Chapter 6 Solid Waste Management Sector of Greater Kumasi Sub-Region

6.1 Present Situation in the Solid Waste Management Sector

The related offices and agencies for the Greater Kumasi MMDAs regarding the Solid Waste Management (SWM) are the regional office of Environmental Health and Sanitation Directorate (EHSD-MLGRD) Ashanti, the office of the Waste Management Department (WMD) of Kumasi Metropolitan Assembly (KMA), and the Environmental Health Departments / Units of the surrounding district / municipality.

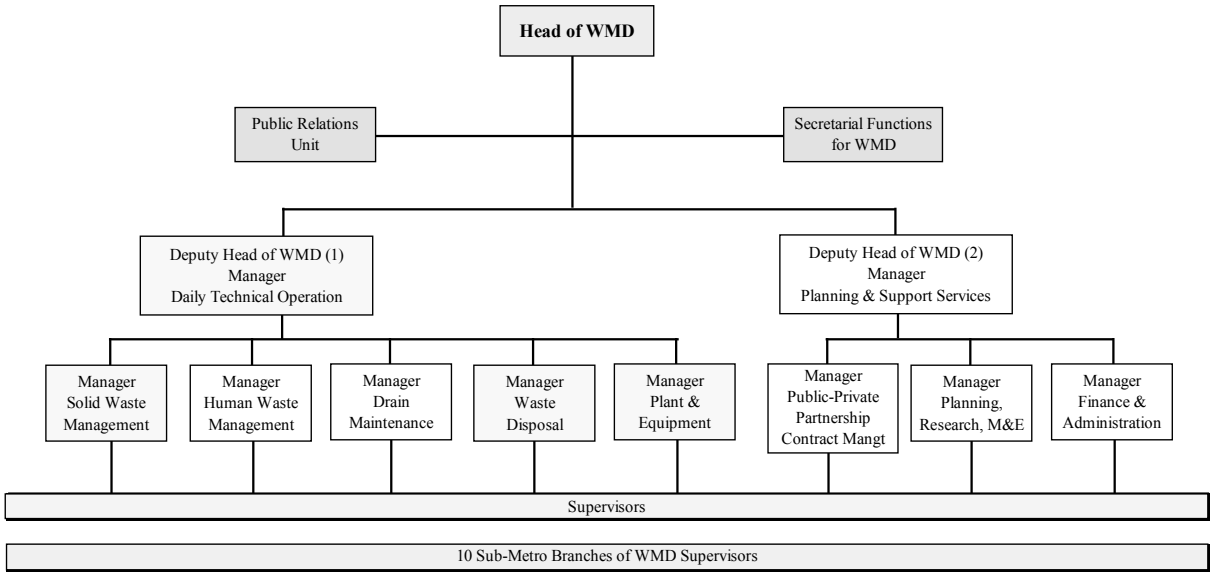
Regarding the regional office of the Environmental Health and Sanitation Directorate mentioned, it was reported in an interview with a Deputy Regional Director, that this regional office does not have any development budget and its functions prescribed in the Local Government Act are to monitor, coordinate and evaluate the performance of the MMDAs in the Region, monitor the use of budgets allocated to the MMDAs, and review and co-ordinate public services generally in the Region. However, it is confirmed that there are no direct actions by this Regional Office for implementing development programs for solid waste management of the MMDAs. Their main concerns are human resources management and assisting in the preparation of reports by the MMDAs.

In general, solid waste is divided into 3 categories, namely, domestic solid waste, industrial waste, and medical hazardous waste. In this chapter, all the waste items in the MMDAs will be discussed.

6.1.1 Kumasi Metropolitan Assembly

(1) Organization and Budget

The Waste Management Department (WMD) is the organization within the Kumasi Metropolitan Assembly (KMA) structures that is charged with the responsibility for implementing waste management functions as set out in the Local Government Law 1993 (Act 462), Section 10, and the Legislative Instrument of Establishment (Ll) of each Metropolitan Assembly. The organization chart of KMA in the field of WMD is shown in Figure 6.1.1. The WMD is responsible for eight sections, namely, solid waste management, human waste management, drain maintenance, waste disposal, plant & equipment, public-private partnership contract management, planning research-M&E, and finance & administration.



Source: KMA-WMD, 2012

Figure 6.1.1 Organization Chart of KMA in the field of WMD

The mission statement of the KMA-WMD is as follows.

> "To keep the city clean and healthy by the provision and delivery of effective and efficient waste collection services and programmes, and environmentally acceptable disposal. In doing all these, the WMD will effectively collaborate with other Ministries, Departments and Agencies, the Private Sector and Civil Society, including the Traditional Authorities. The services shall be delivered, at an affordable cost to all sections of the communities and without any adverse impact to the environment, thereby creating an enabling environment for development and healthy living."

The functions of the KMA-WMD are as follows:

- Keep the Metropolitan area tidy
- Eliminate mess and nuisance
- Develop and continuously update a metropolitan environmental sanitation plan
- Educate the public on how to keep the local environment clean
- Provide conveniently situated refuse disposal points
- Remove solid waste
- Dispose of waste safely
- Manage sludge disposal
- Clean and carry out routine maintenance of drains

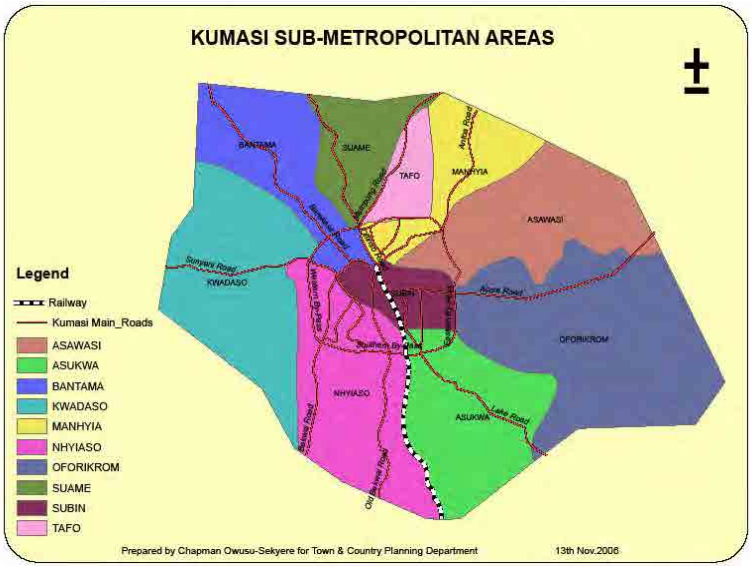
As for the annual budget of KMA, some funding for waste management is allocated from general revenue sources. Annual budget for the waste management department section from the fiscal year of 2011 is GHC 11.18 million or 11.2% of the total annual budget of KMA, consisting of GHC 1.35 million for goods and services and GHC 9.83 million for fixed capital. This is followed by 15.4% for the Central Administration section, 16.6% for the Agriculture section, and 33.2% for the Works section (public works, water, feeder roads) of the KMA.

(2) Collection and Transportation System

In exercise of powers conferred on KMA by section 79 of the Local Government Act, 1993 (Act 462), the KMA-WMD shall conduct solid waste management in the area of the KMA. Currently, solid waste generated by the city stands at 1,500 tonnes per day with Asafo, Central and Race Course Markets as major generators. House-to-house collection (about 20%) and communal collection (about 80%) points are the major forms of waste collection.

As for the average monthly service cost, solid waste management services over the years have been paid for by KMA and the Central Government. The average monthly service cost of solid waste management covering both collection and disposal is about GHC 720,000 which far exceeds the budget of KMA, thus making the assembly to a large extent dependent on the central government. The irregular release of funds by the Government often results in accumulated debts to contractors making the service delivery unsustainable.[1]

KMA is divided into 10 Sub-Metropolitan Areas and these Sub-Metropolitan Areas are used for solid waste collection zoning by service providers as shown in Figure 6.1.2.



Source: Town and Country Planning Department Metro Office, 2008

Figure 6.1.2 Solid Waste Collection Zoning by Service

1) Service Providers for SWM in KMA

The contractors to provider service for each Sub-Metropolitan Area were selected through the National Competitive Bidding process to provide waste collection services in the ten Sub-Metropolitan Areas after negotiations on the bid prices. The service providers who won the bids for the 10 Sub-Metropolitan Areas and their provisional monthly contract sums are shown in the Table 6.1.1. The contract period is five years between 2008 and 2012 and is phased; Phase I: January 2008 - March 2009, and Phase II: April 2009 - December 2012.

[1] "Status report on solid waste collection services in the Kumasi Metropolitan- January 2010"

Table 6.1.1 Waste Service Providers for the Various Sub-Metros and their Provisional Contract Sums

Zone No. of Sub-Metros	Sub-Metropolitan Area	Service Provider	Provisional Monthly Contract Sum (GHC)
1.	Asawasa	Osbon Enterprise Zoomlion Ghana Ltd.	33,051.31
2.	Asokwa	SAK-M Company Ltd.	31,741.67
3.	Bantama	Mesk World Company Ltd.	33,051.37
4.	Kwadaso	Waste Group Company Ltd.	37,924.00
5.	Manhyia	Mesk World Company Ltd.	37,924.00
6.	Nhyiaeso	Kumasi Water Management Ltd.	30,733.00
7.	Oforikrom	Aryeetey Brothers Company Ltd.	37,924.00
8.	Suame	Anthoco Company Ltd.	33,015.28
9.	Subin	Zoomlion Ghana Ltd.	37,924.00
10.	Tafo	Zoomlion Ghana Ltd.	30,051.37
	Total		343,340.00

Source: KMA-WMD, 2012
Note: Since Osbon Enterprise met problems with the owners of their equipment, Zoomlion GH Ltd. took over the contract in an early stage of Phase I. (Phase I: Jan. 2008 - Mar. 2009, Phase II: Apr. 2009 - Dec. 2012)

Service providers who are responsible for carrying waste in the KMA submit their reports on their activities to the KMA-WMD monthly. For example, Zoomlion Ghana Ltd. that has contracted three Sub-Metropolitan Areas submits an operation report for the Sub-Metros of Asokwa, Nhyiaeso & Oforikrom. The report indicates NYEP (National Youth Employment Programme), state of tricycles, status of sanitary logistics, landscape and beautification, vector control (NAMCOP: National Mosquito Control Program), human resource issues (personnel status, accidents), challenges, recommendations, and planned activities for the next month.

2) Current Waste Generation and Collection Rate

According to KMA-WMD[2], with a current population of about two million in 2011, KMA generates an average of 1,500 tonnes of solid waste daily. Out of the 1,500 tonnes/day of waste generation in the city, 1,300 tonnes/day are collected from domestic, commercial and industrial wastes including waste markets of 300 tonnes/day, which is carried to the sanitary landfill site. This waste includes waste from domestic house-to-house, commerce from shops, restaurants, markets, offices, hospitals, schools, factories, etc. in the city. It is noted that the difference between 1,500 and 1,300 tonnes/day is 200 tonnes/day which will be the reminder left at communal sites, gutter and open spaces as uncollected in the city. Evacuation of waste left in the city areas was conducted at almost once per year or less. The collection rate of waste is about 87 % currently. Out of the 87% collection rate, it is also remarked that about 20% collection by compactors is through house-to-house and about 80% collection by trucks (skip types / roll on-off type) is through communal containers. Solid waste is collected basically at least twice a week by 20 refuse trucks and three tractors, all in satisfactory condition (KMA-WMD, 2010). An average daily waste generation per

[2] Based on an interview with Mr. Anthony Mensah, Director of Waste Management Department, KMA in March 2012

capita is currently about 0.6 kg/capita/day.

The rate of waste generation for domestic, commercial and industrial sources (non-toxic and non-hazardous), as well as the market and restaurant waste generated during the 1995-2011 period are shown below.

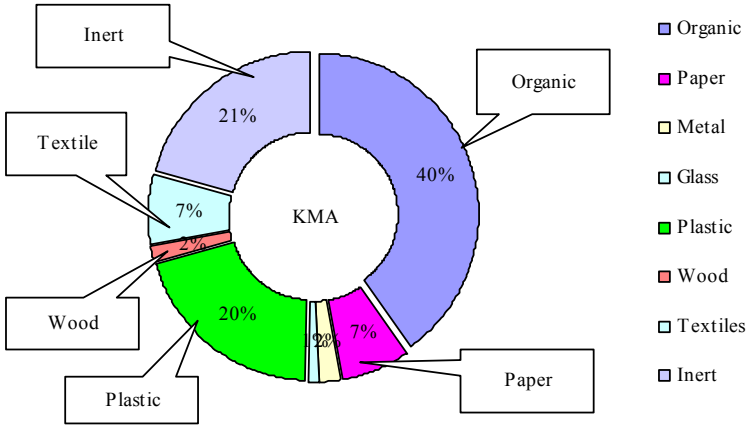
Table 6.1.2 Waste Generation in KMA

Year	1995	2005	2006	2008	2009	2011
Waste Generation (tonnes/day)	600	1,000	1,000	1,200	1,300	1,500

Source: WMD-KMA, 2012

3) Waste Composition by Weight in KMA

Waste composition generated in the city was surveyed by the KMA in 2010 as shown in Figure 6.1.3, and the survey shows that more than 40% is organic and followed by 21% of inert (ashes, debris), 20% of plastics, and 7% of paper and textiles, 2% of wood and metal, and 1 % of glass.



Source: KMA-WMD and Zoomlion Ghana Ltd., 2010
Notes: Inert includes ashes, debris

Figure 6.1.3 Waste Material (Domestic, Commercial & Industrial) Composition by Weight in KMA

4) Equipment Used for the Waste Collection and Transportation System

As the waste collection and transportation equipment, there are compactor trucks and waste bins for house-to-house collection, and kinds of haulage trucks for road sweeping, and various containers and trucks for communal collection, as shown in Figure 6.1.4.

House-to-House Collection (KMA)	 Waste Bin (120 litre)	 Curbside Waste Collection	 Compactor Truck (15 tonnes)
Road Sweeping & Equipment (KMA)	 Waste Haulage Truck	 Bola Taxi Truck (5m^3)	 Manual Bicycle
Communal Containers & Transport (KMA & District)	 Containers (15m^3 & 14m^3) at Community Transfer Station	 Skip Loader with Container (14m^3)	 Tractor loader with Roll On / Off Container (15m^3)

Source: Photos taken by JICA Study Team

Figure 6.1.4 Waste Collection and Transportation System

5) Levies for House-to-House Collection and Communal Collection

In line with the Assembly's Fee Fixing Resolution, there are two collection service systems. For house-to-house collection, GHC 3.00 - GHC 5.00 was charged per household per bin per month as operating costs depending on the housing category. However, a high-income residential class is now charged at GHC 10.00, whereas middle-income residential class GHC 8.00, and low-income class GHC 5.00. On the other hand, as for communal collection, it is now concluded that 0.10 -0.30 GHC could be charged per person and the average number of individuals contributing refuse that fill each of the containers (at the communal containers of 10m^3, 12m^3, 14m^3 and 23m^3) was determined during the survey exercise.

In the past, KMA had planned series of programmed levy schemes as below.

Before 2008, the communities did not pay any levy / fee for dumping their refuse / waste at the collection or dumping sites. Therefore, KMA did not have enough funds to pay the service providers / contractors for effective and efficient service delivery and the collection sites were not well designed. To help mitigate this situation, the City-wide Solid Waste Collection Levy Scheme, which involves the collection of subsidized user fees from service beneficiaries and clean environmental sanitation status was implemented in 2008 for the two types of services of house-to-house and communal container collection systems. With the introduction of the pay-as-you-dump scheme, enough resources were mobilized since the communal collection system is about 80% of the collection system in localities. These funds have helped improve the collection sites at Aboabo and Asawasi.

In 2009, 55,000 households participated in the house-to-house waste collection scheme (WMD-KMA, 2010). Low-income households generally rely on the pay-as-you-dump system, whereby communal containers / skips are placed at designated sites, and households pay between GHC 0.10 - 0.20 per load. In 2011[3], the charge for a head load of waste was 0.30 GHC while for the house-to- house collection system charge became GHC10 per month. Residents share 540 communal small containers, and use 12,000 bins with a storage capacity of 120 or 240 litres. There was a problem with the communal containers that the containers were too high for small children, and as a result sometimes left the waste on the ground. Strategically placed ladders are recommended to resolve this problem. The Department of Parks and Gardens and the Forestry Services Division of KMA, also planed to plant trees around skips, to improve the appearance and reduce the odors emitted by these facilities.

In 2010, there were 148 collection sites in KMA. However, the number of collection sites increased to 150 in 2011. This introduction compelled the service providers to keep their sites clean so that they could justify the money collected from the beneficiaries. The annual report of 2011 by WMD-KMA shows the increase of cost recovery for waste collection was 20%. It was expected that through the expansion of pay-as-you-dump to all communal sites, the charge per head load for pay-as-you-dump as well as the tariff for house-to-house collection should be increased by the end of 2011. Also, it is considered that to recycle the organic waste into compost for agricultural use should be assisted by private sector.

As for transfer stations in the KMA, it is unfortunately noted that there are no transfer stations but only communal dump sites in the KMA. It is stated that a transfer station is a building or processing site for the temporary deposition of waste or refuse. Transfer stations are often used as places where local waste collection carts or pre-collection vehicles deposit their waste cargo prior to loading into larger equipment / vehicles. These larger equipment/ vehicles transport the wastes to the final disposal point in a landfill, an incinerator plant, or for recycling.

The total cost of waste collection for the year stands at GHC 3,800,000 ("the annual report of 2011" by KMA-WMD). Out of this cost, the service providers were able to recover GHC 1,400,000 from the waste charges from house-to-house collection and pay-as-you-dump from the communal sites. The outstanding cost which constitutes the subsidy to be paid by the KMA (the Central Government) is GHC 2,400,000.

6) Recent History of Solid Waste Treatment in KMA

According to a 1999-study, it was estimated that two-thirds of residential waste was dumped in open lots or on the banks of natural streams (Post, 1999). The collected waste posed a serious health hazard and contaminated surface sources. The KMA have responded to the major challenge of maintaining clean environmental sanitation status over the years. In 2008, the WMD-KMA presented "the Case of Kumasi, Solving the Fundamental Challenges" to the public, on how filthy the open dumping sites in the KMA were and how the dump sites were drastically changed before and after the significant impacts of the strategies that had been undertaken, as shown in Figure 6.1.5.

[3] Annual Report of 2011, WMD KMA

Asafo Collegiate (2008)

Labour Dump Site (2008)

YF Transfer Station (2008)

Source: Ing Anthony Mensah, Director, Waste Management Department, KMA, 2008, "Solving the Fundamental Challenges" The case of Kumasi

Figure 6.1.5 Condition of Communal Dump Site (2008)

Atonsu Communal Dump Site
BEFORE (2008)

Atonsu Communal Dump Site
AFTER (2008)

Aboabo Station Dump Site (2008)
BEFORE (2008)

Aboabo Station Dump Site (2008)
AFTER (2008)

Source: "Solving the Fundamental Challenges" The case of Kumasi, Ing Anthony Mensah, Director, Waste Management Department, KMA, 2008

Figure 6.1.6 Communal Dump Sites (Before & After Significant Impacts of Strategies)

7) Means of Waste Disposal

Based on the 2000 Population and Housing Census[4], it is noted that "Collected" ranges only from 0.1% in Kwabre to 2.2% in KMA, while more than three-fourth of households in all districts use the a "public dump" to dispose of solid waste, with the highest proportion (78.8%) in Atwima and the households that dumped their waste "elsewhere" range from 1.4% in Bosomtwe / Atwima Kwanwoma to 14.1% in Atwima as follows.

[4] 2000 Population and Housing Census, Ashanti Region, Analysis of District Data and Implications for Planning", Ghana Statistical Service, 2005

Table 6.1.3 Means of Solid Waste Disposal of Households by District (2000)

Means of Waste Disposal	**Kumasi Metropolitan**	**Surrounding Districts of KMA**	Atwima	Ejisu Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre
Collected	**2.2 %**	**1.3 %**	0.2 %	0.3 %	0.4 %	0.1 %
Burned by household	**3.6 %**	**3.3 %**	3.2 %	4.2 %	3.5 %	3.5 %
Public dump	**81.2 %**	**78.9 %**	78.8 %	80.8 %	85.3 %	80.5 %
Dumped elsewhere	**10.1 %**	**13.4 %**	14.1 %	9.8 %	1.4 %	13.1 %
Buried by household	**2.4 %**	**2.6 %**	3.3 %	4.5 %	3.9 %	2.5 %
Other	**0.6 %**	**0.4 %**	0.3 %	0.3 %	1.4 %	0.6 %

Source: GSS, 2000 Population and Housing Census

Table 6.1.4 Means of Solid Waste Disposal of Households by District (2010)

Means of Waste Disposal	**Kumasi Metropolitan**	**Surrounding Districts of KMA**	Atwima Nwabiagya	Ejisu Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre East	Afigya Kwabre
Collected	**4.0 %**	**13.2 %**	6.5 %	1.3 %	3.6 %	3.7 %	4.7 %
Burned by household	**9.4 %**	**5.4 %**	9.2 %	7.8 %	9.5 %	11.5 %	9.0 %
Public dump	**76.7 %**	**75.9 %**	75.1 %	82.2 %	74.9 %	76.3 %	75.8 %
Dumped elsewhere	**4.9 %**	**2.7 %**	4.1 %	4.4 %	6.3 %	3.5 %	5.9 %
Buried by household	**4.5 %**	**2.2 %**	4.4 %	4.1 %	5.0 %	4.7 %	4.0 %
Other	**0.5 %**	**0.5 %**	0.7 %	0.3 %	0.6 %	0.4 %	0.5 %

Source: GSS, 2010 Population and Housing Census

The high proportion of households throwing solid waste "elsewhere", especially in KMA (10.1%), has very serious financial and health implications. The Metropolitan Assembly uses large sums of money for the cleaning of gutters, which could have been used for other development needs of the assembly. Further analysis of the table above shall be conducted once the 2010 Census results area out.

