on schedule.

Implementation initiative: Public sector (PLN)
Indicative costs: already committed

Rehabilitation and Upgrading of Existing Distribution Lines

While the duration of power interruptions is shorter than the Indonesian average, the frequency of interruption is still higher than the national average. Most interruptions (96.0% in 2004) are resulted from the distribution line troubles. Due to such interruptions, 3,338.7 MWh of energy was lost in 2004.

In order to stabilize the electricity supply in Mamminasata, rehabilitation and upgrading of the distribution facilities as well as strengthening of operation and maintenance capability of staff are recommended.

Implementation initiative: Public (PLN)
Indicative costs: $15 million (2006-2010: including system expansion)

Departure from Dependency on Oil

To better manage the country's energy resources and prevent future energy crises, the government is laying out a new energy strategy in August 2005 that prioritizes the use of coal and natural gas for domestic consumption. Switch in fuel consumption would help reduce the fiscal burden from the fuel subsidy.

In case of the system SULSEL, three coal-fired power stations (total installed capacity of 460 MW), expansion of one gas-fired power station (65 MW), four hydropower stations (545 MW in total) are scheduled to complete by 2015. These power stations will contribute to the reduction of fuel oil consumption and the reduction of the fiscal burden from the fuel subsidy.

Implementation imitative: Public and Private Sectors
Indicative costs: n.a.

Earlier Construction of Hydropower Stations using PPP and CDM

Three coal-fired power stations (total installed capacity of 460 MW) are planned for construction in Takalar and Jeneponto regency by 2011. However, the coal price has rapidly increased in recent years and financial viabilities of these projects are turning out to be less attractive. In addition, conventional coal-fired power station would increase pollution and negative environmental impacts in Mamminasata.

Taking these into consideration, we recommend to postpone at least one coal-fired power station, and to develop hydropower station in the northern area. Besides its environmental friendliness, hydropower stations would be free from fluctuation of exchange rates and fuel prices. Since larger capital investments are required, the hydropower projects should better be implemented under PPP scheme (capital expenditure will be financed jointly by private investors, international donor agency and PLN) and applying the Clean Development Mechanism (CDM).

Implementation initiative: Private and/or PPP
Indicative costs: Malea hydro: US$ 280 million, Poko hydro: n.a.

2. TELECOMMUNICATIONS SECTOR STUDY

2.1 Telecommunication Network Configuration in Mamminasata

The figure 2.1-1 illustrates telecommunication network configuration in the South Sulawesi province. Figures in parentheses indicate exchange capacities. Exchange of fixed phone network in the Province has a hierarchical structure comprising 4 different types of exchange, i.e., one trunk exchange, one tandem exchange, two local exchanges, and 16 remote concentrator units. In addition to these conventional exchange units for fixed phone, exchange for the fixed wireless phone was introduced in 2002. Except for 8 remote concentrator units (i.e., Watampone, Tonasa, Pangkajene, Jeneponto, Sinjai, Selayar, Bulukumba, and Bantaeng), all those exchange units are located Mamminasata.

In order to increase the network efficiency, performance, and call routing flexibility, all switching facilities at exchanges have been digitalized since 1997.

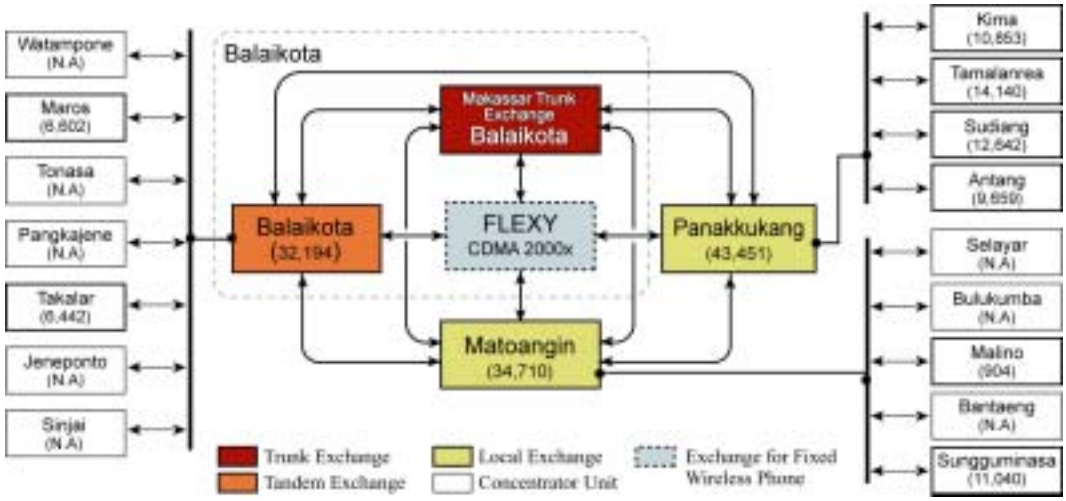


Figure 2.1-1: Telecommunication Network Configuration Mamminasata

The figure 2.1-2 shows the location of exchange units Mamminasata. A trunk exchange is situated in Balaikota, center of Makassar City, and is primarily used for connecting long distance calls.

A tandem exchange is located at the same compound of the trunk exchange in Balaikota, and is used to connect calls between local exchanges over a wide area.

Two local exchanges are located in Panakkukang and Motoangin in Makassar City, and customers are directly connected to these local exchange or thorough a remote concentrator unit.

The remote concentrator unit is part of the local exchange, and positioned close to the customers. There are 16 remote concentrator units in South Sulawesi province and East Sulawesi province, of which 8 units are located in Mamminasata. The remote concentrators

at Antang, Sudiang, Kima and Tamalanrea in Makassar City are connected with the Panakkukang local exchange. Sungguminasa and Malino concentrator units in Gowa regency are connected with the Matoangin local exchange. The remote concentrator units in Maros and Takalar are connected with the Balaikota local exchange.

For fixed wireless and mobile phone network using the CDMA technology, number of the Base Transceiver Station (BTS) is installed in Makassar City, Gowa and Maros, but not in Takalar.

Total exchange capacity in Mamminasata is 207,935, as of May 2005. Of this capacity, 60,710 (29.2%) is networked by optical fiber.

Total exchange capacity in Makassar City is 157,649, accounting for 75.8% of total exchange capacity in the Mamminasata area. Exchange capacity in Gowa is 37,242, (17.9%). However, exchange capacities in Maros and Takalar are representing only 3.2% (6,602) and 3.1% (6,442), respectively.

Figure 2.1-2: Location of Telephone Exchange

Table 3.4-a: Telephone Exchange Capacity in the Study Area

Location	Type	Fixed Phone	Public Phone	Optical Fiber	Total
Balaikota	Trunk/Tandem Exchange	22,376	2,858	6,960	32,194
Matoangin	Local Exchange	27,096	1,214	6,400	34,710
Panakkukang	Local Exchange	30,800	1,560	11,091	43,451
KIMA	Remote Concentrator	5,353	316	5,184	10,853
Antang	Remote Concentrator	5,928	200	3,531	9,659
Tamalanrea	Remote Concentrator	9,928	500	3,712	14,140
Sudiang	Remote Concentrator	5,952	252	6,438	12,642
Makassar Total	-	107,433	6,900	43,316	157,649
Sungguminasa	Remote Concentrator	24,424	874	11,040	36,338
Malino	Remote Concentrator	864	40	0	904
Gowa Total	-	25,288	914	11,040	37,242
Maros	Remote Concentrator	3,464	144	2,994	6,602
Takalar	Remote Concentrator	2,992	90	3,360	6,442
Study Area Total	-	139,177	8,048	60,710	207,935

Source: P.T. TELKOM

Table 2.1-2 shows a capacity utilization ratio and installed line utilization ratio as of May 2005. In Mamminasata, subscriber lines are installed to the fully utilizing exchange capacities. The

capacity utilization in Mamminasata (100.0%) is higher than the country average of 92.3%. By the end of April 2005, TELKOM has deployed 207,935 lines, out of which 172,393 are in services (an installed line utilization ratio of 82.9%).