(3) Open Waste Disposal Sites

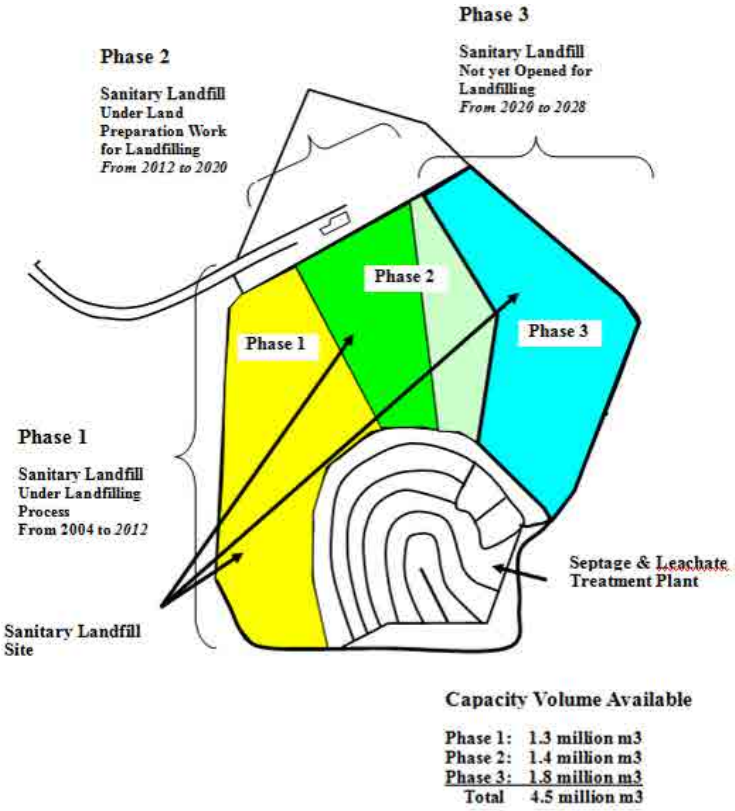
The KMA-WMD has two approved open dump sites located in a northern part of KMA. One is the Ohwimase open dump site which was opened in 2008 and closed in 2011 with the area of about 700 m^2 and the other one is the Duase open dump site which was opened in 2010 and closed in 2011, having an area of about 800 m^2. After those two open sites were closed in 2011, to date the Oti Sanitary Landfill Site has been the only final landfill in KMA.

(4) Oti Sanitary Landfill Site

The KMA-WMD has an engineered sanitary landfill facility at Oti near Dompoase, which was commissioned in January 2004, under the Urban Environmental Sanitation Project (UESP I) financed by the WB. There are three landfill phases at the site, namely, Phase 1, Phase 2 and Phase 3. Phase 1 is divided into four developed cells (Cell 1, Cell 2, Cell 3 and Cell 4). The facility occupies 40 hectares of land which has duly been acquired by KMA.

In 2012, Phase 1 is in the process of landfilling. Although Phase 1 was initially planned to be completely filled in 2009, it is still being filled up and can last for the next 3 years (until December 2012). At the same time, the KMA-WMD is partially developing the construction work for Phase 2 and is to open the new landfill area of Phase 2 in 2012. The further

extending of the remaining area of Phase 2 will also be developed later financing by France. The KMA-WMD is also planning another development of the Phase 3 area. The KMA-WMD is also expecting to develop the landfill areas of Phase 2 and Phase 3 as the case of Phase 1 and they will be able to last for the next 3 years in addition to a 5 year filling cycle per phase. Therefore, it is projected that the Oti Sanitary Landfill Site has the total volume capacity available of 4.5 million m^3 and will last until 2028[5]. Figure 6.1.7 shows the layout plan of the Oti Sanitary Landfill Site, presenting Phase 1, Phase 2 and Phase 3.



Source: Urban Environmental Sanitation Project, July 2012, Proposed Sanitary Landfill and Septage Treatment Maintenance Guidelines, MLGRD

Figure 6.1.7 Layout Plan of the Oti Sanitary Landfill

The landfill facilities consist of the following.

- A gatehouse
- An office and welfare building
- A weighbridge and guard house
- Four on-going landfill cells
- Septage treatment pond system for the treatment of septage and the leachate produced from the landfill.

Procurement of solid waste collection services provider in the Oti Final Sanitary Landfill is undertaken through tendering in line with the Public Procurement Act 2003 (ACT 663) and the service provider, J Stanley-Owusu Group, has been engaged in the operation and

[5] "Proposed Sanitary Landfill and Septage Treatment Facilities for Kumasi, Phase II – Design Phase Operations and Maintenance Guidelines" July 2002, Urban Environmental Sanitation Project, Ministry of Local Government and Rural government

maintenance of the landfill sites since 2004. The operation of the landfill facility has been outsourced to the private contractor at an average monthly cost of GHC 300,000 based on GHC 7.2 per tonne of waste deposited at the site (based on the KMA-WMD, "Waste Management Situational Report" on 17th Feb. 2009).

Figure 6.1.8 shows the existing Oti Sanitary Landfill Site including existing landfill and the fecal sludge treatment plant, and a new construction landfill area, prolonging the life of Oti Sanitary Landfill.

Existing Oti Sanitary Landfill Site (Phase 1 Area)

New Construction Landfill Site in the Oti Sanitary Landfill (Phase 2 Area)

Existing Oti Sanitary Landfill and Fecal Sludge Treatment Plant

Source: JICA Study Team, 2012

Figure 6.1.8 Existing Oti Sanitary Landfill Site

About 20 registered waste pickers (scavengers) are currently operating to collect valuable materials such as plastics, metal, glass, etc. at the landfill site.

(5) Industrial and Medical Hazardous Wastes

The primary responsibility for solid waste management rests with the MMDAs, private enterprises, hospitals, etc. KMA has the responsibility of collection and transport, and disposal of not only the domestic waste but also the industrial and medical wastes generated in KMA.

1) Industrial Waste

The industrial wastes are collected occasionally from major companies in KMA, namely, the timber industry with sawmills, Sokoban Wood Village, Guinness Ghana Ltd, Ashfoam Ltd., and Bank of Ghana Ltd., and $12m^3$ skip containers are used for waste collection. The following are the two alternatives for charging for the industrial waste collection.

- A $12m^3$ skip container is sold to the company and an amount of GHC 120 is charged for each container lift. If 3 containers are lifted in a day, the charge will be GHC 360.
- A $12m^3$ skip container is rented to the company at GHC 20 and an additional charge of GHC 120 is charged. Hence, if 3 containers are lifted in a day, the charge will be GHC 420.

The following are major challenges in the future for industrial waste collection and disposal (information based on the KMA-WMD).

- Disposal of saw dust from wood processing
- Importation of used electronic appliances
- Disposal of e-waste, such as CFC containing refrigerators etc.
- Auto mechanic industry in Suame industrial cluster which services the northern sector and countries to the north of Ghana
- Disposal of oil waste, disposal of heavy metals into water bodies
- Potential zero emission project areas
- Waste sorting and recycling
- Conversion of solid waste into energy by anaerobic digestion and incineration
- Processing of saw dust generated at the Sokoban Wood Village
- Recycling of bio-solids from FSTP, etc.

2) Medical Waste

KMA is the responsible for collection and disposal of hospital waste from three major hospitals in the city. Medical wastes are defined such as sharp objects (needles and blades), syringes, vials, tubes, infectious wastes (cotton, diapers, gloves and clothes), chemical waste (solid, liquid and gaseous chemicals such as disinfectants or solvents for cleaning process), pathological wastes (human tissues and organs), and other microbiological waste, etc. In KMA, there are major three hospitals, namely, KATH (Komfo Anokye Teaching Hospital at Subin Sub-Metro), KNUST Hospital (Oforikrom Sub-Metro), and Manhyia Hospital (Manhyia Sub-Metro). The service providers (Zoomlion) collect the hospital containers ($12m^3$) thrice a day in the KATH and KNUST Hospital and Manhyia Hospital once a day and dispose of wastes to the Oti Sanitary Landfill Site.

Three types of containers are used for collection in the KATH hospital as follows:

- Yellow colored skip container for organic waste collection
- Brown colored skip container for clinical waste collection
- Black colored skip container for general waste collection.

On the other hand, both KNUST Hospital and Manhyia Hospital use a green colored skip container. The system for charging for medical waste is the same as that for the industrial waste.

6.1.2 Surrounding Districts and Municipality Assemblies

The District Environmental Sanitation Strategic Action Plan (DESSAP) is a comprehensive document which provides a framework for addressing sanitation problems towards the achievement of accelerated and sustained poverty reduction in the districts. The DESSAP document provides direction for the implementation of the broad sanitation objectives and programs outlined in the district's Medium Term Development Plan. It is designed to be used in the district and other agencies / organizations that would be involved in addressing sanitation problems in the district for the plan period (2008-2015).

In order to prepare a Comprehensive Urban Development Plan for Greater Kumasi MMDAs, solid waste collection and transportation system, and disposal system will be discussed in this section. Five districts assemblies and one municipality assembly in the Greater Kumasi area have assigned the solid waste collection and transport for respective final disposal sites to the private sector (service provider) which is Zoomlion Ghana Ltd. under a 5-year contract that started in 2007 and ends in 2012. The MMDAs of Greater Kumasi understand that the primary responsibility for the solid waste management rests with the assembly.

Major features regarding the current solid waste management in the surrounding districts and municipality of KMA are summarized in Table 6.1.5 through Table 6.1.10.

Table 6.1.5 Major Features of Current SWM in Afigya Kwabre District Assembly

<table>
<tr><th>No.</th><th>Content</th></tr>
<tr><td>1. Name of MMDA</td><td>Afigya Kwabre District Assembly</td></tr>
<tr><td>2. Area Size (km^2)</td><td>517</td></tr>
<tr><td>3. Population in 2010</td><td>136,140</td></tr>
<tr><td>4. Goal and Objectives of the DESSAP</td><td>The goal of the district is to improve the health status of the people in the district, through increased access to sanitation and improved hygiene by the year 2015. The objective of the district is to promote effective solid waste management and hygiene in 96 communities.</td></tr>
<tr><td>5. Solid Waste Generation and Components</td><td>The solid waste generation in the District is estimated at about 61 tonnes/day.
Solid waste in the district is generated by domestic (household), commercial (market and business activities) and institutional sources.</td></tr>
<tr><td>6. Collection and Transportation</td><td>The service provider (Zoomlion Ghana Ltd.) started operating in the district in 2007. The current contract is for the 5-year period between 2009 and 2014. The contract between the district and Zoomlion is renewable every 2 years.
There are 96 communities within the District and Zoomlion is currently operating in only 29 communities.
<table>
<tr><th>Equipment (Zoomlion)</th><th>Staff (Zoomlion)</th></tr>
<tr><td>▪ Skip loader truck (1unit)
▪ Tricycle - 34 (6 are operational)
▪ Skip containers (9units each $12m^3$)</td><td>265 workers including the staff of National Mosquito Control Programme (NAMCOP)</td></tr>
</table>
The sweepers work from Monday to Saturday between the hours of 5am - 10am.
The communal collection system is the only collection system practiced in the district. The distribution of the 9 skip containers and the communities in which they are located in the district are as follows.
• Atimatim (5 skip containers)
• Buoho (2 skip containers)
• Afrancho (2 skip containers)</td></tr>
</table>

7. Final Disposal Site	The final open dump site in the district was almost full and closed last year due mainly to the recent development situation at the site (residences and schools). The sites were covered with top soil and vegetated (cassava & banana fields). It is, therefore, noted that the waste service provider (Zoomlion Ghana Limited) is now disposing waste at the Oti Sanitary Landfill Site in KMA. The District Assembly has tried to obtain a new landfill site in the district but due to delayed payment by the assembly it is not yet operational. No final disposal site for solid waste currently exists.
8. Challenge	• Searching for a new final disposal site. • Inadequate logistics for efficient work.

Table 6.1.6 Major Features of Current SWM in Kwabre East District Assembly

No.	Content
1. Name of MMDA	Kwabre East District Assembly
2. Area size (km^2)	135
3. Population in 2010	115,556
4. Goal and objectives of the DESSAP	The goal of the district according to the District Environmental Sanitation Strategy and Action Plan, is to improve the health status of the people in the district through increased access to sanitation and improved hygiene by the year 2015. The objective of the DESSAP is to promote effective solid waste management and hygiene in 42 communities. • To identify the sanitation needs of the district. • To identify priority interventions taking into consideration that the available financial resources and institutional capacity at the local level. • To build the capacities of the local institutions to be able to identify, initiate and strategically plan and develop programs to address sanitation problems at the local level. • To ensure that locally developed sanitation systems comply with policies, targets and initiatives at the environmental level and also in alignment with plans of other sanitation related institutions both at the local and national level • Ensure maintenance of good hygiene and sanitation practices
5. Solid Waste Generation and Components	The solid waste generation in the district is estimated at about 64 tonnes/day. Solid waste in the district is generated by domestic (household), commercial (market and business activities) and institutional sources.

Waste Composition by Weight at Kwabre East District Assembly

District: Kwabre East District Assembly

Source	Composition by Weight (%)								
	Organic	Paper	Metal	Glass	Plastic	Wood	Textiles	Misc.	*Total*
Domestic/Low Income	40	10	5	5	5	15	10	10	100
Commercial (shops)	10	20	10	15	35	5	5		100
Hotel	10	15	10	25	20	5	10	5	100
Market	55	5	5	5	5	20	5		100
Insttutional (schools)	25	35	5	5	10	15		5	100
Clinic	5	20	10	15	20	5	10	15	100
Health care waste	5	20	10	15	20	5	10	15	100

Source: District Environmental Sanitation Strategic Action Plan (2008-2012), Nov. 2008, Kwabre East District Assembly

No.	Content
6. Collection and Transportation	The service provider (Zoomlion Ghana Ltd.) started operating in the district in 2007. The current contract is for the period between 2009 and 2014. The contract between the district and Zoomlion is renewable every 2 years. There are 42 communities within the district but Zoomlion is operating in only 30 communities. Only the communal container collection system is applied in the district. There are 12 units of roll on / off containers and 4 units of skip containers for waste collection. Two units of container loader trucks are used for waste transportation to the final disposal dump sites. Open dumping is the main method of refuse disposal in most communities in the district. However, the method is not properly managed and has resulted in indiscriminate disposal of refuse and also the creation of huge piles of refuse in most settlements in the district. Equipment (Zoomlion): ▪ Roll on / off truck - 2; ▪ Roll on / off containers (15 m^3)- 12; ▪ Skip containers (12m^3) - 4; ▪ Tricycles - 53 (operational) Staff (Zoomlion): ▪ Operations manager - 1; ▪ Tricycle supervisor - 1; ▪ NAMCOP leader – 1
7. Final Disposal Site	An existing final dump site of about 4 acres (1.6 ha) is in operation. One bulldozer for leveling and spreading work is occasionally requested almost quarterly.
8. Challenge	• Need for reliable access to the final disposal dump site • Inadequate number of trucks • Need for frequent use of heavy equipment for land-leveling and truck scales at the site

Table 6.1.7 Major Features of Current SWM in Ejisu Juaben District Assembly

No.	Content
1. Name of MMDA	Ejisu Juaben Municipality Assembly
2. Area Size (km^2)	723
3. Population in 2010	143,762
4. Goal and Objectives of the DESSAP	The "Environmental Health & Sanitation Unit Action Plan 2012" by the EJMA is stated as follows: • Removal of refuse from 3 selected communities to be taken by the Assembly / stakeholders / Zoomlion • Ensure proper management of community dumpsites and public toilets • Procure 24 refuse containers for community dumpsites • Procure / distribute 120 dust bins for 40 schools • Commerce arrangement for house-to-house refuse collection in the bigger communities 40% of communities in the bigger towns register for services In addition to the "Environmental Sanitation Strategic Action Plan 2009-2020 EJMA", due to extend of urbanization, this municipality gradually become part of suburban in KMA. Therefore, it faces multiple challenges in addressing environmental sanitation issues within EJMA.
5. Solid Waste Generation and Components	According to the report on the "Structure Plan for Ejisu Area" August 2010, the EJMA coordinates the collection, transport and final disposal of refuse in public areas like streets, lorry parks and markets together with the private service provider. Waste collected from house-to-house and communal sites and offices is taken by the service provider. This includes what is generated from households, markets, parks, shops, bars, industries, health institutions and other sources. The type of waste generated depends on the type of residential

<table>
<tr><th>No.</th><th>Content</th></tr>
<tr><td></td><td>facilities one lives in.
Accumulated waste can be seen within these vicinities, including market areas. This is a significant contribution to the rise in cases of vector diseases. Waste is often dumped outside, due to lack of capacity, poor collection and lack of public awareness about the health risk to people. Open dumps in some of the communities allow free access to waste pickers, animals and flies, and often produce unpleasant and hazardous smoke.
Zoomlion started operating in the municipality in 2007 and it is the only waste management company in the municipality to date. The current contract is for the 5 years between 2009 and 2014. Zoomlion is currently operating in only 16 communities out of total of 84 communities within the municipality. The number of containers to be used in every district is stipulated in the contract document and their allocation is based on the population and activities of a particular community.</td></tr>
<tr><td>6. Collection and Transportation</td><td>The communal system of waste collection is the only type of system practiced in the municipality. The collection of waste is done twice a day at Ejisu Market but once everyday in the other communities in Ejisu. In Juaben, usually, the waste collection is done every two days. The municipality has about 414 crude dumping sites.
Ejisu Town being the capital of the municipality and more populated than Juaben, produces much waste hence it has seven 15m^3 roll on / off containers whilst Juaben has seven 12m^3 skip containers.
Due to the proposed expansion to cover other communities, 1 skip truck and 2 roll on / off trucks are expected within the municipality.
<table><tr><th>Equipment (Zoomlion)</th><th>Staff (Zoomlion)</th></tr><tr><td>・ Skip truck – 1
・ Skip containers – 7
・ Roll on / off truck -1
・ Roll on / off containers – 7
・ Tricycles – 40 (30 are currently operational)
・ Motor bike – 1 (used by the tricycle supervisor)</td><td>・ Operations manager – 1
・ Tricycle supervisor – 1
・ Spraying supervisor – 1
・ NAMCOP sprayers – 5
The sweepers work everyday except Sundays but waste collection is done everyday.</td></tr></table></td></tr>
<tr><td>7. Final Disposal Site</td><td>There are two final disposal sites in the EJMA. One is the open dump site at Ejisu Town which is located about 2 km from the main Accra-Kumasi road, while the other one is an open dump site at Juaben Town about 3 km from the town. Pushing and spreading work by heavy equipment is usually done once in every four months at the Ejisu dump site using a requested bulldozer from the regional office of the service provider.
Additionally, one more possible open dump site (Krapa site) is considered as a final disposal site about 3 km from the Ejisu Town. However, there is still a documentation problem.
The final disposal site at Ejisu is no longer in use because it is too close to residential properties. The residents of the community who live close to the site have always raised objections. This has created a serious problem with a build up of refuse at the dump sites (transfer stations). In addition, the site now serves as defecating grounds and during dry seasons the refuse is set on fire causing smoke nuisance and at times the fire destroy people’s properties. Because the population has been steadily increasing, the current number of refuse containers are not adequate to serve the communities (Municipality Environmental Sanitation Strategic Action Plan 2009-2020).</td></tr>
<tr><td>8. Challenges</td><td>• Bad behavioral attitude of citizens (indiscriminate dumping anywhere)
• Limited organized household waste management in most communities. (In selected communities, refuse containers are located in markets and at refuse dump sites. A refuse truck empties the containers periodically; however, open dumping is also prevalent. IEC to public may also be needed.)</td></tr>
</table>

Table 6.1.8 Major Features of Current SWM in Bosomtwe District Assembly

<table>
<tr><th>No.</th><th>Content</th></tr>
<tr><td>1. Name of MMDA</td><td>Bosomtwe District Assembly</td></tr>
<tr><td>2. Area Size (km^2)</td><td>353</td></tr>
<tr><td>3. Population in 2010</td><td>93,910</td></tr>
<tr><td>4. Goal and Objectives of the DESSAP</td><td>The goal of the district is to improve the health status of the people in the district, through increased access to sanitation and improved hygiene by the year 2015. The objective of the district is to promote effective solid waste management and hygiene in 65 communities.</td></tr>
<tr><td>5. Solid Waste Generation and Components</td><td>Solid waste in the district is generated by domestic (household), commercial (market and small shops) and institutional sources.
The service provider (Zoomlion Ghana Ltd.) started operating in the Bosomtwe District in 2006 and it is the only waste management company in the district. There are 65 communities in the district and the service provider is currently operating in 39 communities.
There are 10 skip containers in the district.</td></tr>
<tr><td>6. Collection and Transportation</td><td>The District Assembly practices both the communal and house-to-house systems of waste collection. The house-to-house (door-to-door) system is practiced in only four communities, namely, Kuntanase, Esereso, Pramso and Feyiase in the district. Twenty-four waste bins (120 litres) are currently being used for this system of collection. Both house-to-house and communal collection systems are conducted and the service provider conveys waste to the final disposal sites twice a week in a skip-truck. The tricycle is also used to convey waste from communities that do not have containers to the nearest located container. The number of containers varies by community, Kuntanase has 2 units, Jachie has 3, Esereso has 2, and 1 unit each for Aputuogya, Abidjan Nkwanta, and High Tension.
<table><tr><th>Equipment (Zoomlion)</th><th>Staff (Zoomlion)</th></tr><tr><td>・ Skip truck – 1
・ Tricycle – 50 (23 are operational)
・ Skip containers – 10
・ Wheel barrows – 23
・ Waste bins – 23</td><td>・ Operation manager – 1 (Alex)
・ Operation monitor – 1
・ NAMCOP Team Leader – 1
・ Janitor – 1
・ Tricycle Supervisor – 1
・ Tricycle mechanic – 1
・ Truck mechanic – 1
・ Truck driver – 1
・ Sweepers – 164
・ Eco-brigade (Beach cleaners) – 150</td></tr></table></td></tr>
<tr><td>7. Final Disposal Site</td><td>There is only one existing open dump site in Bosomtwe District which covers more than 5 acres of land area in Onwe community, which is about 7 km from Kuntanase (District Capital). The open dump site has been used for waste disposal for four years and pushing and spreading were conducted in 2011. The dump site was used as a sand quarry in the community. However, the solid waste disposal is a major problem since there is no proper refuse disposal site resulting in indiscriminate dumping. Bad road access to the dump site and inadequate trucks should be also improved and replaced. The solid waste disposal is a major problem since there is no proper refuse disposal site resulting in indiscriminate dumping.</td></tr>
<tr><td>8. Challenges</td><td>• Need of proper road access to the dumping site
• Need of more proper open dump sites urgently</td></tr>
</table>

Table 6.1.9 Major Features of Current SWM in Atwima Kwanwoma District Assembly

No.	Content
1. Name of MMDA	Atwima Kwanwoma District Assembly
2. Area Size (km^2)	291
3. Population in 2010	90,634
4. Goal and Objectives of the DESSAP	The goal of the district is to improve the health status of the people in the district, through increased access to sanitation and improved hygiene by the year 2015. The objective of the district is to propose effective solid waste management and hygiene in 58 communities, and improve the collection rate from 48% (2008) to 80% by 2015.
5. Solid Waste Generation and Components	The solid waste generation in the district is estimated at about 43 tonnes/day. Solid waste in the district is generated by domestic (household), commercial (market and trading activities) and institutional sources.
6. Collection and Transportation	Open dumping is the main method of refuse disposal in most communities in the district. However, the method is not properly managed and has resulted in indiscriminate disposal of refuse and also the creation of huge piles of refuse in most settlements in the district. The service provider (Zoomlion Ghana Ltd.) started operating in the district in 2006. The service contract between the local government and the service provider was entered into in 2009 with a 5-year contract. The District consists of 58 communities and the service provider (Zoomlion) operates in 41 communities within the district. Both the communal and door-door system of waste collection are practiced in the district. Though the house-to-house collection system is more effective, it is not highly patronized by most communities due to the cost involved in its operation. Currently, the house-to-house collection system is practiced only in Ahenema and Kokoben communities with 220 clients. However, plans are underway to cover Kotwi and Brofoyedu communities. The waste collection is conducted twice a week but at Aburaso, the most populated community, the collection is carried out thrice a week. The following shows the communities where the 6 containers are located with 1 unit each in, Foase, Boko, Ampabame I, and Aburaso and 2 units in Krofrom.