Table 2.1-2: Capacity Utilization Ratio and Installed Line Utilization Ratio

	A. Exchange Capacity	B. Number of Installed Lines	C. Capacity Utilization Ratio (B/A)	D. Number of Lines in Service	F. Installed Line Utilization Ratio (D/B)
Makassar	157,649	157,649	100.0%	127,164	80.7%
Gowa	37,242	37,242	100.0%	33,526	90.0%
Maros	6,602	6,602	100.0%	6,109	92.5%
Takalar	6,442	6,442	100.0%	5,594	86.8%
Sub Total	207,935	207,935	100.0%	172,393	82.9%
Indonesia Total	9,103,638	8,400,662	92.3%	7,750,035	85.1%

Source: P.T. TELEKOM

Since 2003, TELKOM has been executing the optical fiber net work installation project called the FORMA Project (Fiber Optic Ring Makassar) with financial and technical help of the Bukaka Singtel[*12]. In the project, 69,345 lines (1,221,208km in total) of optic fiber line is planned to connect all Makassar City area. As of the end of April 2005, 60,710 optic fiber lines have been installed, accounting for 29.2% of total number of installed line in Mamminasata (207,935 lines).

2.2 Telephone Market Overview

1) Telephone Density

Telephone density (lines in service per 100 inhabitants) of fixed phone (including fixed wireless phone) in Indonesia has gradually increased from 1.69% in 1995 to 3.07% in 2000 and 4.11% in 2004. However, the density is still lower than other ASEAN countries (e.g. Philippines: 10.91%, Thailand: 8.57% in 2001).

Figure 2.2-1: Comparison of Telephone Density (Fixed Phone only)

[12] Please refer to the "2.5 Institutional Development"

The telephone density of fixed phone in Mamminasata is 11.8%, which is higher than the national average. If compared with other 6 major metropolitan areas, telephone density in Mamminasata is comparable with Semarang and Medan, but still lower than the other metropolitan areas.

Increase in the telephone density of fixed phone service is expected to accelerate by the introduction of CDMA (code digital multiple access)-based fixed telephone service.

Since May 2004, CDMA-based fixed telephone service has started in Makassar and Gowa. The service was extended to Maros in July 2004, and to Takalar in the near future. Fixed wireless telephone system by using CDMA technology will enable to reduce the capital expenditure for installation of subscriber lines and ensure rapid development of telephone network than the conventional fixed line network.

After the commencement of the service, fixed wireless telephone customers demonstrated a significant growth. Number of subscribers in Mamminasata were 89,475 (post-paid: 12,273, pre-paid: 77,205) as of May 2005. In a short period of one year, number of fixed wireless phone subscribers has increased to represent 34.2% of total fixed phone subscribers.

2) Number of Subscribers by Consumer Category

Number of subscribers of conventional fixed phone in Mamminasata has increased from 133,854 in December 2002 to 173,252 in May 2005, of which 143,714 (83.0%) were for residential customers, 20,481 (11.8%) were for business customers, 565 (0.3%) were for social customers (which include churches, hospitals, schools and government), and 6,649 (3.8%) were for public telephones, including kiosk phones. Table 2.2-1 shows number of customers by consumer category and its composition as of 1st May 2005.

Table 2.2-1: Number of Subscriber of Conventional Fixed Phone by Area and by Category

	Business	Residential	Social	Public Phone	Others	Total
Makassar	18,985 (14.9%)	101,332 (79.7%)	476 (0.4%)	5,078 (4.0%)	1,293 (1.0%)	127,164
Gowa	818 (2.4%)	31,546 (92.3%)	70 (0.2%)	1,258 (3.7%)	472 (1.4%)	34,164
Maros	326 (5.2%)	5,738 (91.2%)	17 (0.3%)	190 (3.0%)	24 (0.4%)	6,295
Takalar	352 (6.3%)	5,098 (91.1%)	2 (0.0%)	123 (2.2%)	19 (0.3%)	5,594
Total	20,481 (11.8%)	143,714 (83.0%)	565 (0.3%)	6,649 (3.8%)	1,808 (1.0%)	173,217

Source: PT. TELKOM

In Makassar City, residential and business consumers account for about 80% and 15% of total customers, respectively. In the case of other regencies, residential consumers account for more than 90% of total consumers, while business consumers represent smaller percentage (2.4%-6.3%).

Figure 2.2-2 illustrates a growth rate and market size of residential/ business customers.

Vertical axis indicates an annual growth ratio during the period from December 2002 to May 2005. Horizontal axis indicates the telephone density per 1000 population. Diameter of circle indicates number of subscriber.