Equipment (Zoomlion)	Staff (Zoomlion)
・ Roll on / off truck – 1 unit ・ Roll on /off containers – 6 units (5 operational) ・ Bola-taxi – 1 unit ・ Wheelbarrow – 19 ・ Tricycles – 45 (24 operational) ・ Motorbike – 1 ・ Waste bins – 220 (for door-to-door collection)	・ NAMCOP Team Leader – 1 ・ Janitor – 1 ・ Tricycle Supervisor – 1 ・ Tricycle mechanic – 1 ・ Truck mechanic – 1 ・ Truck driver – 1 ・ Sweepers – 180 ・ Sanitation guides (assists in health education) – 9

No.	Content
7. Final Disposal Site	The solid waste is not well managed since there is no proper engineered final waste disposal site. The dumping site for the district is located at Foase. It covers only 2 acres and is the crude type of dumping and uncontrolled. All the collected waste in the district is sent to this dump site for final disposal. However, waste from Krofrom community and Ampabame I community are sent to the Oti Sanitary Landfill Site in KMA due to its closeness. That is, it is about 40 - 60 km to send waste from the two above communities to Foase, whilst it is only 7 - 8 km to send waste from the two above communities to the Oti Sanitary Landfill Site. Due to the small size of Foase Dumping Site, frequent spreading was conducted in both 2010 and 2011. To help mitigate this situation, a new dumping has been acquired but due to political problems with the local chiefs, it is not yet in operation.
8. Challenges	• Need of proper road access to the open dump site. • Need of adequate sized final disposal site.

Table 6.1.10 Major Features of Current SWM in Atwima Nwabiagya District Assembly

No.	Content
1. Name of MMDA	Atwima Nwabiagya District Assembly
2. Area Size (km^2)	597
3. Population in 2010	149,025
4. Goal and Objectives of the DESSAP	The goal of the district is to improve the health status of the people in the district, through increased access to sanitation and improved hygiene by the year 2015. The objective of the district is to promote effective solid waste management and hygiene in 89 communities.
5. Solid Waste Generation and Components	The solid waste generation in the district is estimated at about 85 tonnes/day. Solid waste in the district is generated by domestic (household), commercial (market and trading activities) and institutional sources. The composition by weight of the various solid wastes being generated in the district is shown below. It is noted that organic component of solid waste generated by households, commercial areas and institutions such as schools is high, namely, 75%, 56% and 47%, respectively. Plastic waste is also high, especially in the urban / peri-urban commercial areas. Solid waste generated by institutions in the district is mainly organic and paper.

Waste Composition by Weight at Atwima Nwabiagya District Assembly

District: Atwima Nwabiagya District Assembly

Source	Composition by Volume (%)							
	Organic	Paper	Metal	Glass	Plastic	Wood	Textiles	*Total*
Household	75.0	4.0	1.0	1.5	9.0	2.0	7.5	100.0
Commercial	56.4	4.0	0.7	2.3	27.5	1.6	7.5	100.0
Institutional	47.5	34.0	0.0	1.5	8.5	8.5	0.0	100.0

Source: Seven-Year District Environmental Sanitation Strategic Action Plan (2009-2015), October 2009, Atwima Nwabiagya District Assembly

<table>
<tr><th>No.</th><th>Content</th></tr>
<tr><td>6. Collection and Transportation</td><td>
Open dumping is the main method of refuse disposal in most communities in the district. However, the method is not properly managed and has resulted in indiscriminate disposal of refuse and also the creation of huge piles of refuse in most settlements in the district. There are 28 huge piles of refuse in the district.

In 2007, the District Assembly entered into a 5-year contract with the service provider (Zoomlion Ghana Ltd.) for waste operation and it started operating in the district. The district has 89 communities of which the service provider (Zoomlion) operates the waste service in 31 communities. The waste collection rate in the district is estimated at about 26 %.

The District Assembly has only one tractor, one skip loader, eight large communal refuse containers and fifteen tricycles, for refuse collection and disposal in the district. About 112 people employed by the service provider are engaged in the collection and disposal of solid waste in the District. There is the need for additional refuse containers to be located at vantage points for refuse collection and its disposal in Abuakwa and other urban areas in the District.

<table>
<tr><th>Equipment (Zoomlion)</th><th>Staff (Zoomlion)</th></tr>
<tr><td>・ Roll on / off truck (15m^3) – 1 unit
・ Waste bins – 22
・ Tricycles – 50 (34 operational)
・ Roll on / off containers – 21units (7 containers for Zoomlion, 14 containers for the district)
6 containers of the district are not lifted / used because the platform on which they should be placed on is not prepared. Hence the total operational containers are 15.</td><td>・ Operations manager – 1
・ Tricycle supervisor – 1
・ NAMCOP leader – 1
・ Team leaders – 15</td></tr>
</table>

All the communities in the district are categorized into the six area councils which are Nkawie, Abuakwa, Afari, Akropong, Barekese, and Adankwame.

For efficient flow of work in the district, the service provide (Zoomlion) has divided the district into 3 zones, namely:
• Zone 1 (Abuakwa - Nkawie) has 8 team leaders
• Zone 2 (Abuakwa - Tabre) has 5 team leaders
• Zone 3 (Asuofua - Barekese) has 3 team leaders

Team leaders inspect the work of the sweepers and mark attendance registers
</td></tr>
<tr><td>7. Final Disposal Site</td><td>
Open dumping of refuse is the main method of refuse disposal in most communities in the District. This has resulted in the creation of huge piles of refuse in most settlements in the District. These huge piles of refuse serve as breeding grounds for mosquitoes and are a source of typhoid, cholera and other sanitation related diseases.

The District Assembly has final disposal sites each zone as the following table.

<table>
<tr><th>Zone</th><th>Zone 1
(both communal and house-to-house)</th><th>Zone 2
(only communal)</th><th>Zone 3
(only communal)</th></tr>
<tr><td>No. of Containers</td><td>9</td><td>2</td><td>4</td></tr>
<tr><td>Dumping Sites</td><td>1 (almost full)</td><td>1 (full)</td><td>1 (almost full)</td></tr>
<tr><td>Location of Dumping Site</td><td>Nerebehi</td><td>Koforidua</td><td>Barekese</td></tr>
</table>

Final disposal sites in the district are not adequate. Apart from the site located at Manhyia, which serves Abuakwa and its environs, other towns such as Nkawie, Toase, Asuofua, Barekese, Adankwame, etc. do not have final refuse disposal
</td></tr>
</table>

No.	Content
	sites. Most of the domestic waste that is generated in the district finds its way into drains, streams and other water bodies, and open spaces. The acquisition and development of sites for final disposal of refuse and intensive hygiene and sanitation education are necessary for proper waste management in the district. The final disposal site for solid waste is inadequate as only one site is available in the district.
8. Effective Management of Solid Waste	For effective safe solid waste management the following will be carried out: • Review and enforce District Assembly Sanitation bylaws on solid waste management • The district assembly will, in collaboration with private waste management organizations implement house-to-house collection of refuse in some urban and peri-urban settlements to complement the existing communal refuse collection approach • Provision of sanitation management equipment (plastic containers, communal refuse containers, refuse tuck, shovels, rakes, wheel barrows, etc.) • Remove existing refuse heaps • Land will be acquired, developed and protected against encroachment for disposal of waste in major settlements • Fumigate drains, refuse dumping sites and open spaces • Physical planning and management of physical management of physical development will be promoted in urban and peri-urban settlements to create the right conditions for effective waste management.
9. Challenges	• Need for final disposal dump sites • Need for heavy equipment for land-leveling and truck scales at the site • Need for adequate number of containers for collection and trucks for transportation • Need of IEC to public against bad attitude of communities (indiscriminate dumping)

6.2 Review of Past and Existing Development Plans and Projects for Solid Waste Management Sector

In recent years, due to the rapid rate of urbanization and population increase in Greater Kumasi, Kumasi Metropolitan Assembly (KMA) and the surrounding assemblies of five districts and one municipality, the Solid Waste Management (SWM) problem can no longer be tolerated technically or environmentally. Many environmental challenges regarding SWM have been caused by uncontrolled dumping for years in the past, which have serious consequences on public health and environmental hazards.

6.2.1 Final Oti Sanitary Landfill Site

The Government of Ghana, acting through the Ministry of Local Government and Rural Development (MLGRD), implements the second Urban Environmental Sanitation Programme II (UESP II) with IDA support and funded by the World Bank. Through the UESP II, a project regarding SWM started to introduce the construction and use of properly-engineered landfill sites in KMA. In 2004, KMA succeeded in construction of a sanitary landfill with a land area of 40 ha in Oti within KMA, and it is now in operation. In KMA, the current waste collection rate is 87%. This is a result of the improvement of urban infrastructure for solid waste management being conducted in the city urban areas.

6.2.2 Existing Plan and Programme

As stated in the Strategic Sanitation Plan for Kumasi 1996-2005[6], KMA is the forerunner in the adaptation of the strategic sanitation planning process owing mainly to the involvement of the World Bank's Regional Water and Sanitation Group (RWSG-WB) in the execution of the UNDP / KMA- Kumasi Sanitation Project (KSP).

KMA, with the assistance of RWSG-WB, produced a Strategic Sanitation Plan for Kumasi (SSP-Kumasi) for the period 1990-2000. The SSP-Kumasi identifies the facilities needed to provide comprehensive services; and describes the implementation and financing arrangements for each component. To implement this strategy KMA will (i) strengthen and re-orientate its KMA-WMD to oversee implementation; (ii) promote provision of services by the private sector; and seek financing for a mix of household, public and school facilities to serve the city's low and middle income households.

The plan differs from a traditional master plan in that it (i) matches recommended technical options to each type of housing area in the city, (ii) considers user preferences and willingness-to-pay, (iii) uses relatively short planning horizon (10 - 15 years), emphasizing actions that can be taken now, and (iv) breaks the overall plan into projects that can be implemented independently but which together provide full coverage.

Then, the Environmental Sanitation Policy (Revised, 2009) was revised and it is the outcome of reviews to address limitations of the old policy published in 1999.[7] The revised policy was approved by the Cabinet in March 2010 and it is expected that the planning

[6] The Strategic Sanitation Plan for Kumasi 1996-2005, June 1995, KMA, Republic of Ghana
[7] "Environmental Sanitation Policy (Revised 2009)" April 2010, MLGRD, Ghana

guidelines issued by the National Development Planning Commission to MMDAs for preparing and updating Medium Term Development Plans will adequately identify priorities of District Environmental Sanitation Strategies and Action Plans (DESSAPs) to enable the implementation of measures and actions of this policy at the appropriate decentralized local government levels.

Definitions of solid waste management in components of environmental sanitation are stated in Annex 3 of the Environmental Sanitation Policy (Revised, 2009) as below.

Solid waste comprise all solid waste materials generated by households, institutions (including health-care waste from hospitals and clinics), commercial establishments and industries, and is discharged from their premises for collection; all litter and clandestine piles of such wastes; street sweepings, drain cleanings, construction/demolition waste, dead animals and other waste materials. Hazardous wastes comprise those wastes that are toxic, flammable, corrosive, radioactive, explosive or otherwise dangerous as defined by the EPA. Primary responsibility for solid waste management rests with the Assembly. However, in general, the private sector shall be invited to provide the actual services under contract or franchise, as appropriate. In the case of franchise, the franchisee may propose services above the minimum specified standard, as long as the user's willingness and ability to pay can be relied upon. The franchisee may also propose tariffs and subsidy levels, subject to final approval by the Assembly.

Site acquisition for treatment and disposal of wastes such as landfills, compositing facilities, waste stabilization ponds, trickling filters, septage treatment plants, etc. shall be located not to create safety hazards or aesthetic problems in the surrounding area. In order to ensure adequate provision of such sites, all district assemblies shall be required to:

- produce medium and long term plans for the provision of treatment and disposal sites, including the preparation of environmental impact assessments;
- acquire sufficient land and secure title with payment of due compensation for the land for immediate and future use and protect such acquisitions by proper demarcation, fencing, etc.; and
- ensure that the sites are managed so as to satisfy approved environmental protection standards

Relevant legislation on the acquisition of land for treatment and disposal sites shall be reviewed and legislative and administrative provisions established to facilitate site valuation, negotiation and payment of compensation by the district assemblies.

6.2.3 MRF and Recycling

(1) Establishment of MRF

In 2011, the KMA-WMD acquired 100 acres of land (40 hectares) to build a Material Recovery Facility (MRF) at Adagya, a peri-urban community in the Bosomtwe District Assembly, Greater Kumasi. The land is located at about 10 km from the center of Kumasi and just about 2 km in a straight line from the Oti Sanitary Landfill Site. The site construction cost will be about US$25 million excluding GHC 0.5 million of the operation and maintenance cost. The contract agreement between the Bosomtwe District Assembly

and the investor / contractor (Zoomlion Ghana Ltd.) will be entered into when the MRF is built.

The construction of MRF is to start in mid 2012 with 18 month construction period. The same type of recycling plant which has been constructed in the Accra Composting and Recycling Plant is to be constructed on this site. The site includes not only MRF but also recycling, composting, and possible future landfill purposes and the operation scale will be expected to be about 600 tonnes/day.

In Greater Accra Region, a new MRF, Accra Composting and Recycling Plant will be open and be commissioned soon in 2012 after about 15 months construction work at Adjen Kotoku, Accra Nsawam (refer to Figure 6.2.1). The Accra Composting and Recycling Plant is located about 43 km from Accra, with the total land area of 80 acres (32 ha). The total construction cost including costs of equipment manufacturing and installation and O&M is about GHC 40 million. Waste materials to be sorted and used in the plant are plastics, metals, papers, organics, etc. and are to be carried from the disposal sites in Accra. Accra Metropolitan Assembly currently generates an average of 2,000 tonnes of solid waste daily, of which only 60% is collected and 40% uncollected. It is expected that about 600 tonnes (50% of the collected waste) will be used at the MRF plant operation daily under two-shift a day operation.

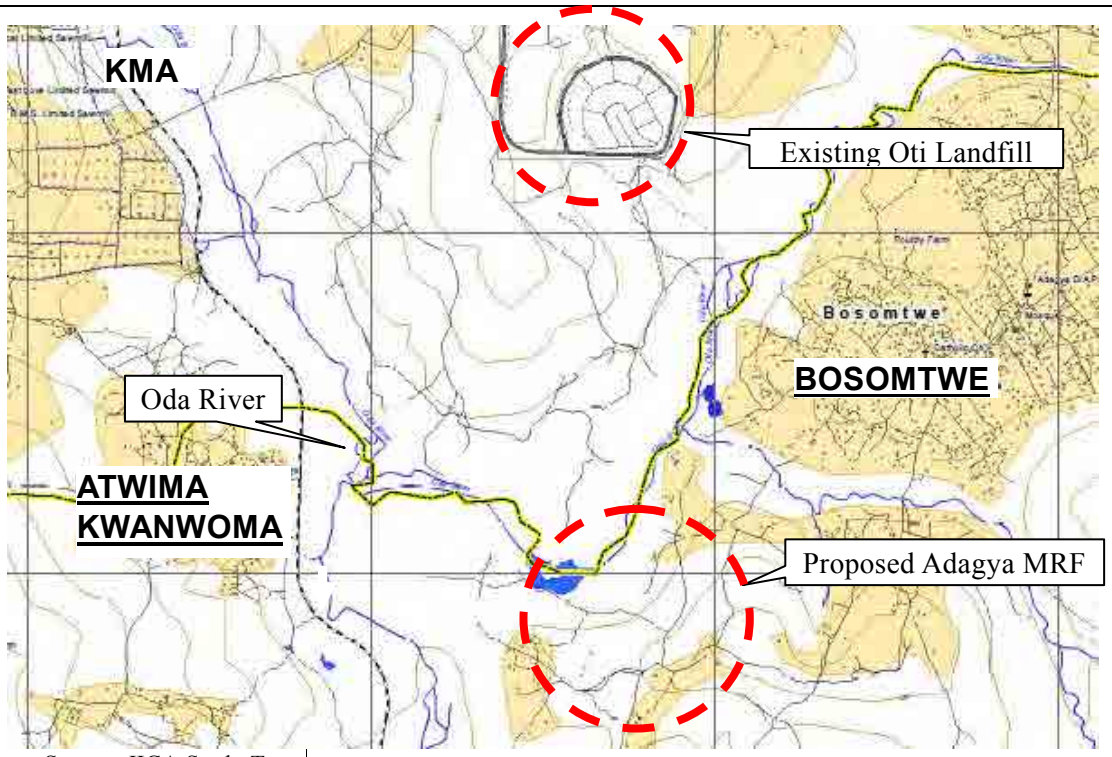
(Under construction, 2012)
Accra Composting & Recycling Plant

Accra Composting & Recycling Plant

Source: JICA Study Team, 2012

Figure 6.2.1 Existing Accra Composting and Recycling Plant

Waste managing should be found as a matter of urgency. The pressing situation has led to the establishment of the Accra Composting and Recycling Plant. In particular, the scarcity of land will be one of the future challenges for Greater Kumasi.



Source: JICA Study Team

Figure 6.2.2 Existing Oti Landfill Site and Proposed Adagya MRF Site in Greater Kumasi

(2) Composting and Recycling

In the KMA, composting and recycling of waste materials have not yet been conducted. It is recommended to consider composting and recycling as an option for household waste treatment to reduce waste amounts, it is important to separate the waste at the source into at least three categories. In Kumasi, as the most part of household waste from the Metropolitan area is biodegradable organic waste, which is more than 40% as shown in Figure 6.1.3, the option which could be primarily considered is compositing. The miscellaneous fraction, comprising a mixture of organic and inorganic material that cannot be composted must be land filled.

If waste separation is implemented properly in Kumasi, composting and / or landfilling would be good options for handling household waste. To implement recycling, it is therefore noted that local residents in Greater Kumasi have to be educated through IEC campaign (Information, Education and Communication) before waste is deposited into containers or dustbins, to separate waste at the source.

(3) Pilot Research of Fecal Sludge Treatment Plant

In an effort to develop the world's first technology for converting fecal sludge into biodiesel using the cutting-edge research such as that being done by Water Enterprisers Ltd., Columbia University, and Kwame Nkrumah University of Science and Technology (KNUST), a pilot project is planned to start at the Fecal Sludge Treatment Plant (FSTP) in the Oti Landfill Site. The cutting-edge research is an attempt to convert human waste to liquid fuel.

6.3 Issues on the Solid Waste Management Sector

Open dumping methods are still used in major urban areas of the surrounding districts and municipality, while KMA uses sanitary landfill sites. The percentages of collected solid wastes out of generated solid wastes in the surrounding districts and municipality are still low (30 - 80%). Although the waste collection and disposal practices in the districts Assemblies have been conducted since 2006, the waste situation becomes worse and it is one of pressing issues requiring concerted actions. See Table 6.3.1 for the summary of current conditions for solid waste management.

Table 6.3.1 Current Conditions of Solid Waster Management in Greater Kumasi Sub-Region

Assembly	KMA	Afigya-Kwabre District	Kwabre East District	Ejisu-Juaben Municipality	Bosomtwe District	Atwima Kwanwoma District	Atwima Nwabiagya District
Population*1 (2010)	2,035,064	136,140	115,556	143,762	93,910	90,634	149,025
Waste Generation (tonnes/day)	1,500	61	64	73	37	43	85
Collection & Transport system	Both house-to-house & communal collection	Communal container collection only	Communal container collection only	Communal container collection only	Both house-to-house & communal collection	Both house-to-house communal collection	Both house-to-house & communal collection
Collection Rate	87 %	45 %	62 %	59 %	78 %	60 %	26 %
Open Dump Sites	2 open dump sites will be full and completely closed in 2013.	Almost every community has an open dump site.	Almost every community has an open dump site.	Almost every community has an open dump site.	Almost every community has an open dump site.	Almost every community has an open dump site.	Almost every community has an open dump site.
Final Disposal Site	Existing Oti sanitary landfill (40 ha)	No existing final disposal site (the last dump site was fully closed in 2011.)	1 existing open dump site (1.5 ha)	2 existing open dump sites (one is almost full, the other is far away)	1 existing open dump site (2 ha)	1 existing open dump site (1 ha)	3 existing open dump sites (2 are almost full, the other is far away)
Waste carried to the Site (tones/day)	1,300	27	40	43	29	26	22
MRF* / Recycling	One MRF plant planned (40 ha).	So far no plan	So far no plan	So far no plan	So far no plan	So far no plan	So far no plan
For Future Greater Kumasi	Another final landfill site would be sought for future disposal.	Adequate final disposal site is required.	Adequate final disposal site is required.	Adequate final disposal site is required.	Adequate final disposal site is required.	Adequate final disposal site is required.	Adequate final disposal site is required.

Source*1: GSS, 2010 Population and Housing Census, 2010
Source: KMA, Districts / Municipality, Zoomlion GH Ltd.
Notes: *Material Recovery Facility

As can be seen from the table, the low collection rate and lack of well planned existing final disposal sites are the major issues in SWM.

- Waste collection and transportation by service providers shall be enhanced and plan based on the proper system, and additional refuse containers and loader trucks for proper collection and transportation system are required in the Municipality and District Assemblies of Greater Kumasi. Also, the transfer station system shall be enhanced and planned properly.

- Need for well-documented solid waste management because the documentation of accurate data is faced with handicaps, making it difficult to plan the collection and treatment of household waste, particularly in the Municipality and District Assemblies.
- All unapproved disposal sites shall be controlled well by the administrators in the Municipality and District Assemblies.
- There is a need for vacant land on which to construct properly planned and designed final disposal sites, as current sites for final disposal of refuse are inadequate in the Municipality and District Assemblies.
- The final disposal sites which are to be located in Greater Kumasi shall be adequately planned so as to accommodate all the wastes generated up to the target year of 2025. Against the projected future population of about 4 million in 2025 for Greater Kumasi, it is estimated that the required capacity of landfill sites in the Greater Kumasi may be 21 million m^3 in total (assuming a landfill density of 0.6 tonne/m^3).
- Intensive hygiene and sanitation education to the public are necessary for proper waste management in Greater Kumasi, and in order to improve the current SWM system in Greater Kumasi, all the concerned MMDAs, related agencies, citizens, NGOs, and private sector entities involved shall enhance their capabilities through the IEC (Information, Education and Communication) campaign.

Full existing final open dump site
(Afigya-Kwabre District Assembly)

Existing final open dump site at Ejisu Town
(Ejisu-Juaben Municipality Assembly)

Existing final open dump site
(Kwabre East District Assembly)

Existing final open dump site near Juaben Town
(Ejisu-Juaben Municipality Assembly)

Existing final open dump site
(Atwima-Nwabiagya District Assembly)

Existing community open dump site
(Bosomtwe District Assembly)

Source: JICA Study Team, 2012

Figure 6.3.1 Conditions of Existing Open Dump Sites in Districts and Municipality of Greater Kumasi (2012)

Chapter 7 Liquid Waste Sector of Greater Kumasi Sub-Region

7.1 Present Situation of Liquid Waste

7.1.1 Institutions and Responsibilities

According to the Environmental Sanitation Policy[1], MMDAs (Metropolitan, Municipality and District Assemblies) shall ensure the availability of facilities for the safe handling and disposal of human excreta (night soil and sewage), industrial waste, animal manure, industrial sewage and domestic / commercial wastewaters. These include excreta disposal facilities and systems for the conveyance (sewerage, vehicular and manual), treatment and final disposal of liquid waste. The Ministry of Local Government and Rural Development (MLGRD) issues technical guidelines from time to time specifying which technologies may be used, including design parameters and recommended operating procedures.

The Waste Management Department (WMD) of Kumasi Metropolitan Assembly (KMA) and Works Department (WD) of districts and municipality surrounding KMA are in charge of the construction/maintenance (hard side) of the management of liquid waste. On the other hand, the Environmental Health Departments (EHD) of all assemblies in Greater Kumasi are in charge of the environmental sanitation education, inspection / enforcement of sanitary regulations etc. (soft side) regarding the liquid waste.

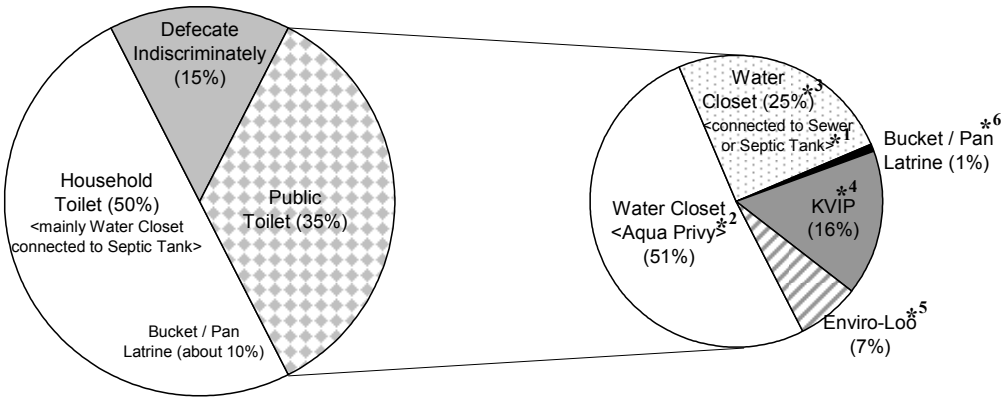
7.1.2 Present Situation

(1) Kumasi Metropolitan Assembly

1) Toilet Facilities

The 2011 annual report prepared by the KMA-WMD states that of the over 2 million population in the metropolis, 35% rely on public toilets, about 50% have access to household toilets (most rely on on-site holding facilities; septic tanks) and the remaining defecate indiscriminately. Comparing the population using public toilets in the year 2000, which was 36.8% (2000 Population and Housing Census), public toilet usage percentages in 2000 and 2011 are almost the same; thus, it can be said that public toilets in KMA have increased in number along with the population growth. The figure below shows the overview of the toilet situation (including the toilet type) in KMA.

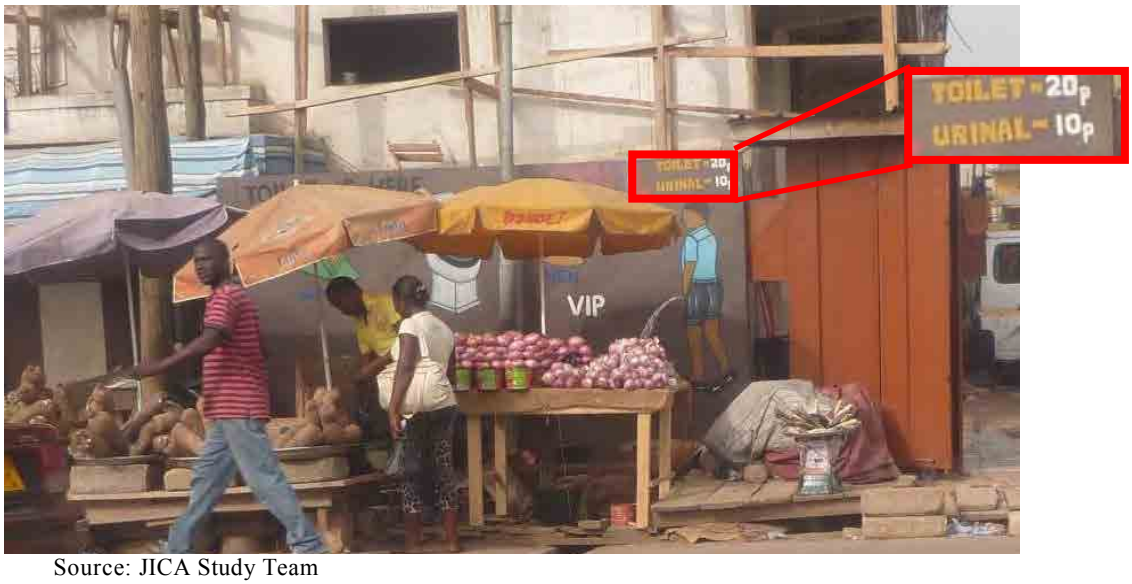
[1] Ministry of Local Government and Rural Development (2010), Environmental Sanitation Policy (Revised 2009)



Source 1: <Household-Public Toilet, Defecate Indiscriminately> KMA-WMD 2011 annual report
Source 2: <Breakdown of Public Toilets> Colombia University Working Paper[2]
(based on KMA-WMD 2008 data)
Note: Although data for different years (2011/2008) are applied, they can express the overview of the toilet situation

*1 A covered, horizontal flow tank that involves a series of treatments. The effluent will be soaked into the ground or discharged to a drainage. Septage at the bottom of septic tank is collected by the cesspit emptier to the Oti septage treatment pond for treatment before discharging to the drainages.
*2 Squatting plate is directly above a tank. Septage is collected by the cesspit emptier to the Oti Septage Treatment Pond.
*3 Flush toilet which is linked to a septic tank or sewer.
*4 Kumasi Ventilated Improved Pit Latrine (or Double Vaulted / Twin Pit Latrine). A pit latrine which has two adjoining pits. One pit is covered when full in order to allow the material to digest. Meanwhile the other pit is used.
*5 A dry sanitation toilet system that functions without water.
*6 A bucket or pan placed under a toilet. It is emptied manually when full. Environmental Sanitation Policy and KMA's Byelaw clearly mentioned that the use of bucket / pan latrine is banned and the existing ones shall be phased out.

Figure 7.1.1 Overview Toilet Situation in KMA



Source: JICA Study Team

Figure 7.1.2 Public Toilet (type: VIP) at Asafo Community

[2] Colombia University (2010) MCI Social Sector Working Paper Series No. 16/2010, A Water and Sanitation Needs Assessment for Kumasi, Ghana (hereinafter Colombia University Working Paper)

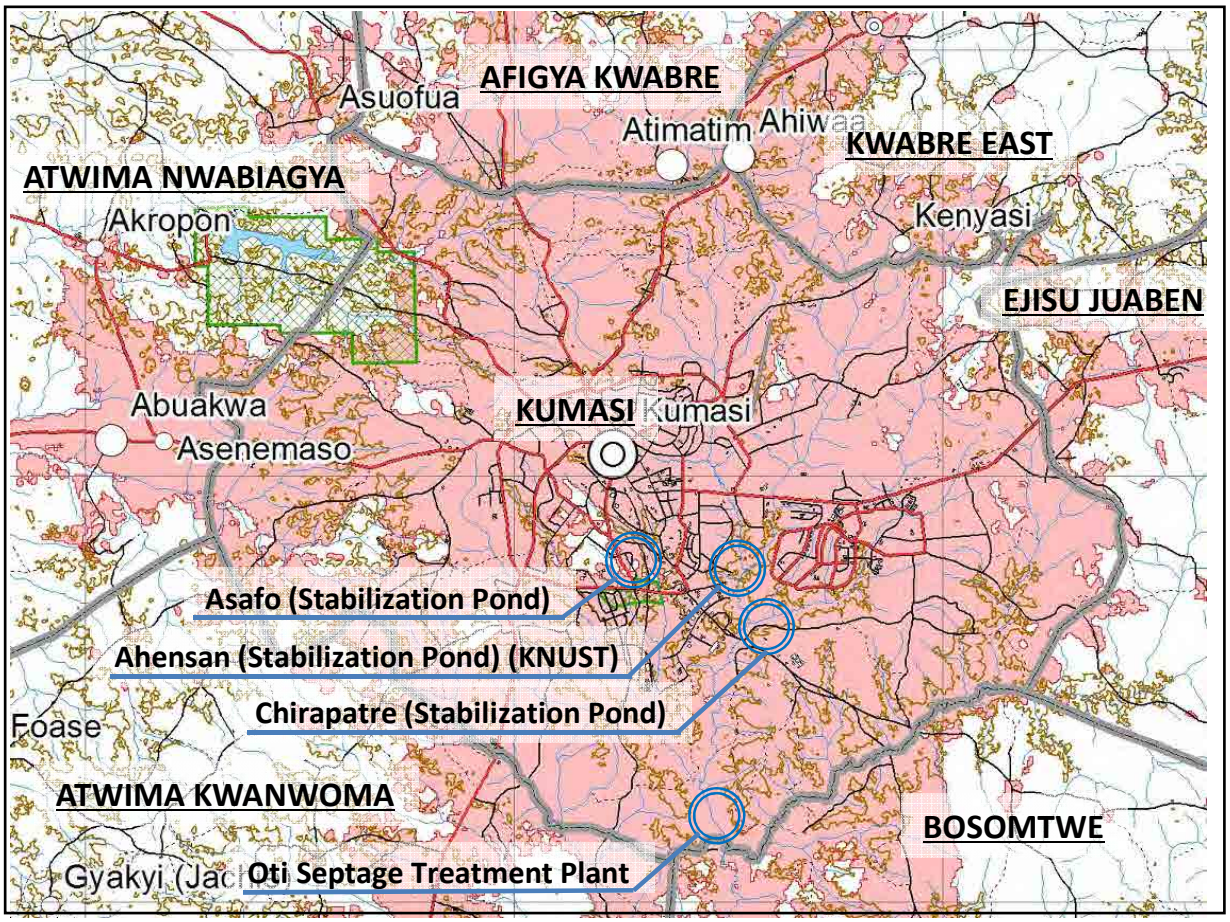
KMA has determined that 0.20 GHC is the maximum charge for using a public toilet. However, according to the survey of the charge of using public toilets3, the charge has a range in between 0.10 - 0.30 GHC. Toilets far from the city center and toilets which have fewer facilities (such as fans on the ceiling, doors on the cubicles, radios etc.) tend to charge less. This survey report also mentioned that provision of public toilets in KMA relies on three primary models as follows.

- Facilities run by the Sub Metropolitan Areas
- Facilities run by assembly members
  The Guidelines for the Provision, Operation and Maintenance of Public Toilets issued by the Ministry of Local Government and Rural Development categorically states that "due to widespread abuse in the past, the practice of assembly members managing public toilets is not permitted." assemblymen are also barred from "being involved in firms bidding for toilets within their own constituency." In practice though, as discussed throughout this document, most assembly members continue to run at least one public toilet facility in their jurisdiction.
- Facilities run by private franchisees under Build, Operate and Transfer contracts

2) Liquid Waste Facilities

Of all the communities in Kumasi, only three (Asafo, Ahinsan and Chirapatre) are sewered. All beneficiaries of the sewerage system in the sewered communities pay for services. According to the 2000 Population and Housing Census, 8.8% of household in Kumasi Metropolitan Area are connected to the sewerage system. Septage from the aqua privy and septic tank are delivered to the Oti Septage Treatment Pond. Location and details of the 3 sewerage systems and Oti Septage Treatment Pond are summarized in Figure 7.1.3 and Table 7.1.1 respectively.

[3] Ken Caplan (2010) Quick Stakeholder / Context Analysis of Public Toilets in Kumasi, Ghana: Initial Recommendations for WSUP



Source: JICA Study Team

Figure 7.1.3 Liquid Waste Facilities in KMA

As mentioned in the Development Plan for Kumasi Metropolitan Assembly (2010-2013), the industries known for discharging large volumes of effluent are Guinness Ghana Brewery Limited, Coca Cola Bottling Company and Kumasi Abattoir. The Guinness Ghana Brewery Limited and Coca Cola Bottling Company have installed treatment plants on the site with Environmental Health Officers who ensure that the effluent discharge into the water bodies in the Metropolis are free from contamination. The abattoir, however, is not endowed with this facility and hence has been discharging its untreated effluents into the water bodies.

Table 7.1.1 Details of Liquid Waste Facilities in KMA (In Preparation)

	Constructed	Treatment Target	Treatment Method	Remarks
Asafo Sewerage System (collect wastewater from Asafo Community Golden Tulip Hotel, KATH, and 4BN army barrack)	1994	320 households	Stabilization pond (also referred as oxidation pond or lagoon)	・ Owned by KMA ・ Operated by Contractor
Ahensan (Ahinsan) Sewerage System (near to the KNUST)	2000		Stabilization pond	・ Owned by KMA ・ Operated by Contractor
Chirapatre (Kyirapatre) Sewerage System			Stabilization pond	・ Owned by KMA ・ Operated by Contractor
Kumasi National University of Science and Technology (KNUST) Sewerage System	1950s	KNUST	Trickling filter type	・ Owned by KNUST ・ The treatment plant was out of order for about 20 years, until pumps and pipes were replaced and/or restored in 2007.
Oti Septage Treatment Pond	2004	Septage / wastewater of KMA and its surrounding districts and municipality. Leachate from the adjoining landfill site	Stabilization pond	・ Capacity:600 m^3/day (assuming 300 m^3/day of septage and 300 m^3/day of leachate) ・ The acceptable effluent standard from the septage treatment pond system is a BOD loading of < 75 mg/L. ・ The stabilized bio-solids are sand dried and stored at certain locations on the landfill. ・ The septage treatment ponds and access roads occupy approximately 80,000 m^2. ・ Constructed under the Urban Environmental Sanitation Project (UESP I) ・ Kaase and Buobai (capacity 200 m^3/day) ponds were treating the wastewater / septage in the past. These 2 ponds are not functioning now.

Source: <Oti Septage Treatment Pond> MLGRD (2002) Proposed Sanitary Landfill and Septage Treatment Facilities for Kumasi, KMA (2011) Environmental Management and Monitoring Plan for Construction of Additional Landfill Cell at the Oti Sanitary Landfill Site in Kumasi
<KNUST Sewerage System> Bernard Keraita et al. (2003) Influence of urban wastewater on stream water quality and agriculture in and around Kumasi, Ghana

(2) Districts and Municipality surrounding KMA

There is no sewerage system or septage treatment facility in any of the districts and municipality surrounding KMA. The present situations of toilets in these areas are summarized below.

Table 7.1.2 Toilet Situation in Districts and Municipality surrounding KMA

		Rate (%)						
		W.C.	Pit latrine	KVIP	Bucket/Pan	Other	Public toilet	No facilities
KMA	Urban	40.1	10.7	7.1	0.3	0.4	38.8	2.5
Afigya-Kwabre	Urban	22.1	34.6	10.5	0.3	0.2	24.4	7.7
	Rural	10.1	24.0	16.0	0.2	0.3	38.4	11.0
Kwabre East	Urban	22.3	20.0	10.7	0.1	0.2	42.4	4.2
	Rural	16.1	22.1	12.2	0.2	0.2	37.8	11.4
Ejisu-Juaben	Urban	21.3	23.9	11.8	0.3	0.2	36.8	5.8
	Rural	8.5	20.6	9.8	0.2	0.5	53.7	6.7
Bosomtwe	Urban	16.9	25.9	16.0	0.1	0.3	37.3	3.4
	Rural	5.8	25.0	8.8	0.4	0.3	53.0	6.7
Atwima Kwanwoma	Urban	21.8	26.9	12.0	0.1	0.4	30.4	8.4
	Rural	9.9	25.9	10.2	0.6	0.4	41.4	11.6
Atwima-Nwabiagya	Urban	24.6	23.6	10.5	0.3	0.4	38.2	2.4
	Rural	14.5	24.5	10.1	0.1	0.2	44.1	6.5
Total	Urban	38.2	12.2	7.6	0.3	0.4	38.5	2.8
	Rural	10.7	23.6	11.3	0.3	0.3	45.1	8.7
Total	KMA	40.1	10.7	7.1	0.3	0.4	38.8	2.5
	Other Districts	14.4	24.0	11.4	0.2	0.3	42.2	7.5
Greater Kumasi Sub-Region		33.3	14.2	8.2	0.3	0.4	39.7	3.8

Source: GSS, 2010 Population and Housing Census

1) Afigya Kwabre District

According to the Sanitation and Strategies Action Plan (2008-2015) prepared by Afigya Kwabre District, the toilet situation is as below.

Table 7.1.3 Toilet Situation in Afigya Kwabre

Town / Area Council	Pop. (2008)	Household Toilets	Public Toilets
Nkaben	28,307	122	16
Kwabre Manyia	15,018	199	6
Ahinaso	33,370	1,209	7
Kyekyewere	33,836	327	10
Tetrem	22,035	259	11
Adumakase	9,126	128	6
Total	141,692	2,244	56

Source: Afigya Kwabre District Environmental, Sanitation and Strategies Action Plan (2008-2015)

2) Atwima Kwanwoma District

According to the Atwima Kwanwoma District Assembly Environmental Sanitation Plan 2008-2015, the toilet situation in 2008 is summarized in the Table below. As can be seen from the table, the main types of toilet facilities in the District include: KVIP, WC, VIP, Aqua Privy, Pan and Pit latrines. It is mentioned that 40% of the population dispose of liquid waste to the facilities listed in Table 7.1.4.

Table 7.1.4 Liquid Waste Collection Situation in Atwima Kwanwoma District

Category of Service		Current services		
		Facility	Number	Capacity
1. Public		WC	3	12 seater
		KVIP	7	12 seater
		A. PRIVY	3	12 seater
		PIT	48	12 seater
		OTHERS	12	12 seater
2. Private		WC	3,215	
		KVIP	47	
		VIP	45	
		A. PRIVY	20	
		PAN	431	
		PIT	133	
3. Institution	a) Health, Police, Prison, Barrack	WC	50	
	b) Schools	WC	84	
		VIP	7	
		A. PRIVY	8	
		OTHERS	3	

Source: Atwima Kwanwoma District Assembly Environmental Sanitation Plan 2008–2015

3) Atwima Nwabiagya District

According to the Seven-Year District Environmental Sanitation Strategic Action Plan (2009-2015) prepared by the Atwima Nwabiagya District Assembly, the toilet situation in the district as of 2008 was as follows.