As shown in the figure left below, number of residential subscribers and telephone density in Makassar is by far the largest in Mamminasata, followed by Gowa. While the telephone market for residential consumers in Takalar and Maros is small, a growth ratio (33.5% and 30.8% respectively) is higher than Makassar (8.4%) and Gowa (17.1%).

The figure right below illustrates the number of business consumers. Makassar has a dominant market size in terms of number of subscribers (19,213) and telephone density (16.8). Growth ratio of business consumers in Mamminasata ranges from 7.6% (Maros) to 11.3% (Takalar), which is relatively lower than the subscriber by residential category.

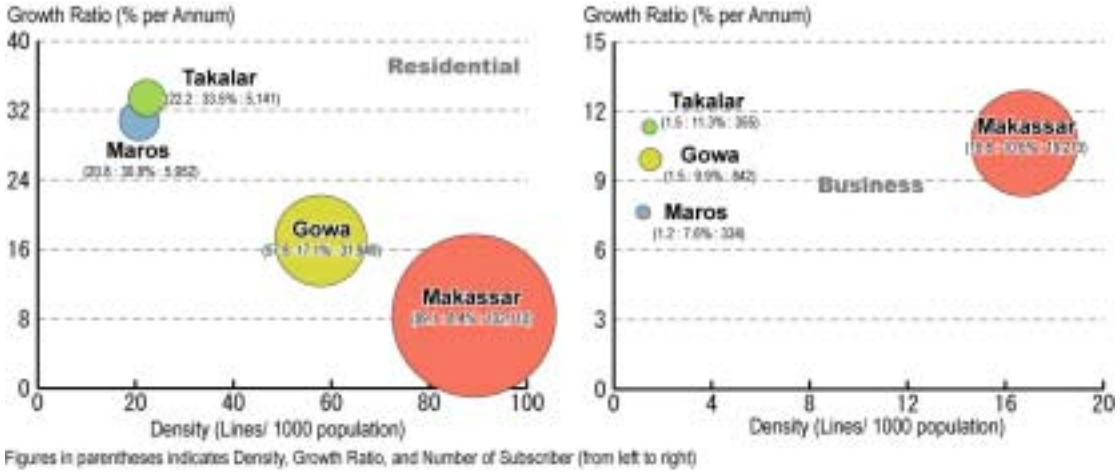


Figure 2.2-2: Growth Rate and Market Size of Residential and Business Customers

3) Internet Service

In Mamminasata, access to the Internet is made by conventional phone-line dial-up (28.8 kbps) and ISDN dial up (56.6 kbps). As shown in Table 2.2-2, there are 7 Internet Service Providers (ISPs) in Mamminasata. Total number of subscribers is only 9,480. Top two ISPs are TelkomNet (5,386: 56.8%) and Indosat Net (2,578: 29.1%), accounting for 85.9% of total subscribers. However, in reality, most of people access to internet through not ISPs but free subscription internet service called "TELKOMNet Instan". Thus, there are no concrete data about the total number of internet users.

TELKOMNet Instan has been popular among the public, because in order to access this service, customers do not have to subscript ISP. Customers are only required to dial the designated telephone number (uniform within the country: 080-989-999) through a regular house phone, and just enter designated username (telkomnet@instant), and password (telkom). While customers do not pay subscription fee and monthly fee to ISP, TELKOM charges to consumers at the rate of Rupee 150 per minute in the form of telephone charge. The service

is also accessible through a mobile phone.

Table 2.2-2: Internet Service Provider (ISP) in Mamminasata

Name of ISP	Number of Subscribers	Number of Call	Duration (Minutes)	Total Pulse
Indosat Net	2,578	187,160	116,641,743	867,195
Wasantara Net	167	4,973	2,169,345	17,321
Telkom Net*	5,386	163,604	128,605,470	99,935
IndoNet	421	19,777	10,920,363	81,074
CBN	5	17	476	-
Nanura Net	440	9,107	7,419,794	51,024
Rainbow Net	483	6,528	4,297,431	30,533
Total	9,480	390,986	270,054,622	1,137,082

Source: TELKOM *: Excluding TELKOMNet Instan

In September 2005, TELKOM starts high-speed internet access services called TELKOM Speedy (384 to 512 kbps) in Makassar. The service is using regular telephone line and adopts the Asymmetric Digital Subscriber Line (ADSL), which separates data and voice services from one telephone line allowing the users to access the internet and use the telephone at the same time.