Access to safe toilet facilities in the district is 33.17%
Total coverage in the rural areas is about 20.58% and that of the urban / peri-urban areas is 37.58%
There are 138 public basic schools; 42 of them have safe toilet facilities
There are 5 major markets; 2 of them have safe toilet facilities

Breakdown of the above numbers is shown in the following tables.

Table 7.1.5 Percent Coverage of Safe Toilet Facilities by Area Council

Areas Council	2008 Total Population	No. of Toilet Holes			Total Pop. Served	Total Coverage
		HH VIP	HH WC	Public Toilet		
Abuakwa	42,613	103holes	283 holes	260 holes	16,860	39.57 %
Akropong	43914	187 holes	87 holes	200 holes	13,020	29.65 %
Nkawie-Toase	26,761	125holes	137 holes	130 holes	9,817	36.68 %
Barekese	32,251	54 holes	50 holes	82 holes	5,130	15.91 %
Afari	12,421	21 holes	82 holes	60 holes	4,040	32.53 %
Adankwame	26,891	197 holes	222 holes	166 holes	12,450	46.30 %
District Total	184,851	687 holes	861 holes	898 holes	61,317	33.17 %

Source: Seven-Year District Environmental Sanitation Strategic Action Plan (2009-2015)

Table 7.1.6 Urban / Peri-Urban and Rural Safe Toilet Facility Coverage by Area Council

Area Council	Urban /Peri-Urban			Rural		
	2008 Total Population	Population Served	Coverage	2008 Total Population	Population Served	Coverage
Abuakwa	42,613	16,860	39.57 %	---	---	---
Akropong	32,346	9,250	28.60 %	11,568	3,770	32.59 %
Nkawie-Toase	17,208	6,080	35.33 %	9,556	3,737	39.11 %
Barekese	12,938	3,940	30.45 %	19,373	1,190	6.14 %
Afari	9,916	3,980	40.14 %	2,505	60	2.40 %
Adankwame	21,794	11,310	51.90 %	5,097	1,140	22.37 %
District	136,815	51,420	37.58 %	48,099	9,897	20.58 %

Source: Seven-Year District Environmental Sanitation Strategic Action Plan (2009-2015)

Table 7.1.7 Institutions in the District by Area Councils

Area Council	No. of Public Health Facility	No. with Toilet	No. of Public Basic Schools	No. with Toilets	No. of Markets	No. with Toilets
Abuakwa	1	1	16	2	1	0
Akropong	1	1	37	10	1	1
Nkawie_ Toase	1	1	27	17	1	1
Barekese	1	1	22	4	1	0
Afari	0	0	10	3	0	0
Adankwame	1	1	26	6	1	0
Total	5	5	138	42	5	2

Source: Seven-Year District Environmental Sanitation Strategic Action Plan (2009-2015)

4) Kwabre East District

According to the District Medium Term Development Plan (2006-2009) of Kwabre East District, toilet facilities available in the district are KVIPs, aqua privy, pit and VIP (household) latrines. The majority of the people (54%) depend on public toilet facilities while 20% have access to a private place of convenience. The inadequacy of public toilet facilities compels some of the people to dispose of human excreta in the bush (5%) while a good number of them bury their human waste behind their houses and the remaining (21%) use pit latrine.

5) Bosomtwe District

According to the District Environmental Sanitation Strategy and Action Plan (Dessap, 2010-2013) prepared by Bosomtwe District Assembly in 2010, liquid waste facilities are summarized in the tables below.

Table 7.1.8 Liquid Waste Facilities in Bosomtwe Area Council

Name of Area Council	Category	Types of Toilet Facilities and Quantities						
		WC	STL	KVIP	VIP	PAN	PIT	Others
Kuntanase Area Council	Public	0	4	19	0	0	26	2
	Private	76	1	0	10	0	33	0
	School	0	0	5	0	0	1	---
	Industrial	20	0	0	0	0	0	0
Jachie / Pramso Area Council	Public	0	0	17	0	0	14	0
	Private	100	1	0	611	0	6	1
	School	14	0	39	8	0	22	0
	Industrial	20	0	0	4	0	1	0
Boneso Area Council	Public	0	1	7	0	0	14	0
	Private	28	0	0	72	0	26	0
	School	0	0	8	0	0	3	0
	Industrial	0	0	0	0	0	0	0

Source: District Environmental Sanitation Strategy and Action Plan (Dessap, 2010-2013)

Table 7.1.9 Liquid Waste Facilities in Bosomtwe District (Excluding Area Councils)

Category	WC	KVIP	VIP	Aqua Privy	Environ Loo	PIT
Private	193	---	666	1	---	91
Public	---	46	---	4	4	58
School	2	89	8	---	---	9
Industrial	28	_	4	---	---	4
Total	223	135	678	5	4	162

Source: District Environmental Sanitation Strategy and Action Plan (Dessap, 2010-2013)

The district has a big problem with the management of both solid wastes and liquid waste. With liquid waste, the problem is the inadequacy of public latrines and as a result, some communities are still using pit latrines and those without the pit latrines are practicing open defecation and others also use the refuse dumps.

6) Ejisu-Juaben Municipality

As mentioned in the Ejisu-Juaben Municipality Environmental Sanitation Strategic Action Plan (2009-2020), the situation of both private and public toilets are as the following tables.

Table 7.1.10 Type of Private Toilets in Ejisu-Juaben

Area Council	No. Houses	WC	KVIP	STL	PAN	PIT	VIP	Total
Ejisu	6,376	536	---	---	---	1	139	676
Juaben	6,860	49	9	---	---	30	562	650
Hwere Anum	1,714	8	38	---	---	---	67	113
Kwabere Mponua	7,869	1459	---	---	---	489	137	2,085
Besease / Bonwire	4,452	154	---	---	---	68	253	475
Anum River	2,482	33	---	---	---	39	67	139
Mponua	2,944	22	---	---	---	---	164	186
Onwe	1,822	26	2	---	---	31	233	292
Total	34,519	2287	49	0	0	658	1622	4,616

Source: Ejisu-Juaben Municipality Environmental Sanitation Strategic Action Plan (2009-2020)

Table 7.1.11 Type of Public Toilets in Ejisu-Juaben

Area Council	No. Houses	WC	KVIP	STL	PAN	PIT	VIP	Total
Ejisu	6,376	---	5	3	---	---	2	10
Juaben	6,860	1	7	3	---	---	28	39
Hwere Anum	1,714	---	14	---	---	4	14	32
Kwabere Mponua	7,869	---	17	2	---	1	2	22
Besease/Bonwire	4,452	---	7	1	---	---	---	8
Anum River	2,482	---	6	3	---	---	14	23
Mponua	2,944	---	11	---	---	---	6	17
Onwe	1,,822	---	7	---	---	---	---	7
Total	34,519	1	74	12	0	5	66	158

Source: Ejisu-Juaben Municipality Environmental Sanitation Strategic Action Plan (2009-2020)

7.2 Review of Past and Existing Development Plans and Projects for the Liquid Waste Sector

7.2.1 Kumasi Metropolitan Assembly

(1) Strategic Sanitation Plan for Kumasi

Under the UNDP Water and Sanitation Program, KMA had produced a Strategic Sanitation Plan for Kumasi (SSP-Kumasi) in 1999. This plan recommended different sanitation systems for different areas of the city as follows.

- High Density Tenement Area (300 - 600 person/ha): Simplified Sewerage System
  In the high-density tenement area, it is concluded that sewerage is the only viable option, as there is insufficient open space for WC / septic tank drain fields, inadequate room on the ground floor for VIP latrines, and interference from the multi-storey buildings themselves with the wind flow needed for proper ventilation of VIP latrines.
- Medium Density Indigenous Area (20 - 50 person/ha): Household Latrines (VIP)
  In the medium-density indigenous area, household latrines and WC / septic tanks are viable technologies. However, WC / septic tanks are not recommended in medium density areas because they are more expensive than sewers and wastewater almost always overflows to street drains.
- Low Density Area: Household Latrines or WC / septic tanks
  In the estate and low-density, high-cost housing areas, latrines and WC / septic tanks are viable.

According to KMA-WMD, SSP-Kumasi is not finalized; thus no detailed plan was proposed in the report. Moreover, due to population growth in KMA, the situation has changed since 1999. Therefore, it is clear that an updated sanitation plan is necessary.

(2) Fecal Sludge-to-Biodiesel Pilot Plant

KMA recognizes that converting human waste to liquid fuel may bring great public benefits. Therefore, in February 2012, KMA had made an agreement with the Waste Enterprisers Ltd., Columbia University, and Kwame Nkrumah University of Science and Technology to conduct research on Fecal Sludge-to-Biodiesel at the Oti Septage Treatment Pond for 2 years. The Bill & Melinda Gates Foundation (Seattle, WA, USA) has funded this research.

(3) Public Toilet Management Policy

According to the 2011 annual report prepared by KMA-WMD, a public toilet management policy was developed with the view to streamlining the operations and management of public toilets in the city. The purpose was to establish a policy to insulate investors from loosing funds through illegal seizure of sites and protect an important revenue source for the assembly. This policy report includes the public toilet mapping. However, it has not received the Assembly's ratification yet. This management policy supports the Environmental Sanitation Policy which stipulates that "where possible, environmental sanitation services shall be provided by the private sector".

However, according to S. Oduro-Kwarteng et al. (2009)[4], most of the households using public toilets (86%) were not satisfied with the cleanliness and odor. Hopefully, the Public Toilet Management Policy will contribute to the improvement of public toilet services.

There is one more topic regarding public toilets. According to the UNICEF / WHO Joint Monitoring Programme on sanitation, public shared toilets (and home toilet facilities shared by more than one household) are not considered as improved sanitation. This means increasing the number of public toilets does not contribute to the MDG7 target[5]. However, the Study Team is of the opinion that efforts to develop public toilets are important. Moreover, it is expected that the number of household toilets will increase in the future because in the KMA (Building) Bylaws of 2011 (Assembly has not yet ratified), it is stipulated that for the purposes of granting a building permit, the KMA shall take into consideration the adequate provision of toilets in the house.

7.2.2 Districts and Municipality surrounding KMA

All the districts and municipality surrounding KMA have an Environmental Sanitation Action Plan. The plans generally propose the construction of toilets; however it seems that there is difficulty in the implementation. Although MMDAs shall ensure the availability of facilities for the liquid waste, it seems that districts and municipality have been receiving assistance from the CWSA (Community Water and Sanitation Agency) for the provision of toilets in the past.

Furthermore, a few assemblies are taking action to construct septage treatment facilities in their areas; for instance, Kwabre East District Assembly is negotiating with the land owners to build septage facilities at Kenyase and Abirem, and Ejisu-Juaben Municipality Assembly is planning to construct a sewage treatment plant of not less than 100 ha in size along the Oda[6] River. However, definite plans are not yet available.

[4] S. OduroKwarteng, E. Awuah & K. B. Nyarko (2009) Shifting from public shared toilets to home toilets in urban settlements: Implications of household demand in Kumasi, Ghana (34th WEDC International Conference)

[5] The United Nations (UN) Millennium Development Goals (MDGs) launched in 2000, presents a minimum set of targets for achieving poverty reduction and sustainable development. The Government of Ghana is committed to the principles of the MDGs and with respect to MDG 7, which seeks to ensure environmental sustainability, will work towards improving access to safe water supply and sanitation to reduce the proportion of population without access to basic water supply and sanitation by 50% by 2015 and 75% by 2025.

[6] Ejisu-Juaben Municipality (2010) Structure Plan for Ejisu Area

7.3 Issues on the Liquid Waste Sector

7.3.1 Kumasi Metropolitan Area

(1) Low Accessibility to Hygienic Toilets

Although there are some public toilets in KMA and the surrounding District and Municipality, most of the households use public toilets (86%)[7], but they were not satisfied with the cleanliness or odours. Moreover 3% of the people in KMA and a higher percentage in the surrounding District and Municipality cannot access household toilets or public toilets[8].

In the future, the expected population growth will cause an even greater shortage of access to hygienic toilets facilities.

(2) Insufficient Sewerage System

Although SSP-Kumasi had concluded that a simplified sewerage system is the most economic system for the liquid waste treatment, only 3 communities (approximately 10% of the households) in KMA are sewered. Based on the hearing from KMA-WMD, more sewerage systems are necessary and the areas are summarized in the table below.

Table 7.3.1 Proposed Areas to Construct Sewerage Systems

Area	Treatment Method	Remarks
Aboabo	Stabilization Pond	---
Dichemso	Not Stabilization Pond	Due to insufficient area
Ash-town	(ditto)	(ditto)
Bantama	Stabilization Pond	---
Adum	(ditto)	---

Source: Hearing from KMA-WMD
Note: Coverage areas and proposed land for the treatment facilities will be input in the GIS which is being prepared.

As stipulated in the Environmental Sanitation Policy, stabilization ponds are the recommended technology for the treatment of liquid waste. Conventional sewage treatment technologies (eg. trickling filters, activated sludge, etc.) shall only be used where there are limitations on the use of stabilization ponds. MMDAs shall adopt such systems taking due consideration of the capital and replacement costs, operation and maintenance costs and skilled manpower requirements. The table above is proposing stabilization ponds based on this policy.

[7] S.Oduro Kwareteng, E.Awuhah & K.B. Nyarko (2009) Shifting from public shared toilets to home toilets in urban settlements: Implications of household demand in Kumasi, Ghana (34th WEDC International Conference)

[8] 2000 Population and Housing Census Ashanti Region Analysis of District Data and Implications for Planning

(3) Noncompliance of Industry

As stipulated in the Environmental Sanitation Policy, liquid industrial effluents shall be pre-treated by industries to prescribed standards before discharge into the water bodies. However, as mentioned in the previous section, an abattoir is not equipped with this facility hence it has been discharging its untreated effluents into the water bodies.

In the future, more industries are expected to arise due to the population growth; thus it is essential for KMA to take more efforts to regulate / enforce industries to install treatment plants on their sites to ensure that their wastewater discharge into the water bodies is not contaminated.

7.3.2 Districts and Municipality surrounding KMA

Due to the population growth in the Greater Kumasi area, all the districts and municipality surrounding KMA will face the issues KMA is currently facing.

Currently, septage and wastewater of surrounding districts and municipality is conveyed to and treated at Oti Septage Treatment Pond so the transport of septage is costly for surrounding districts and municipality due to their distance to the pond.

Chapter 8 Drainage Sector of Greater Kumasi Sub-Region

8.1 Present Situation of Drainage

8.1.1 Institutions and Responsibilities

Drainage is necessary to limit sanitary nuisances, vector breeding and the physical hazards of flooding. According to the Environmental Sanitation Policy[1], the institutions concerned with implementing environmental sanitation are divided into the "principal sector agencies" with direct responsibility for aspects of environmental sanitation, and the "allied sector agencies" which play a supporting role. As mentioned in the Environmental Sanitation Policy, the Ministry of Local Government and Rural Development (MLGRD) and MMDAs (Metropolitan, Municipality and District Assemblies) are the principal sector agencies. Since MLGRD functions as a central government agency such as providing guidance and promulgating national legislations, MMDAs are the main agencies to ensure that their jurisdiction areas are provided with adequate and consistently functioning drainage works.

In Kumasi Metropolitan Assembly (KMA), the 2 main departments involved in the drainage construction / maintenance are the Waste Management Department (WMD) and the Department of Urban Roads (DUR). Their responsibilities are summarized in Table 8.1.1.

Table 8.1.1 Responsibilities of WMD / DUR regarding Drainage in Kumasi Metropolitan Area

Items	Construction	Maintenance
Primary*[1] / Secondary*[2] / Tertiary*[3] Drainage	WMD	WMD
Roadside Drainage*[4]	DUR	WMD (Cleaning) DUR (Repair)

Source 1: <Definition of Drainage> KMA (2007), Preparation of a stormwater drain maintenance program - Drainage Inventory Report, Volume I - Main Report
Source 2: <Responsibilities> Study Team (based on the report from the director of KMA-WMD)
Note: *[1] the main stream that flows through the basin
*[2] the stream that flows directly into the primary drain
*[3] the stream that flows directly into a secondary drain
*[4] the drain constructed along the road to carry sullage and runoff from the road and surrounding communities to the primary / secondary / tertiary drains.

[1] Ministry of Local Government and Rural Development (2010), Environmental Sanitation Policy (Revised 2009)

WMD / DUR are in charge of the construction / maintenance (hard side) as shown in Table 8.1.1. On the other hand, the Environmental Health Department (EHD) is in charge of the environmental sanitation education, inspection / enforcement of sanitary regulations etc. (soft side).

In the districts and municipality surrounding KMA, the Works Department and Environmental Health Department of the assemblies function as the WMD and EHD of KMA respectively.

8.1.2 Present Situation

(1) Kumasi Metropolitan Area

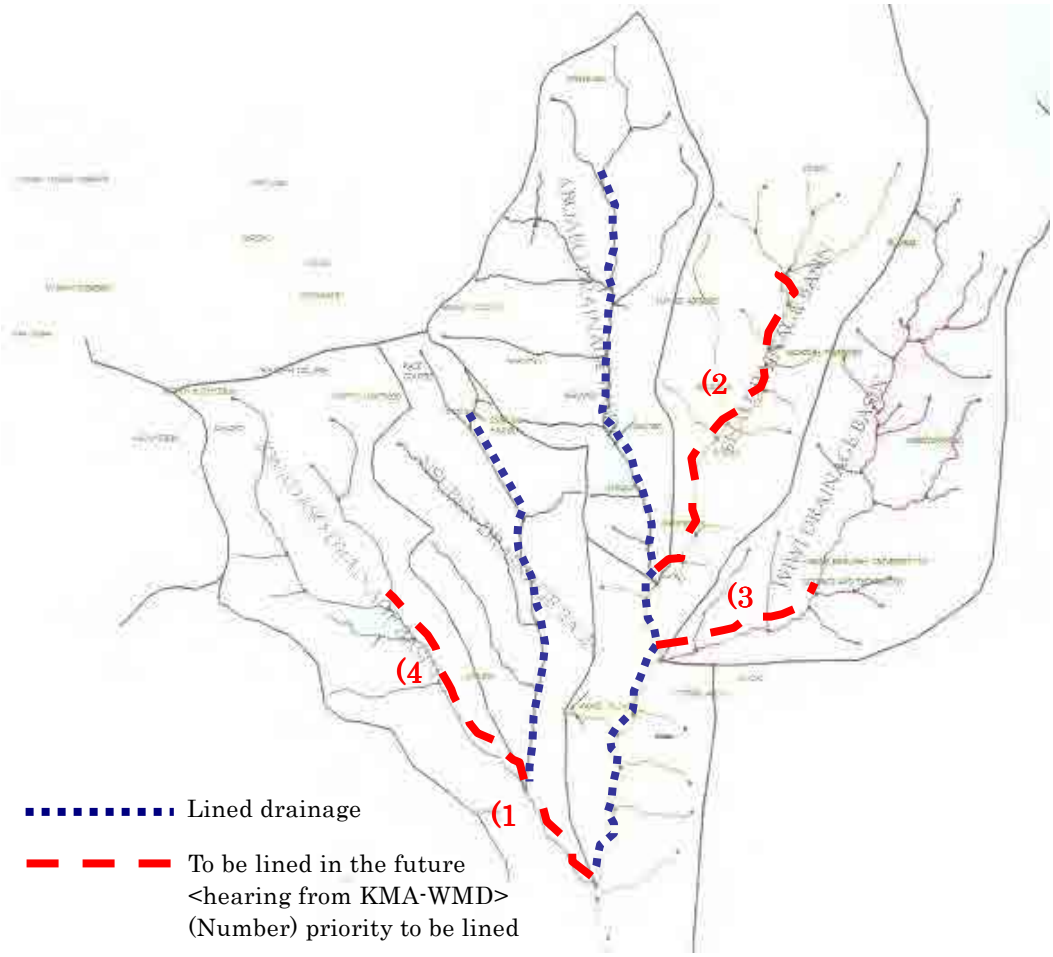
There are 5 main drainage basins in Kumasi Metropolitan Area, namely Aboabo, Kwadaso, Nsuben, Sisai and Wiwi drainage basins, which generally run in a north-south direction. Each basin is drained by a number of tributaries categorized into primary, secondary and tertiary drains as shown in the table below.

Table 8.1.2 Lengths (in meters) of Drains in Kumasi Metropolitan Area (as of August 2012)

Drain	Primary	Secondary	Tertiary	Total	Lined*[1]	Unlined*[2]
Aboabo	11,299	15,608	1,969	28,876	9,999	18,877
Kwadaso	13,746	11,419	2,000	27,165	0	27,165
Nsuben	8,060	8,653	2,020	18,733	6,670	12,063
Sisai	15,532	20,174	805	36,511	7,166	29,345
Wiwi	11,461	15,897	3,300	30,658	0	30,658
Total	60,098	71,751	10,094	141,943	23,835	118,108
Percentage	42.3%	50.5%	7.1%	100.0%	16.8%	83.2%

Source 1: <Definition of Drainage> KMA (2007), Preparation of a stormwater drain maintenance programme - Drainage Inventory Report, Volume I - Main Report
Source 2: Lined/Unlined lengths are calculated based on Figure 8.1.1
Note: *[1] drain that is open or covered which is concreted / piped
*[2] drain that has been created by runoff water or sullage from nearby homes and follows the natural low points of the topography of the area

As can be seen from the table above, the total drain length is about 141 km and most of them are in their natural unlined states. Lined sections can only be found along some sections in the Aboabo, Nsuben and Sisai drainage.



Source 1: <Drainage Network > KMA (2007), Preparation of a stormwater drain maintenance program – Drainage Inventory Report, Volume I - Main Report
Source 2: <Lined Sections > Report from director of KMA-WMD

Figure 8.1.1 Drainage Network in KMA

Sisai Drainage:
Blockage of drain channel by refuse, siltation and weeds

Kwadaso Drainage:
Siltation and weeds resulting in the formation of islets

Source: KMA (2007), Preparation of a stormwater drain maintenance program - Drainage Inventory Report

Figure 8.1.2 Drainage Situation in Kumasi Metropolitan Area

As mentioned in "Preparation of a Stormwater Drain Maintenance Program", the drain maintenance status in Kumasi is generally poor.

- Most drains are heavily silted, sometimes resulting in the formation of islets along channel beds.
- The unlined drains are mostly overgrown with weeds.
- Refuse in drains, resulting from dumping of refuse along drain banks is common.
- The effect of refuse and siltation is worse at culvert locations, where they sometimes virtually block the entrances.
- Erosion is also common at the upper reaches of the drains, at confluences, unlined outfalls into culverts and at culvert exists.
- Developers continue to encroach upon stream valleys and hamper drain maintenance.

Recommended maintenance includes weed clearing, refuse removal, drainage dredging and desilting. In the next section, past and existing development plans regarding maintenance are summarized.

(2) Districts and Municipality surrounding Kumasi Metropolitan Area

Similarly to Kumasi Metropolitan Area, the districts and municipality surrounding Kumasi Metropolitan Area have few lined drains. Due to insufficient drains, erosion such as pictured below occurs, and buildings might collapse if the erosion continues.

Source: JICA Study Team, 2012

Figure 8.1.3 Erosion due to Insufficient Drains at Bosomtwe District

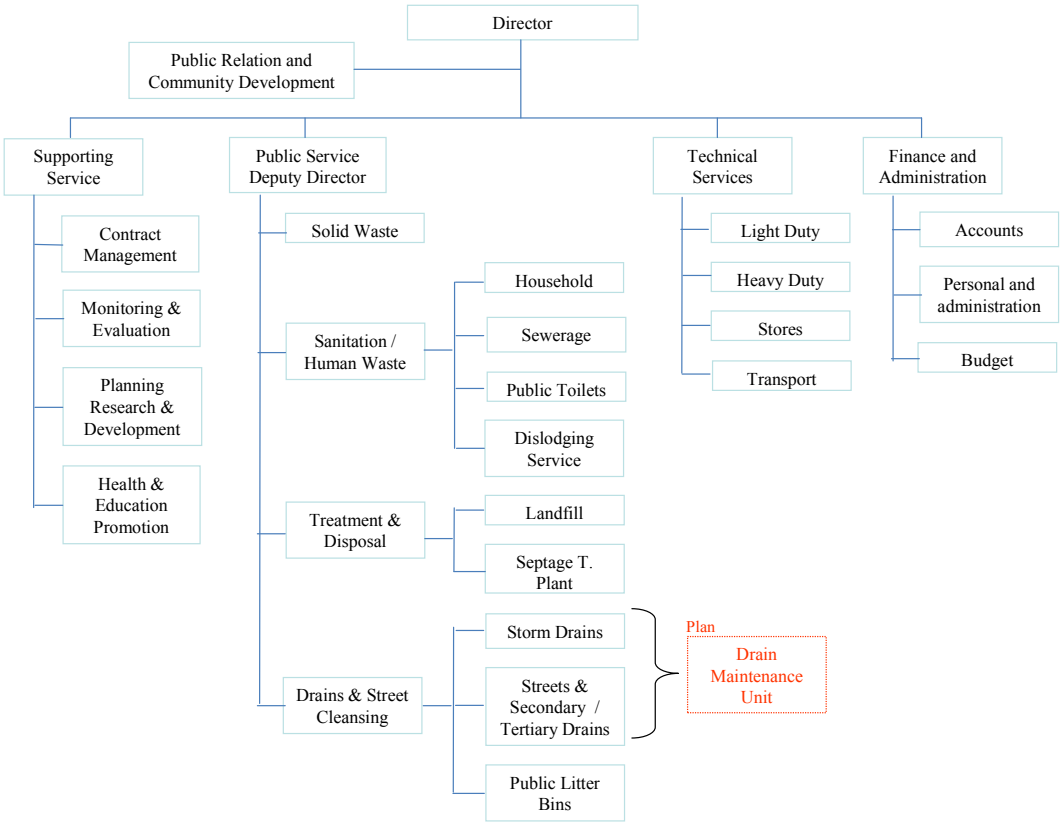
8.2 Review of Past and Existing Development Plans and Projects for Drainage Sector

8.2.1 Kumasi Metropolitan Area

(1) Establishment of Drain Maintenance Unit

As mentioned in the previous section, KMA is responsible to ensure that its jurisdiction area is provided with adequate and consistently functioning drainage works. As a part of its responsibility for planning and implementing drain maintenance, KMA is planning to establish a Drain Maintenance Unit (DMU) in its WMD.

The figure below shows the existing organization chart of KMA-WMD and the planned allocation of DMU. When DMU is established, it might cover the roles conducted by the existing units of "Storm Drains" and "Streets & Secondary / Tertiary Drain".



Source: KMA-WMD

Figure 8.2.1 Organization Chart of KMA-WMD and the Planned Allocation of DMU

To aid in the establishment of the DMU, KMA has 1) conducted a drainage inventory survey, and 2) prepared a maintenance program.

1) Drainage Inventory Survey

KMA conducted a drainage inventory survey in March and April 2007. Drainage type (lined / unlined), dimensions, status of drainage maintenance, impact on flooding in various low-lying areas etc. were surveyed. The results are summarized in the Drainage Inventory Report (June 2007).

2) Maintenance Program

Based on the results of the inventory survey mentioned above, necessary equipment and man power for the drainage maintenance were estimated and an annual maintenance program was prepared. The table below shows the necessary costs abstracted from the annual maintenance program.

Table 8.2.1 Necessary Cost for the Maintenance Program

Items	Cost
Initial investment to set up the DMU (cars, office equipment, maintenance tools etc.)	103,300.00 GHC
Recurrent expenditures (salaries, office supplies etc.)	59,930 GHC/year
Drain maintenance (weed clearing, refuse removal, drain dredging etc.)	4,417,948 GHC/year

Source: KMA (2008), Preparation of a stormwater drain maintenance program - annual maintenance program - report on institutional and financial requirements

The Agence Francaise de Development (AFD) as part of its contribution towards the Second Urban Environmental Sanitation Project[2] (UESP-II), has agreed to assist KMA in establishing the DMU and facilitate the work of the unit when established.

(2) Construction of Drains

Some lined drainage sections shown in Figure 8.1.1 were constructed under the UESP-II. As the Study Team still has not received documents regarding UESP-II, the drainage construction details are not summarized in this report.

8.2.2 Districts and Municipality surrounding Kumasi Metropolitan Area

Generally, the districts and municipality surrounding Kumasi Metropolitan Area are facing issues such as erosion and flooding due to insufficient drains as mentioned. However, there has been no particular definite plan for drainage construction / maintenance in the past.

[2] UESP-II is funded by a credit from the World Bank (WB) which aims at improving urban living conditions in the five largest cities (Accra, Kumasi, Sekondi-Takoradi, Tamale, and Tema) of Ghana by improving access to roads, sanitation, drainage, street lighting, and water supply.

8.3 Issues on the Drainage Sector

8.3.1 Insufficient Drainage Maintenance / Lined Drainage

As mentioned in the previous section, the drain maintenance in Kumasi Metropolitan Area is generally poor; thus KMA is planning to establish a DMU for the maintenance work.

In order to assist KMA in the establishment and running of the DMU, UESP-II had prepared Guidelines for the Drain Maintenance Fund. The guidelines clearly mentioned that KMA shall establish a fund only for the maintenance and rehabilitation of drains and related facilities within its jurisdiction area.

Due to the present drainage situation, the maintenance cost is assumed to be 4.5million GHC/year (4,417,948 GHC/year + 59,930 GHC/year as mentioned in Table 8.2.1). Judging that KMA's 2012 expenditure budget is about 100million GHC (99,666,070 GHC), 4.5million for the maintenance can be considered as an affordable cost. However, in terms of sustainable funding, it is preferable that the maintenance cost will be reduced in the future.

It is obvious that if more sections are lined, erosion, siltation or forming of islets will be reduced. In other words, if more sections are lined, not only flow capacity of the drainage will be secured but also the maintenance cost for desiltation can be reduced. As shown in Table 8.1.2, only 11.2% of the total length of the drainage in Kumasi Metropolitan area is lined, and this is insufficient.

Therefore, it is recommended that KMA (DMU) conducts drainage maintenance and at the same time makes an effort to line some sections of the drainage to reduce the future maintenance cost.

8.3.2 Flooding and Erosion

KMA is located in the most upper part of the Pra River basin on the catchment divide between the Offin and Oda Rivers. In this topographical sense, the KMA is free from danger of prolonged flooding due to high water in the rivers. However, KMA has a serious potential that she could be troubled by flooding and erosion.

Figure 8.3.1. is the topographical relief of KMA based on SRTM3 data. As can be seen, many natural drainage patterns (so called dendritic patterns) have developed. In general, the areas having such densely developed drainage patterns are prone to erosion as well as flooding due to high intensity rainfall and soft surface soil condition.

The flooding has already become quite serious in KMA. With regard to flooding, Susansu, Oforikrom, Atonsu, Aboabo, Anloga, Asafo, Asokwa and Breman are areas identified as flood-prone areas. This phenomenon was attributed to the construction of buildings in waterways, dumping of refuse in gutters and drains and the inability of existing culverts to receive large volumes of water whenever there is a heavy downpour. The effect has been loss of valuable property of residents in the affected communities.

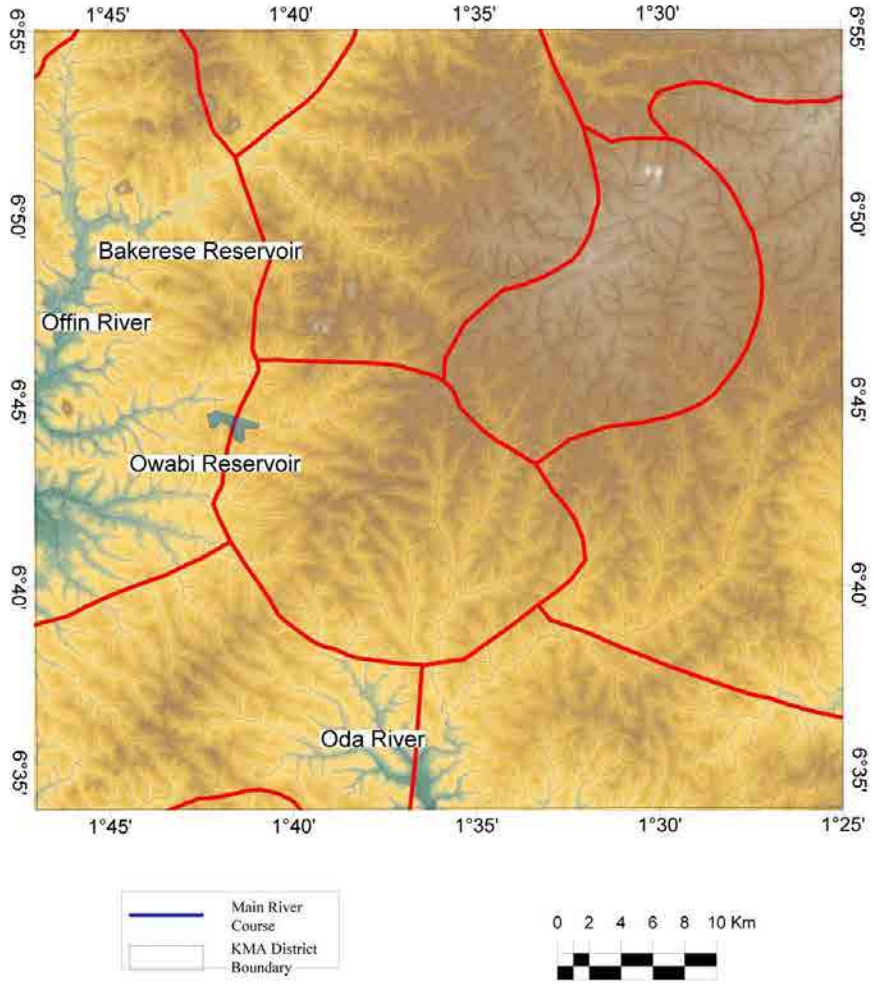


Figure 8.3.1 Natural Drainage Pattern in KMA

Erosion is also a serious issue in KMA. Erosion has degraded some settlements leaving many buildings hanging. Some of the affected communities are Nweneso No.1, Trabuom, Gyekye, and Foase. This is mainly due to inadequate drainage systems. (Atwima Kwanwoma District Medium Term Development Plan under the Ghana Shared Growth and Development Agenda (GSGDA), 2010-2013)

The drainage issue in KMA should be treated based on the following viewpoints.

- KMA, which was developed on a granite rock area, has experienced high intensity rainfall, resulting in the existing dense natural drainage pattern.
- Urbanization progressed, at first in higher elevation areas.
- As the impermeable areas expanded, the rainfall runoff from the land surface increased enough to result in erosion on the natural river courses as well as the areas between houses.
- The sediment runoff also increased because of the land erosion, and sedimentation in drainage channel and river courses would further reduce the flow capacity and create further flooding.
- It is envisaged that the present floodplain will be under pressure due to new low income settlements because the floodplain is the only remaining open space for low income

settlement. In terms of rainwater drainage, the floodplain should be reserved as much as possible unless there are substantial alternatives.

- The most important thing is that any improvement works in KMA should not affect the current conditions of the downstream area along the Oda River until facilities are provided that can handle the increased flow including flood control, erosion control, drainage improvement and waste water management.

Chapter 9 Electricity Supply Sector of Greater Kumasi Sub-Region

9.1 Present Situation of the Electricity Supply Sector

9.1.1 Institutional Structure of Power Sector

(1) Ministry of Energy

The Ministry of Energy is responsible for formulating, monitoring and evaluating policies, programs and projects for the power sub-sector and the energy sector in general. The Ministry is also implementing the Government's National Electrification Scheme.

Ministry of Energy sets the vision for the energy sector as; to ensure availability of and universal access to energy services and for export by 2020.

Within the context of the vision above, the overall goal of the energy sector is to make energy service universally accessible and ready available in an environmentally sustainable manner. There are ten objectives in order to achieve this goal.

- Secure long term fuel supplies for the thermal power plants
- Reduce technical and commercial losses in power supply; Information from Energy Commission
- Support the modernisation and expansion of energy infrastructure to meet growing demands and ensure reliability
- Increase access to modern forms of energy
- Improve the overall management, regulatory environment and operation of the energy sector
- Minimise the environmental impacts of energy supply and consumption through increased production and use of renewable energy and make energy delivery efficient;
- Ensure cost recovery for energy supply and delivery
- Ensure the productive and efficient use of energy
- Promote and encourage private sector participation in the energy sector
- Diversify the national energy mix by promoting renewable energy sources nuclear and coal

(2) Volta River Authority

The state-owned Volta River Authority (VRA) is involved in power generation in the country. It owns and operates the Akosombo Hydropower Station, Kpong Hydropower Station and Takoradi Thermal Plant (TAPCO) situated at Aboadze. VRA is also a minority joint partner with TAQA, a private sector company, which owns and operates the Takoradi International Power Company (TICO) thermal plant, also located at Aboadze. VRA was responsible for generation and transmission of electricity in Ghana. In 2005, following the Ghana Government Power Sector Reforms, VRA's mandate has now been largely restricted to generation of electricity. The transmission function has been separated into an entity designated the Ghana Grid Company (GRIDCo). The VRA will continue to operate its distribution agency. The amendment has a key function of forming the requisite environment to attract independent power producers (IPP's) onto the Ghana energy market.

(3) Bui Power Authority

A state-owned agency, Bui Power Authority, under the Ministry of Energy, is implementing the Bui Hydroelectric Power Project. An Act has been implemented to provide for the establishment of an Authority charged with the development of a Hydroelectric Power Project on the Black Volta River at Bui and other potential hydroelectric power sites on the Black Volta River and for related matters Date of Assent 31.

Work on the transmission lines involving the proposed line route survey was completed in July 2008, minor realignment and modification was carried out and completed in January 2010. The transmission lines are:

- 18.6km Bui -Tiselima Transmission Line 1, connected to Techiman - Sawla to become Bui - Tiselima - Techman;
- 17.2km Bui - Tiselima Transmission Line 2, connected to Techiman - Sawla Line to become Bui - Tiselima - Sawla;
- 66.2km Bui - Kintampo Transmission Line; and
- 168.9km Bui - Kenyase Transmission Line.

(4) Ghana Grid Company (GRIDCo)

GRIDCo was established in accordance with the Energy Commission Act, 1997 (Act 541) and the Volta River Development (Amendment) Act, 2005 Act 692, which provides for the establishment and exclusive operation of the National Interconnected Transmission System by an independent utility and the separation of the transmission functions of the Volta River Authority (VRA) from its other activities within the framework of Power Sector Reforms. GRIDCo was incorporated on December 15, 2006 as a private limited liability company. The company became operational on August 1, 2008 following the transfer of the core staff and power transmission assets from VRA to GRIDCo.

(5) Electricity Company of Ghana (ECG)

The Electricity Company of Ghana was incorporated under the companies code, 1963 (ACT179), and was established in November 1997 as a joint-stock company based on the Companies Code in accordance with the 1993 Corporate Act (Act 461). It supplanted the former Electricity Company of Ghana, which was established as a result of a government ordinance (NLCD 125) in 1967. The government owns all its stock. The ECG is a distribution company that purchases all of its power from VRA, and sells it to final customers. It is obligated to perform power distribution and supply in eight areas, i.e. Accra East, Accra West, Tema, Eastern Central, Western, Ashanti, and Volta. ECG's organizations as of the year 2010 are shown in Figure 9.1.1 through Figure 9.1.3.

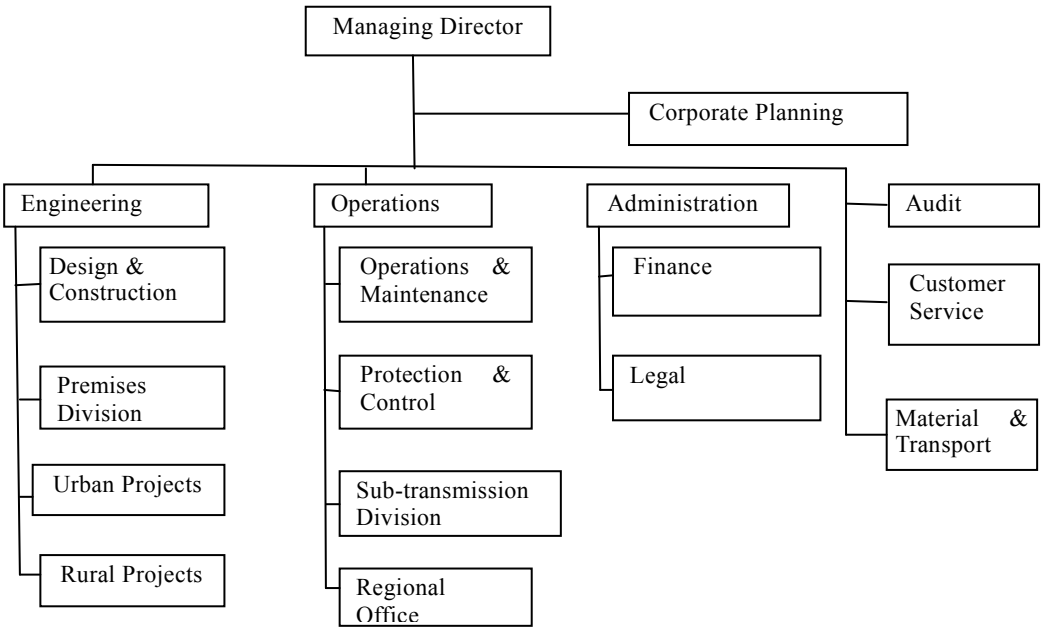


Figure 9.1.1 Organization of ECG

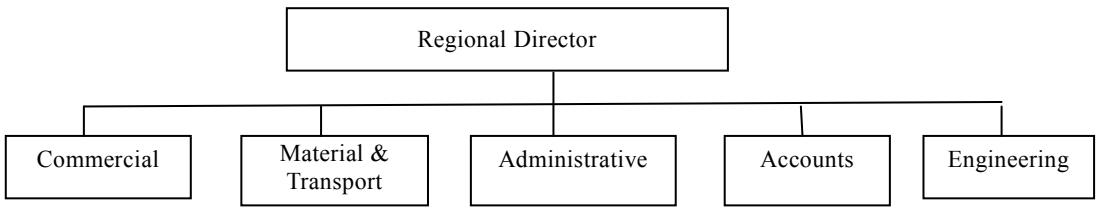


Figure 9.1.2 Organization of ECG Regional Office

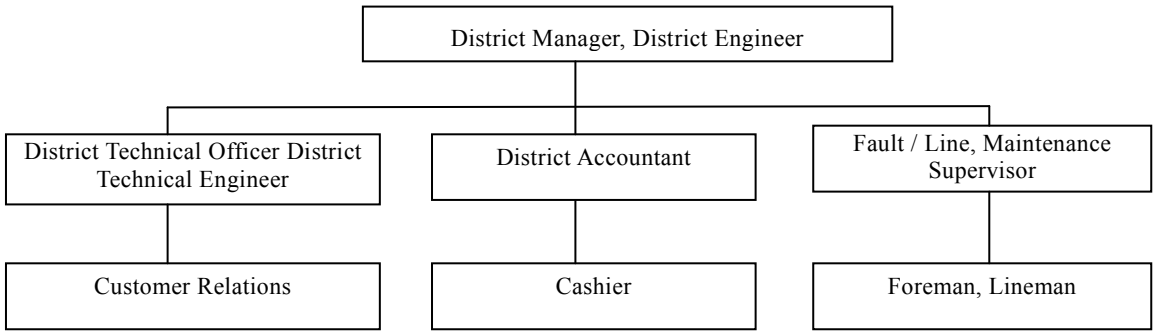


Figure 9.1.3 Organization of ECG District Office

Table 9.1.1 Number of Employees of ECG Ashanti Regional Offices

Regional Office	Executive Director	Managing	Employees	Total
Ashanti West	10	97	374	481
Ashanti East	9	96	347	452

Source: Energy Commission Annual Report for 2007 & 2008

In the Regional Office of ECG in Kumasi, one manager is in charge of extension of sub-transmission and distribution lines. Due to its limited budget, only a little progress has been achieved over the last four years.