It is noted, however, that the service cost is expensive[*13] for the ordinary people. As shown in Figure 2.2-3, taking the connection speed into consideration, TELKOM's ADSL cost is more expensive than the other provider in OECD countries.

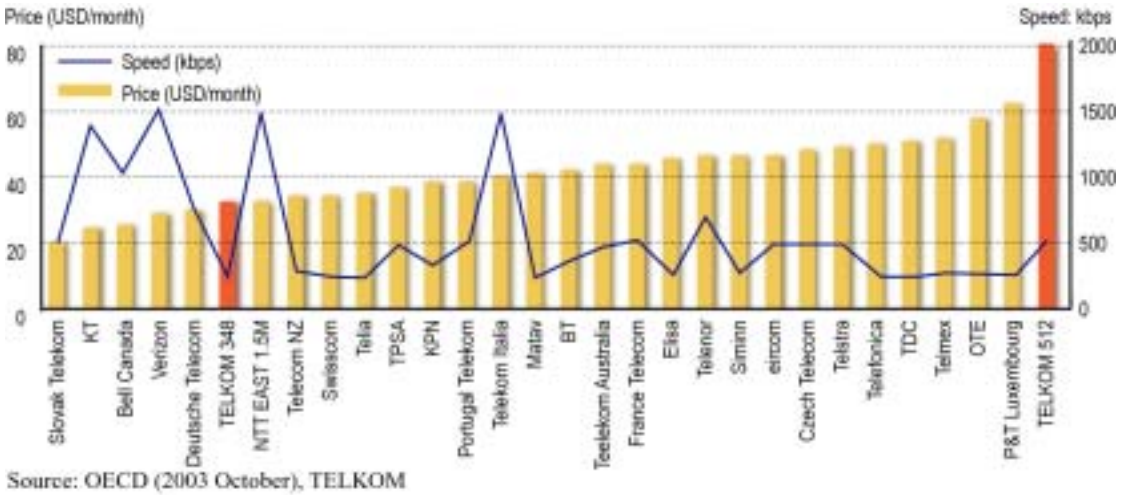


Figure 2.2-3: Comparison of Price and Speed of Broad Band Service (less than 1,500 kbps)

In the case of Japan, broad band has spread rapidly owing price-cutting competition among providers (e.g. The Yahoo BB! provides 8,000 kbps service at 21.7US$ per month). Without

[13] The rate offers to individual customers includes activation fee of Rupee 200,000 plus a monthly fee ranging between Rupee 300,000 and Rupee 800,000, depending on the selected speed, between 384 kbps and 512 kbps.
In the meantime, for corporate customers, unlimited services are available with speed between 384 kbps, with an activation fee of Rupee 2,500,000 sand a monthly fee Rupee 3,800,000.

sharp reduction of the cost, the high speed internet service in Mamminasata would not be popularized to a great extent.

2.3 Quality of Telecommunication Service

Quality of telecommunication service can be measured by the Call Completion Ratio (or ASR: Answer to Seizure Ratio) and the Fault Rate.

The Call Completion Ratio is the percentage of calls that are successfully completed, as measured by the number of calls successfully answered divided by the number of call attempts that are recognized by the caller's local exchange, in the case of call completion rates for local calls and call attempts that are recognized by the trunk exchange, and in the case of call completion rates for long distance calls. Call completion rate is measured by the Answer to Seizure Ratio (ASR).

On the other hand, the Fault Rate is a rate of faults per 100 connected lines per month. Faults mean the inability of an item to perform a required function, excluding inability due to preventive maintenance. A fault includes the fault in customer's premises, internal wiring and subscriber's terminal equipment.

The Call Completion Ratio in Mamminasata shows a better performance than the Indonesian average. Since the facilities in Maros and Takalar are recently developed, figures in these areas indicate an excellent performance.

The Fault Rate in Mamminasata shows better performance than the Indonesian average (see Table 2.3-1). If compared with other Asian countries, the Fault Rate in Mamminasata is generally in a better position (Malaysia: 40.0, Thailand: 19.6, Philippines: 5.7, Taiwan: 2.1 and Korea: 1.1).