(6) Northern Electricity Department (NED)

The Northern Electricity Department, which is a subsidiary of VRA distributes power in the northern part of the country.

(7) Public Utilities Regulatory Commission (PURC)

The Public Utilities Regulatory Commission of Ghana is an independent body set up to regulate and oversee the provision of the highest quality of electric and water services to consumers.

(8) Energy Commission (EC)

The Energy Commission's mission is to provide leadership and collaborate with its clients, the leading energy providers such as VRA, TOR, BOST, ECG, GRIDCo. and Independent Power Producers (IPPs), to efficiently create an enabling environment for excellence and fair competition in energy service delivery. The Commission is fully committed to serving the national interest in the discharge of its statutory mandates and functions effectively and efficiently. The Commission is equally committed to accepting and dealing with the challenges that Ghana must meet head-on in its quest for a truly functioning, competitive energy industry that creates affordable energy supplies, improves energy reliability, efficiency and security, and above all, protects and enhances public safety, economic well-being and environmental quality.

9.1.2 Existing Condition of Power Generation Facilities

(1) Current Situation of Power Generation

Table 9.1.2 explains power plant capacity as of 2008 in Ghana. The biggest plant, Akosombo, provides more than 50 % of all capacity. The annual growth rate of installed capacity was 3.1% between 2001 and 2008 as indicated in Table 9.1.3. However the growth percentage does not mean peak demand growth rate.

Table 9.1.2 Ghana Plant Capacity in 2008

Type	Plant Name	Plant Capacity (2008)	
		Installed (Gwh)	Percentage(%)
Hydro	Akosombo	1020	50.7
	Kpong	160	8.0
	Total	1180	58.7
Thermal	TAPCO	330	16.4
	TICO	220	10.9
	Mines Diesel Reserve Plant	80	4.0
	Emergency Diesel Reserve Plant	126	6.3
	Tema Diesel Reserve Plant	25	1.2
	Tema Diesel Plant	30	1.5
	Kumasi Reserve Plant	20	1.0
	Total	831	41.3
Total	Total (Hydro + Thermal)	2011	100.0

Source: Energy Commission Annual Reports for 2007 & 2008

Table 9.1.3 Trend of Electricity Capacity and Generation

Year	Installed Capacity (MW)	Electricity Generated (GWh)			Percentage (%)		
		Hydro	Thermal	Total	Hydro	Thermal	Total
2000	1,652	6,610	613	7,223	91.5%	8.5%	100.0%
2001	1,551	6,608	1,251	7,859	84.1%	15.9%	100.0%
2002	1,574	5,036	2,260	7,296	69.0%	31.0%	100.0%
2003	1,582	3,885	2,015	5,900	65.8%	34.2%	100.0%
2004	1,740	5,281	758	6,039	87.4%	12.6%	100.0%
2005	1,730	5,629	1,159	6,788	82.9%	17.1%	100.0%
2006	1,730	5,619	2,810	8,429	66.7%	33.3%	100.0%
2007	1,935	3,727	3,251	6,978	53.4%	46.6%	100.0%
2008	1,981	6,196	2,128	8,324	74.4%	25.6%	100.0%

Source: Energy Commission Annual Reports for 2007 & 2008

(2) Details of Current Power Generation Facilities

1) Akosombo Hydroelectric Plant

The plant is with a hydroelectric dam on the Volta River in southern Ghana in the Akosombo Gorge and is a part of the Volga River Authority. The construction of the dam inundated part of the Volta River Basin, and the subsequent creation of Lake Volta is the

world's largest man-made lake, covering 8,502 square kilometers (3,283 mi^2), which is 3.6% of Ghana's land area. The catchment of the reservoir is estimated more than 40% of capacity which has an impact on the management of electricity supply in Ghana.

The primary purpose of the Akosombo Dam was to provide electricity for the aluminum industry. The Akosombo Dam was called "the largest single investment in the economic development plans of Ghana". Its original electrical output was 912 MW, which was upgraded to 1,020 MW in a retrofit project that was completed in 2006. The power generated has provided primary interests within Ghana, while also supplying power to the neighbouring countries such as Togo and Benin. Ghana's industrial and economic expansion triggered a higher demand for power, beyond the Akosombo's power plant capability. By 1981, a small dam was built at the town of Kpong, downstream from Akosombo and further upgrades to Akosombo have become necessary for maintaining hydropower output. The features of the Dam are as follows.

Type of dam	:	Embankment, rock-fill
Height (foundation)	:	114 m (374 ft)
Length	:	680 m (2,170 ft)
Base width	:	366 m (1,201 ft)
Volume	:	7,900,000 m^3 (10,300,000 yd^3)
Impounds	:	Volta River
Spillways	:	Twin gate-controlled
Spillway capacity	:	34,000 m^3/s (1,200,000 ft^3/s)
Creates	:	Lake Volta
Capacity	:	148 km^2 (120,000,000 acre·ft)
Surface area	:	8.502 km^2 (3,283 mi^2)
Reservoir length	:	400 km (250mi)
Hydraulic head	:	68.8m (226ft) (max)
Turbines	:	6×170 Francis-type
Installed capacity	:	1,038 MW

Initially, the dam's power production capabilities greatly overreached the actual demand, while the increase in demand since the dam's construction resulted in the doubling of hydropower production. Increasing demands for power exceed what can be provided by the current infrastructure. Power demands, along with unforeseen environmental trends, have resulted in rolling blackouts and major power outages in the 1990s. An overall trend of lower water levels has been observed, sometimes below the requirement for operation of the Akosombo Dam. In the beginning of 2007, there were concerns over the electricity supply from the dam due to low water levels in the lake Volta Reservoir. During the latter half of 2007 much of this concern was abated when heavy rain fell in the catchment area of Volta River. In 2010 the highest ever water level was recorded at the dam. This necessitated the opening of the flood gates at a reservoir elevation of 84.45m (277ft), and for several weeks water was spilled from the lake causing some flooding downstream. The trend in water level behind the Akosombo Dam (ft) from 2003 to 2008 is shown in Figure 9.1.4.

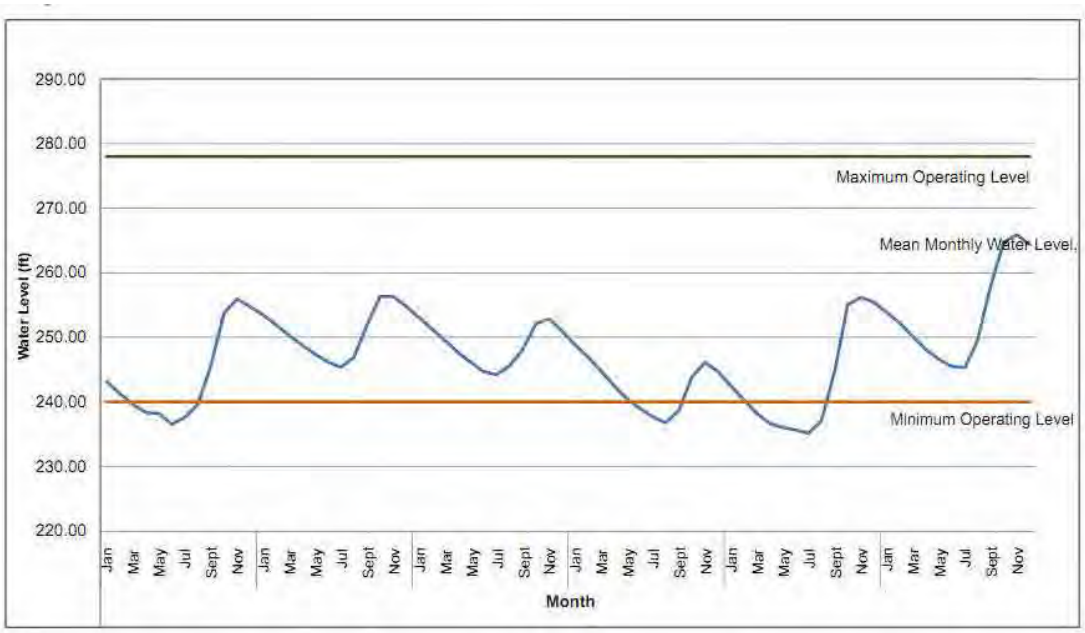


Figure 9.1.4 Trend in Water Level behind the Akosombo Dam (2003 – 2008)

2) Kpong Hydropower Plant

The Plant represents the third stage in the development of the Volta River, commonly known as the Volta River Project. The first stage began in 1961 when the VRA was established and work started on the Akosombo Dam and power station. By September 1965 the first power was flowing from Akosombo, marking an important step in the economic development of the newly formed Republic of Ghana.

The Kpong generating station was completed in 1982 with a total installed capacity of 1,180 MW. The Kpong head pond has minimal storage capacity and it is therefore separated in tandem with Akosombo as a run-of-the-river plant to optimize water use from the Volta Lake. The joint firm energy output from the Akosombo / Kpong hydroelectric development is about 4,800 GWh. Meanwhile the Long-Term Average (LTA) capability of the two plants is about 6,100 GWh.

3) Bui Hydropower Plant

Bui Dam is an under construction 400 MW hydroelectric project at the Bui Gorge at the southern end of Bui National Park in Ghana. The project is a collaboration between the Government of Ghana and Sino Hydro, a Chinese construction company. Construction on the main dam began in December 2009, and its first generator should be outline in 2012. The project completion is expected in 2013. It will be the third major dam in the country after the Akosombo Dam and the Kpong Dam. It would flood about 20% of the Bui National Park and impact the habitats for the rare Black Hippopotamus as well as a large number of the native wildlife species. It will also require the forcible resettlement of 1,216 residents.

Type of dam	:	Gravity, roller-compacted concrete
Height (foundation)	:	90 m (295 ft)
Length	:	492.5m (1,618 ft)

Crest width	:	7 m (23 ft)
Volume	:	1,000,000 m^3 (35,314,667 yd^3)
Impounds	:	Black Volta River
Type of spillways	:	Emergency, five gate-controlled
Spillway capacity	:	10,450 m^3/s (369,038 ft^3/s)
Creates	:	Bui Reservoir
Capacity	:	12,570,000,000 m^3 (6,258,706 acre·ft)
Surface area	:	Minimum level: 288 km^2 (111 mi^2)
Normal elevation	:	Minimum level: 167m (548 ft)
Max. water depth	:	88 m (289 ft)
Reservoir length	:	40 km (25 mi) avg.
Commission	:	2012
Turbines	:	3×133Francis-type
Installed capacity	:	400 MW
Net generation	:	969 GWh

The Bui Hydropower Plant will increase the installed generation capacity in Ghana by 22%, up from 1920 MW in 2008 to 2360 MW. Together with the three thermal power plants that are being developed at the same time, it will contribute to alleviate power shortages that are common in Ghana. Furthermore, like all hydropower plants, the project avoids greenhouse gas emission unlike the thermal power plants. An additional expected benefit is the irrigation of high-yield crops on 30,000 hectares of fertile land in an "Economic Free Zone". The current status of the irrigation project is unclear.

4) Takoradi Thermal Power Station

The Takoradi Thermal Power Station (TTPS) is located at Aboadze, 17 kilometers east of Sekondi-Takoradi in the Western Region of Ghana. The Power Station, which started operation in 1997, was initiated by the VRA to compliment the existing Hydro Plant at Akosombo and Kpong. TTPS is therefore a facility of strategic importance for meeting Ghana's needs.

The current installed capacity of Takoradi Power Plant is 550 MW and is to be upgraded to 660 MW by the CMS / VRA joint venture.

With the objective of being the electricity supplier of choice for customers in Ghana and Western Africa, the plant operates in two modes, namely Simple Cycle and Combined Cycle. The primary fuel used for power generation is Light Crude Oil (LCO) which is normally received from ocean tankers via a Single Point Mooring (SPM), connected to the plant by approximately 4.5km of undersea pipeline and is stored in four 29,500 m^3 capacity storage tanks. The secondary fuel on site - Distillate Fuel Oil (DFO) is normally used for start-up and shutdown as it is less volatile. On the average, a gas turbine at base load (110 MW) can generate 2.5GW of electricity using about 890m^3 of LCO per day.

Water for use is obtained either from Ghana Water Company Ltd. or the Reverse Osmosis (RO) Plant and stored in a reservoir with a storage capacity of 9,000m^3, 50% of which is reserved for fire extinguishing. The Reverse Osmosis (RO) system produces freshwater from seawater. It produces 1,135 m^3 of freshwater per day. It is used to supplement water supply

from Ghana Water Company Ltd.

For steam generation, water is obtained from the water treatment plant (Demin Plant).

This is a two steam demineralization plant that produces dematerialized (ultra pure) water at a rate of 70 m^3/h, which is then stored in two storage tanks of capacity 840 m^3 each. This ultra pure water produced is also used for control of the emission of nitrogen oxides (NOx) in the CTGs. Waste water from various parts of the plant is collected into an Oily Wastewater System which is a 300 m^3 capacity basin which collects only waste water from various parts of the plant for separation and incineration or to be sold to secondary users as fuel for their boilers or for wood preservation.

In thermal generation, VRA-TTPS has been proactive in addressing issues that affect the environment and public safety and has shown this with an elaborate programme that effectively controls and monitors air quality, noise level, sea temperature and oil spillage.

To ensure that the environment is protected, stringent monitoring of the emissions from the Gas Turbine is carried out. The emission of NOx, Sulphur and Carbon is reduced by injecting demineralised water into the gas turbine to meet the requirements of Ghana. VRA-TTPS thus manages the natural resources in its area of operation in an environmentally sustainable manner.

5) Tema Thermal Power Station 1 (TT1)

Tema Thermal Power Station 1 is a gas turbine power plant with the capacity of 110 MW, and is under operation.

6) Tema Thermal Power Station 2 (TT2)

Tema Thermal Power Station 2 is a combined type power station with the capacity of 7.9 MW×3 and 12.9 MW×2, and is under operation.

7) Tema Station 1 for Mining (MRP)

Tema Station 1 for mining is a gas turbine power plant with the capacity of 15 MW, 20 MW and 45 MW, and is under operation.

8) Renewable Energy

The Renewable Energy Services Project (RESPRO) was funded by UNDP / GEF and the Government of Ghana with co-financing from the U.N. Department of Energy and the National Renewable Energy Laboratory (NREL) for technical support. The goal of this project was to support the development of the national capacity, combining both private-sector and public-sector efforts, to primarily use renewable energy-based technologies, especially photovoltaics (PV), PV/wind and PV/hybrid power systems for sustainable rural electric power delivery. These technologies will be used for both individual applications and centralized electrification of off-grid communities, which are technically or economically not suitable for electrification via grid extension. The central objective of this project is to assess the economic and technical performance of these renewable energy options on a pilot scale in the type of environment in which they would be used on a much

larger scale in subsequent investment projects. Another goal of the project is to also demonstrate the commercial viability of a rural energy services enterprise.

The government initiated the National Electrification Scheme to provide the whole country with reliable electricity for household energy needs, community services and productive uses by the year 2020. In this context therefore, the government, through the Ministry of Energy, is exploring the potential role of decentralized renewable energy-based electricity services as an alternative to grid extension and also as a least cost option.

9) Small Hydropower

Potential small hydro sites are identified in five regions, throughout Ghana such as Brong-Ahafo Region, Ashanti Region, Volta Region, Eastern Region and Western Region. The features of Ashanti Region Barekese Water Supply Dam in Kumasi are:

- Catchment area: 352 sq miles;
- Head: 12m;
- 60" pipe available for installation of a turbine;
- Excess water only available for a few months in a year;
- Power generated possible to be used by the GWCL; and
- Validity of SHP depending on flow data and willingness of GWCL.

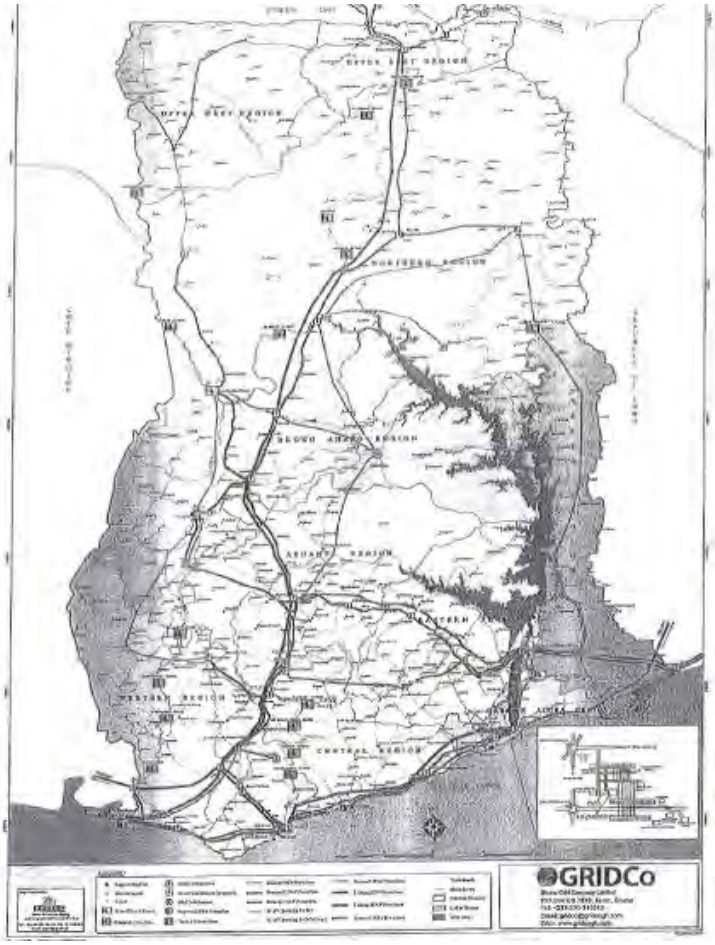
9.1.3 Existing Condition of Transmission and Transformation Facilities

(1) Transmission Line including Bulk Supply Point

Ghana's power system consists of 161- and 69-kV transmission lines (with an extended length of 4,000 km) and 29 trunk substations. The frequency is 50 hertz (Hz). International connection lines link the system to those of Togo (161kV), Benin (161kV), and Cote d'Ivoire (225kV). (See Figure 9.1.5) The trunk system containing the hydropower plants is comprised of 161 kV lines. The VRA and GRIDCo own and operate facilities up to and including the primary substations in major cities. The ECG and VRA-NED own and operate the 33 kV (or 34.5 kV) / 11 kV lines. The primary substations are 11 kV distribution lines, and posterior facilities. About one-third of Ghana's transmission and transformation facilities were built in the 1960s along with Akosombo Hydropower Plant. More than 40 years have consequently passed since their construction, and it is facing a turning point for systematic repair over the coming years. Along with the demand expansion in urbanized areas, additional trunk substations are being built in Accra, and to be implemented in Kumasi.

Source: JICA Needs Study for Power Sector Infrastructure in Ghana, 2012

Figure 9.1.5 HV Transmission Networks & Prospective Interconnection Projects (West Africa Power Pool)



Source: GRIDCo referred by JICA Needs Study for Power Sector Infrastructure in Ghana, 2012

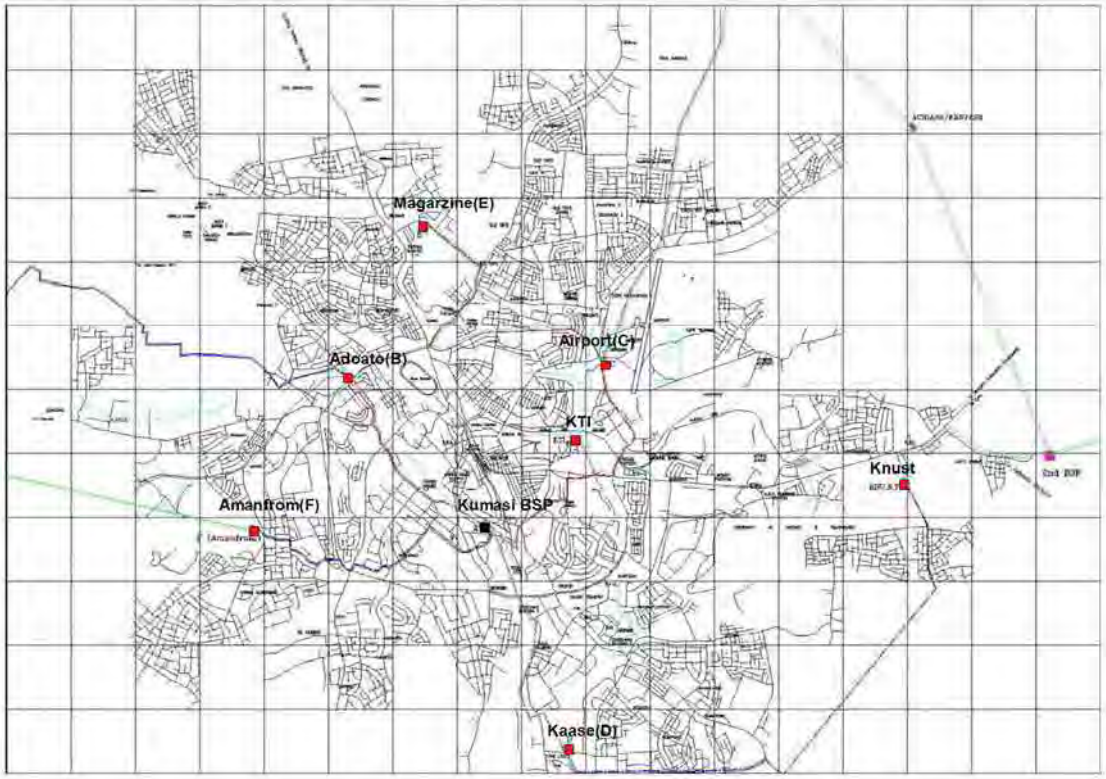
Figure 9.1.6 National Interconnected Transmission System of Ghana

Electricity consumption has been growing at 10 to 15 percent per annum for the last two decades. It is projected that the average demand growth over the next decade will be over six percent per year. The projected electricity growth assumption has profound economic, financial, social and environmental implications for the country. The aspirations of developing countries for higher living standards can only be satisfied through sustained development of their electricity power markets as part of their basic infrastructure. Electricity demand will grow much faster than overall economic growth (4-5 percent per year) or than population growth (which is less than two percent a year) because continuing urbanization will allow newly urbanized segments of the population to expand their electricity consumption.