Table 2.3-1: Quality Indicators of Telephone Service in the Study Area

	Makassar	Gowa	Maros	Takalar	Indonesia Average (2003)
Call Completion Ratio					
Local Call	77.8%	77.8%	79.0%	81.7%	77.3%
Domestic Long Distance	74.1%	74.7%	77.7%	75.8%	69.5%
Fault Rate	2.96	3.18	0.14	0.33	4.11

Data in the Study area are average during January – May, 2005.
Source: P.T. TELKOM

2.4 Challenges towards e-Government

1) Law and Regulation Related to e-Government

Introduction of e-government in Indonesia started in 1999 as a response toward the enactment of the New Regional Autonomy Law No. 22/1999. General objectives of e-government are to build clean, transparent, and efficient local governments, and to utilize potential resources as much as possible in achieving a better economic condition in the local area. The picture of a better government management profile will be an interesting factor for investors to spend their investments in local areas (provinces, counties, districts).

The government of Indonesia puts a target that as much as 60% of the local government would provide the e-government services by the end of 2005.

Strategy of e-Government is as follows;

- Develop reliable, trust and affordable public services
- Organization, management system and business process reform Optimal use of ICT
- Public-private partnership
- Human resource development and increase society e-literacy
- Realistic and measurable implementation plan

Introduction of the e-government is to redefine business process in local government and to customize the e-government application, as well as to execute training for operators, administrators, and executives of the governments. To carry forward the e-government, following constraints are considered:

- Lack of sufficient budget
- Lack of human resources
- Culture for sharing information is generally low
- Low telephone density
- Internet and personal computer has not popularize

2) Pilot Project in Takalar

In order to develop the "Integrated Voice (telephone) and Web Based Public Services System", a pilot project was implemented in Takalar regency. The pilot project includes the "Development and Implementation of an Integrated Voice and Web Based Public Services System for Rural Community in Indonesia", which was completed in October 2002. The project was conducted by TELKOM with financial assistance of JICA and technical supports from the Communications Research Laboratory, University of Science, and The University of Electro- Communications, Tokyo, Japan. All equipment (server,

IVR card, networking element, etc.) required for V-SIMTAP pilot project in Takalar are provided under this project.

SIMTAP (System Information Management Satu Atap) is a web-based e-public service system developed by TELKOM. SIMTAP has three main functions: payment in a cashier, services and monitoring. In this system, applicant will request his permit from the Public Service Office. Then, he can check his permit status using telephone. IVR (interactive voice response) server that connects to the public service real-time database performs the status checking process using voice. Government officers from also can monitor the applicant's status in the same way that the applicants do. As noted above, however, the internet is still not prevailing widely to the public.

Thus, in the pilot project, in addition to the existing SIMTAP, the Voice-based SIMTAP (V-SIMTAP) was developed in Takalar regency. V-SIMTAP", is an online public service system using the voice technology (telephone) integrated with the web technology, which is used by the local government to provide better quality public services.

After the project, the web and voice based e-public services has introduced in Takalar regency. With this service, Takalar people can access to information and monitor the status of the services provided by the government. People can access this service via internet as well as telephone. According to the final report of the "Integrated e-Government Pilot Project in Indonesia[*14]", there are improvements in the government public services and significant efficiency in the working environment of public office. The outcomes of the project are evaluated as summarized below:

- Faster public service completion, such as:
  Obtaining personal ID card from several days to only 10 minute
  Obtaining any kind of certifications from several days to only one day
- Revenue from certifications and personal ID card fees are increased to 154% during the year of 2001. It also reflected awareness and appreciation from citizens to the improvement of e-government performance.
- Paper efficiency up to 70%.

The e-Government project is also underway in Makassar.

[14] APEC Telecommunications and information working group, August 2002

2.5 Institutional Development

1) Deregulation of Telecommunication Market

Under the government regulation, TELKOM is granted with exclusive rights to provide local and long-distance telephone services; however, with the enforcement of the New Communications Law (Law No. 36 in 1999) the Indonesia's communications services came to be a competitive market. Local call services were deregulated in August 2002, with long-distance service deregulation following in August 2003. Private corporations have begun to provide services in both markets, and TELKOM has lost its status of monopoly. On the other hand, TELKOM began offering international call services after they were deregulated in August 2003.

In Mamminasata, however, local calls and long-distance calls are still monopolized by TELKOM. On the other hand, mobile phone market is highly competitive, with three mobile phone operators (i.e. Telkomsel, Indosat and Excelcomindo). Telkomsel and Indosat are currently dominant in the mobile phone market in Mamminasata.

2) Profile of PT. TELKOM

P.T. Telekomunikasi Indonesia Tbk. (TELKOM), a majority state-owned company, is the principal provider of fixed line and cellular services in Indonesia. The company provides a wide range of telecommunication services including fixed line, mobile, interconnection, network, data and internet services and other telecommunication services. In 1995, TELKOM restructured its operation by converting all 12 Witels into 7 regional Divisions (Division I: Sumatra, Division II: Jakarta and the surrounding areas, Division III: West Java, Division IV: Central Java, Division III: East Java, Division IV: Central Java, V: East Java, Division VI: Kalimantan, and Division VII: Eastern Part of Indonesia).

Responsibility for the telecommunication service in Mamminasata falls to Makassar branch office (Kandatel Makassar) of Division VII. The TELKOM's head office in Jakarta is responsible for formulating operational policy and strategy, whilst the head office of Region VII in Denpasar is in charged of dispatching a wide range of duties within the eastern part of the country, including O&M of facilities and equipment, equipment planning, demand forecasts, marketing and so on. Region VII has 10 branch offices (Kandatel), which are responsible for day-to-day O&M of facilities and equipment (predominantly to subscriber cables) as well as for marketing tasks.

3) Public Private Partnership (PPP) of Telecommunication Sector

In the telecommunication sector, there are three different types of Public Private Partnership structure; namely Revenue Sharing Arrangement, Joint Operation Scheme (KSO), and Joint

Venture Company.

In Mamminasata, KSO scheme has been adopted since 1996. Details of KSO arrangement is as follows;

Joint Operation Scheme (KSO)

In 1996, TELKOM transferred the management and operation of five of its seven regional divisions to private investors through Joint Operation Scheme (two largest divisions, division II: Jakarta and division V: East Java were retained by TELKOM). In the case of the division VII (inclusive of Mamminasata), Bukaka SingTel International*[15] was selected as a KSO investor. KSO agreement had been concluded between TELKOM Division VII and the PT Bukaka SingTel on January 1 1996.

The Division VII is operated and managed by the Bukaka SingTel during the KSO period (up to 2010), in the name of TELKOM and for and on behalf of TELKOM. The Bukaka SingTel is managed and operated in accordance with the management and operational plan annually approved by TELKOM. In addition, the KSO agreement requires the Bukaka SingTel to undertake planning, design, engineering, financing and construction of a specified minimum number of installed lines during the KSO period.

Revenues generated from the facilities are divided among TELKOM (35%) and the Bukaka SingTel (65%). In addition, even if the revenue is lower than envisaged, the Bukaka SingTel has to pay Rupee 253.2 billion per month to TELKOM. This amount is called the Minimum TELKOM Revenues (MTR).

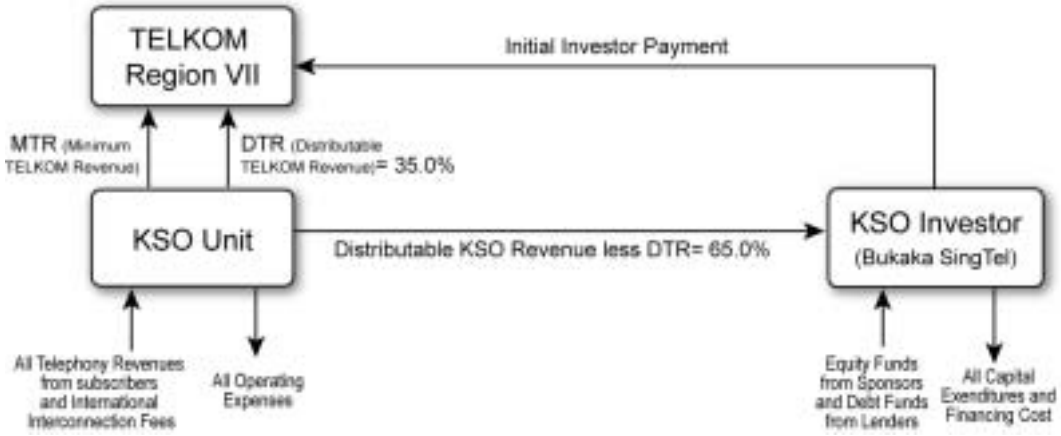


Figure 2.5-1: KSO Unit Payment Flow (Region VII)

KSO investors are accountable for the achievement of specific operational performance targets during the KSO period in relation to the expansion and quality of telecommunication service. At the end of the KSO period, all rights, titles and interests of each KSO investor in existing

[15] PT Bukaka SingTel International is joint-venture company of PT Bukaka Telekomindo International (share of 60%) and Singapore Telecommunication International Pte. Ltd (40%).

installations and all work in progress, inventories, equipments, materials, plans and data relating to any approved additional new installation projects, will be transferred to TELKOM without requiring any further action by any party, upon payment by TELKOM to each KSO investor in the amount of Rupee 100.

2.6 Recommendations for Implementation

1) Short-term Action Programs

Introduction of e-Government for Gowa and Maros

Introduction of e-government in Indonesia has been started since 1999 as a response toward the enactment of the New Regional Autonomy Law. The system has already introduced at Takalar Government, and achieved certain results. The introduction of e-Government is also in progress at Makassar Government. To improve efficiency of works and services, introduction of the system at Gowa and Maros is recommended. To facilitate information sharing among the governments in Mamminasata, the new system for Gowa and Maros should design similar to the existing system in Takalar and/or Makassar.

Expansion of CDMA-Based Fixed Phone Service Area

The telephone density of fixed phone in Indonesia (4.1% in 2004) is lower than other ASEAN countries, while the telephone density of fixed phone in Mamminasata is 11.8%, which is higher than the national average. If compared with other 6 major metropolitan areas, telephone density in Mamminasata is comparable with Semarang (12.8%) and Medan (11.7%), but still lower than the other metropolitan areas (Jakarta: 21.1%, Surabaya: 29.4%, Bandung: 18.0%, and Denpasar: 34.7%).

Given condition, CDMA-based fixed telephone service is expected to contribute for improving telephone density in Mamminasata. The service is available in Makassar and Gowa since May 2004. The service was extended to Maros in July 2004, and will be extended to Takalar in the near future.

The fixed wireless telephone system using CDMA enables reduction of capital expenditure in installing subscriber line and rapid improvement of the telephone network than the conventional fixed line network. In addition, cost of service levied on subscriber is much cheaper than mobile phone. It is therefore recommended that TELKOM install additional base transceiver stations to expand service area throughout the Mamminasata area.

Reduced Tariff in High Speed Internet Service

In Mamminasata, access to the Internet can be made by conventional phone-line dial-up (28.8 kbps) and ISDN dial up (56.6 kbps). While there are 7 internet service providers, most people access to internet through free subscription service named “TELKOMNet Instan”.

High speed internet service using ADSL is starting in September 2005 by TELKOM. The cost of service is, however, still expensive for the pubic (the rate for individual customers includes activation fee of Rupee 200,000 plus a monthly fee of Rupee 300,000 for 384 kbps or Rupee 800,000 for 512 kbps).

To disseminate the high speed internet service in Mamminasata, price reduction of ADSL service through charge cutting competition among internet service provider is be expected. In addition, to encourage competitive environment among internet providers, deregulation and simplify of licensing procedure for new comers is required.

2) Mid/Long-term Action Programs

Rehabilitation and Modernization of Existing Telecommunication Facility

In order to increase the network efficiency, performance and call routing flexibility, digitalization of all switching facilities in Mamminasata was completed in 1997. In addition, 29.2% of the total exchange capacity has already been replaced to the optical fiber. Consequently, a call completion ratio and a fault rate in Mamminasata have attained better performance than the Indonesian average. Particularly, the fault rate in Mamminasata (0.14 - 3.18) is better than other Asian countries (Malaysia: 40.0, Thailand: 19.6, Philippines: 5.7, Taiwan: 2.1 and Korea: 1.1).

Such a level of telecommunication services should be well maintained and further improved in the Mamminasata area in view of the fact that financial and trade industries are to be developed in a more accelerated manner.

In order to increase network efficiency, performance, and a call routing flexibility, replacement of existing cupper wire with optical fiber is required for major sections. In addition, since the part of equipments in Makassar City and Gowa regency has deteriorated, rehabilitation and upgrading of these equipments are required.