9.1.4 Existing Condition of Distribution Facilities

(1) Existing Distribution Network

Figure 9.1.7 shows the distribution network with Bulk Supply Points (BSP) and the primary substations around KMA. The distribution network has been expanded following the growth of city development, but the recent rapid expansion of city development caused a delay in the installation of the distribution network and facilities.



Source: ECG, Ashanti Regional Office

Figure 9.1.7 Power Distribution Network around KMA

(2) Configuration of Medium-Voltage Distribution Line System

Basic configuration of the medium-voltage distribution line system is as follows.

i. Voltage reduced from 161kV (transmission lines) to 33kV in bulk supply points (BSPs), and delivered to distribution substations in 33kV lines.
ii. Voltage reduced from 161kV (transmission lines) to 11kV in BSPs, and deliver to distribution substations in 11kV lines.
iii. Voltage reduced from 161kV (transmission lines) to 33kV in BSPs, and carried to remote areas in 33kV sub-transmission lines, followed by further reduction to 11kV delivering in 11kV distribution lines to secondary substations.

With regard to configuration, the medium-voltage distribution lines mostly have a radial pattern, but there are some loop formats in Kumasi.

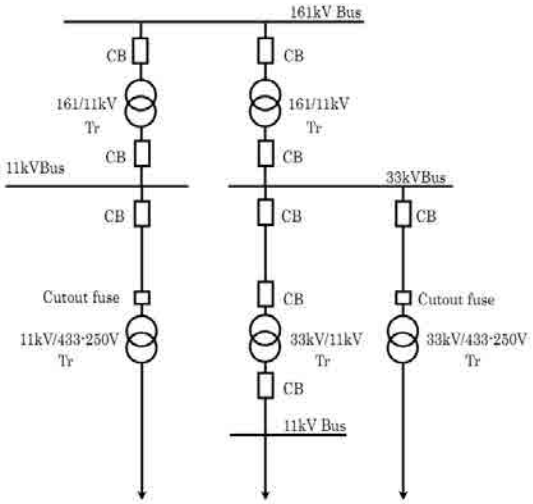
(3) Configuration of Low-Voltage Distribution Lines

The nominal low-voltage value in Ghana is 433/250V. There are from two to five low-voltage distribution (feeder) lines from a single distribution substation, in a radial pattern.

(4) Distribution Facility Design

ECG has laid down guidelines for design of sub-transmission and distribution lines. The current status of major types of distribution facilities is summarized as follows.

- The distribution system consists of three-phase, three-line 33kV and 11kV
- Medium-voltage lines and three-phase, four-line 433V and 250V low voltage lines.



Source: ECG, Ashanti Regional Office

Figure 9.1.8 Basic Configuration of the Distribution System

(5) Expansion Plan of Power Distribution System in KMA and its Surrounding Areas

Master plan study was conducted for KMA and its surrounding area in 2008 by JICA study team. The study was done in detail, and Kumasi T2 Bulk Supply Point was designated as necessary. ECG has an expansion plan of power distribution system by constructing another Bulk Supply Point for this area.

9.1.5 Current Power Consumption

(1) Current Supply Condition by VRA & GRIDCo

Along with major power outages rolling blackout was announced at the request of VRA in Kumasi in March 2012. The rollout blackout was conducted by group in the schedule shown in Table 9.1.4. The cause of this rolling blackout was due to the shortage in supply of natural gas from Nigeria to Thermal Power Plants in Ghana.

Table 9.1.4 In-Rotation Blackout Schedule

Group	Feeder	Load MW	Areas Affected
A	B71	5.83	Kwadaso, Asuoyeboa, Tanoso, Paramount, Abuakwa
	Techiman	0.67	Kakari Farms, Techiman town, Part of Edwinase
	Guinness 1	5.6	Adiebeba, Ahodwo, Daaban
	C31	3.19	Aboabo, Asawase, Akwatia Line, Roman Girls
	F31	3.6	Boadi, Emina, Apiadu
	C71	3.8	Antoa, Abirem, Doti, Duase, Kenyasi, Adwumam
	Guinness 2	4.69	Georgia hotel, Guinness Company, Part of Kaase
	NSUTA/KUMAWU	11.12	Mamponteng, Agona, Kumawu, Mampong, Effiduase, Part of Ejisu
	B61	0,46	Kwadaso Estate, Patase Cambridge
	D41	2.78	Kumi Timbers, Kaase Angola, Star Sawmill
	WAHW	4.69	West Africa Hardwoods, Asokwa Pentecost, Asofa, Baso Club.
	G11	2.23	Justice Hotel, Afull Nkwanta, St. Paul, Goldem Gate Hotel
	OBR	1.35	KMA Boss Residence, Tigo, Yegola Hotel, Dakwadwom, Nhyiaeso
	TOTAL	50.01	
B	B41	3.4	Bantamacash office, racecourse
	GBC	0.62	GBC, Dadiesoba
	E21	5.21	Nkwantwima, I&II, Magazine, New Road, Tafo Nhyiaeso, Tafo
	MANSO NKWANTA	9.78	Nkwie, Toase, Trabuom, Moseaso, Bonte, Manso Nkwanta
	C51	2.2	Diamond Hotel, Yenyawoso, Dichemso plaza, Dichemso
	B31	1.4	Bantama cash office, Racecourse
	ST Hubert	6.7	Odenho Kwadaso, Christian Village, Rexmar Hotel, Santasi, Anyinam
	B81	6.1	Bokankye, Akropong, Esaase, Barracks, Nyankyerenease
	E11	6.75	Bremang, Kronum, Afrancho
	E31	6.12	Suame, Magazine, A-lang, Mathias junction
	TOTAL	50.2	
C	D11	3.07	Atonsu, Dompoase, Chirapatere, Ramseyer
	Airport 2	7.12	Moshie Zongo, Airport, Pankrono, UGC, Atimatim, Ahwia, Meduma
	F41	2.9	Kentinkrono, KNUST Police station
	C61	6.13	Asawase market, Akwatia Line, Okyeame Akoto
	BEKWAI	7.79	Adagya, Esereso, Iachie, Kuntenase, Bekwai Town, Anwiankwanta
	C31	2.62	Asawase market, Akwatia Line, Okyeame Akoto
	E41	6.4	Maase, Ahwiaa, Ahas, Meduma
	E51	2.5	Breman West, Abuohia, Buacho, Kadie
	IND/OHL	4.22	Kaase Industrial Areas
	YABI	2.21	Yahi. Apire, Nwamase, Agric Nzema
	B11	5.4	Adoato, Kropo, Ampabame, Bohyen, Abrepokese, Asubonteng
	TOTAL	50.36	
D	Airport 1	4.71	Sepe owsusansa, Buokrom Estate, Airport Round-about
	D31	6.13	Atonsu S-line, Gyinyase, Kotei
	D51	4.48	Fares Timbers, STP, Mow, BOST, Daban, Ampeyaoo, Wood Village, Bedase
	C21	3.01	Sewaba, Asokore mampong
	Lake Road	2.9	A-Life, Cocoa Clinic, Cocoa board, Labour, Kpoly
	G21	2.41	KTI, Jackson Park, Zongo Police station, Basslica
	F51	4.77	Oduom, Fumesua, Kwamo, Ejisu, Onwe
	D21	3.07	Aprabon, Kuwait, Sewuah, part of Kotei
	LLL	2.48	LLL Company
	EDWINASE	2.71	Edwinase, Kwadaso Estate
	TOTAL	36.67	

Source: ECG, Ashanti West Regional Office

(2) Power Loss of ECG

The power loss of ECG is shown below. According to the "Power Distribution System Master Plan Study for Ghana prepared by JICA in 2008" the total loss was between 24.7% and 27.5% for the period of 2000 and 2008, which is very large. .

Table 9.1.5 Electricity Sales and Losses

Details	2000	2001	2002	2003	2004	2005	2006	2007	2008
Total Supplied (ECG & NED)	4,320	4,530	4,709	4,920	5,298	5,546	5,759	5,643	6,328
Total Sales (ECG & NED)	3,142	3,330	3,465	3,626	3,865	4,127	4,334	4,271	4,727
Total Losses	1,178	1,200	1,244	1,294	1,433	1,419	1,425	1,372	1,601
% of Total Losses	27.3%	26.5%	26.4%	26.3%	27.0%	25.6%	24.7%	24.3%	25.3%

Source: Energy Commission Annual Reports for 2007 & 2008

Table 9.1.6 Detailed Electricity Sales and Losses in 2008

Details	First Quarter	Second Quarter
Total Electricity Purchases (GWh)	1,736	1,827
Total Electricity Sales (GWh)	1,366	1,272
Technical Distribution Losses (%)	12.00%	15.00%
Commercial Distribution Losses (%)	9.34%	15.37%
Distribution System Losses (%)	21.34%	30.37%
Number of Customers	2,270,354	2,164,461

Source: Energy Commission Annual Reports for 2007 & 2008

(3) Electricity Consumption

Table 9.1.7 shows the detailed electricity losses by type from 2000 to 2008. Most losses came from the distribution system, therefore upgrading the distribution system is very important.

Table 9.1.7 Electricity Loss by Type

Sector		2000	2001	2002	2003	2004	2005	2006	2007	2008
Industries	VALCO	2,505	2,565	2,063	250	10	259	1,199	205	171
	Others	1,522	1,772	1,836	1,955	2,075	2,282	2,394	2,492	2,795
	Total	4,027	4,337	3,899	2,205	2,085	2,541	3,593	2,697	2,966
Non Residential		445	503	477	493	530	748	842	802	927
Residential		1,610	1,713	1,822	1,886	2,012	1,986	2,105	2,095	2,269
Total (with VALCO)		6,082	6,553	6,198	4,584	4,627	5,275	6,540	5,594	6,162
Total excluding VALCO		3,577	3,988	4,135	4,334	4,617	5,016	5,341	5,389	5,991
Distribution Losses		1,178	1,200	1,244	1,294	1,433	1,419	1,425	1,370	1,601
Transmission Losses		229	259	368	333	205	249	318	230	303
Total System, Losses		1,407	1,459	1,612	1,627	1,638	1,668	1,743	1,600	1,904

Source: Energy Commission Annual Reports for 2007 & 2008

(4) Electricity User Tariff

The cash flow of ECG was in red from year 2000 to 2008 due to low tariff rate.

Table 9.1.8 Electricity End User Tariff

Charges	2001	2002	2003	2004	2005	2006	2007	2008
BST*[1]	1.94	3.59	4.27	4.25	4.25	4.94	6.11	6.11
DSC*[2]	1.96	2.64	2.92	3.15	3.15	4.5	5.85	5.85
EUT*[3]	3.9	6.23	7.19	7.4	7.4	9.44	11.96	11.96

Source: Energy Commission Annual Reports for 2007 & 2008
Note: *[1] Bulk Supply Tariff
*[2] Distribution Service Charge
*[3] Electricity Transmission Utility

9.1.6 Present Situation of Greater Kumasi Sub-Region in the Electricity Sector

(1) Household Facilities

The following tables show the main source of lighting and the main means of cooking in Ghana, Ashanti Region and the districts which belong to the area of Greater Kumasi as of year 2000. In all of the surrounding districts of KMA beside Kwabre, kerosene lamp is the most used source of lighting. This is assumed to be due to the rural communities which are still not un-electrified as well as the electricity fee in the urban areas where there is electricity. As for means of cooking, wood is the main fuel for cooking in the surrounding districts of KMA whereas charcoal is the main fuel used for cooking in KMA. The usage of electricity is very limited for cooking in Ghana in general.

Table 9.1.9 Main Source of Lighting in Greater Kumasi (2000)

	Ghana	Ashanti Region	Kumasi	Atwima	Ejisu-Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre	Afigya Sekyere
Urban Pop.	-	51.3 %	100.0 %	20.3 %	26.5 %	5.0 %	38.9 %	35.6 %
Electricity	49.2 %	52.5 %	88.4%	31.0 %	40.3 %	36.0 %	53.1 %	40.6 %
Kerosene Lamp	49.3 %	46.1 %	9.6 %	67.7 %	59.0 %	63.0 %	45.4 %	58.7 %
Gas	0.4 %	0.3 %	0.1 %	0.4 %	0.2 %	0.5 %	0.2 %	0.2 %
Solar	0.1 %	0.1 %	0.2 %	0.3 %	0.0 %	0.0 %	0.1 %	0.1 %
No Light	0.4 %	0.7 %	1.1 %	0.5 %	0.3 %	0.3 %	0.8 %	0.3 %
Others	0.6 %	0.3 %	0.5 %	0.2 %	0.2 %	0.2 %	0.4 %	0.1 %

Source: 2000 Population and Housing Census, Ghana Living Standards Survey 5

Table 9.1.10 Main Source of Lighting in Greater Kumasi (2010)

	Ghana	Ashanti Region	Kumasi	Atwima Nwabiagya	Ejisu-Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre East	Afigya Sekyere
Urban Pop.	50.9 %	60.6 %	100.0 %	31.5 %	27.5 %	30.2 %	58.0 %	25.8 %
Electricity	64.9 %	74.2 %	91.7%	71.3 %	70.1 %	72.3 %	81.8 %	77.3 %
Kerosene Lamp	17.8 %	7.0 %	2.2 %	8.6 %	11.5 %	8.7 %	4.7 %	9.1 %
Flashlight/ Tourch	15.7 %	17.3 %	4.6 %	18.5 %	16.5 %	16.7 %	11.8 %	11.9 %
Gas	0.2 %	0.2 %	0.1 %	0.2 %	0.2 %	0.3 %	0.2 %	0.2 %
Solar	0.2 %	0.2 %	0.1 %	0.1 %	0.2 %	0.1 %	0.1 %	0.2 %
Others	1.3 %	1.2 %	1.4 %	1.4 %	1.5 %	1.9 %	1.3 %	1.3 %

Source: GSS, 2010 Population and Housing Census,

Table 9.1.11 Means of Cooking in Greater Kumasi (2000)

	Ghana	Ashanti Region	Kumasi	Atwima	Ejisu-Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre	Afigya Sekyere
Urban Pop.	-	51.3 %	100.0 %	20.3 %	26.5 %	5.0 %	38.9 %	35.6 %
None / No Cooking	4.4 %	5.1 %	8.4 %	2.6 %	3.5 %	3.4 %	5.9 %	4.4 %
Wood	53.5 %	49.9 %	3.9 %	72.2 %	72.6 %	77.0 %	50.1 %	85.4 %
Crop residue / Sawdust	1.1 %	0.2 %	0.3 %	0.1 %	0.1 %	0.1 %	0.1 %	0.1 %
Gas	9.5 %	4.8 %	10.8 %	2.0 %	2.9 %	1.5 %	2.1 %	0.9 %
Electricity	0.3 %	1.6 %	3.0 %	0.6 %	0.5 %	0.4 %	1.0 %	0.4 %
Kerosene	0.6 %	1.7 %	2.1 %	1.3 %	1.4 %	1.3 %	1.7 %	1.1 %
Charcoal	30.6 %	36.2 %	70.9 %	20.8 %	18.7 %	15.4 %	38.3 %	7.6 %
Others	0.0 %	0.6 %	1.0 %	0.4 %	0.3 %	0.7 %	0.9 %	0.1 %

Source: 2000 Population and Housing Census, Ghana Living Standards Survey 5

Table 9.1.12 Means of Cooking in Greater Kumasi (2010)

	Ghana	Ashanti Region	Kumasi	Atwima Nwabiagya	Ejisu-Juaben	Bosomtwe / Atwima Kwanwoma	Kwabre East	Afigya Sekyere
Urban Pop.	50.9 %	60.6 %	100.0 %	31.5 %	27.5 %	30.2 %	58.0 %	25.8 %
None / No Cooking	5.6 %	8.1 %	10.7 %	6.5 %	6.0 %	6.5 %	7.6 %	6.9 %
Wood	40.2 %	29.8 %	1.5 %	22.7 %	44.5 %	38.4 %	13.2 %	32.3 %
Crop residue / Sawdust	1.0 %	0.4 %	0.3 %	0.3 %	0.4 %	0.4 %	0.3 %	0.4 %
Gas	18.2 %	21.1 %	34.3 %	19.4 %	14.9 %	14.6 %	18.2 %	12.6 %
Electricity	0.5 %	0.7 %	0.6 %	0.3 %	0.4 %	0.4 %	0.4 %	0.3 %
Kerosene	0.5 %	0.4 %	0.5 %	0.4 %	0.3 %	0.4 %	0.4 %	0.4 %
Charcoal	33.7 %	39.3 %	51.8 %	50.2 %	33.3 %	39.3 %	59.9 %	47.0 %
Others	0.2 %	0.2 %	0.3 %	0.3 %	0.2 %	0.1 %	0.0 %	0.1 %

Source: GSS, 2010 Population and Housing Census

(2) Issues on Electricity Supply Sector in KMA

The issues of electricity supply sector identified in KMA Medium Term Development Plan (MTDP) 2010-2013 of KMA are:

- Frequent power outages;
- Overloaded power supply stations;
- Illegal connection of electricity;
- Faulty meters and the high number of un-metered premises;
- Poor customer services by staff of ECG; and
- Inadequate supply of LPG.

These issues raised in KMA's MTDP can be also identified in the surrounding areas of KMA.

(3) Un-Electrified Communities of Surrounding Areas of KMA

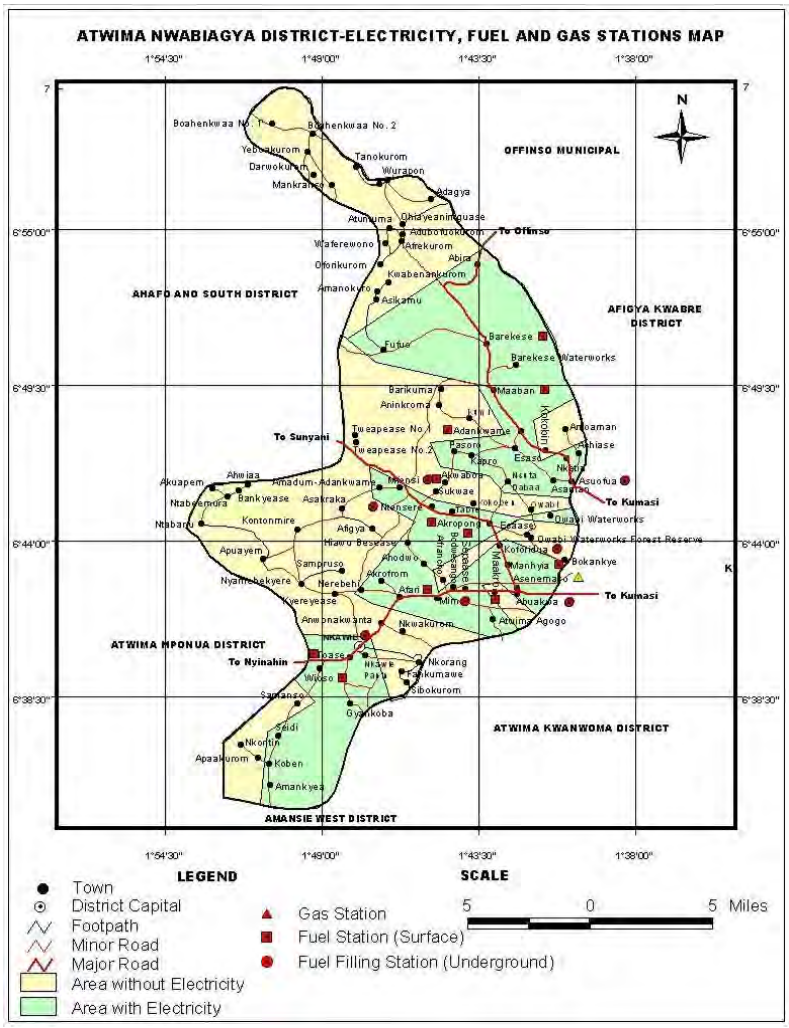
Although KMA does not have un-electrified communities with population of over 500, there are still un-electrified communities whose populations are over 500 in the surrounding areas of KMA.

In Atwima Nwabiagya District, 18 communities (27.69% of the communities with population 500 and above in the district) with population 500 and above do not have electricity. See Table 9.1.13. Figure 9.1.9 shows the areas within the district which does not have electricity.

Table 9.1.13 Electricity Supply Situation in Atwima Nwabiagya

Area Council	No. of communities with population 500 and above	Communities (population 500 and above) with electricity		Communities (population 500 and above) without electricity	
		No.	%	No.	%
Abuakwa	7	7	100	0	0
Akropong	22	16	72.73	6	27.27
Nkawie-Toase	10	8	80.0	2	20.0
Barekese	11	4	36.37	7	63.63
Adankwame	10	8	80.0	2	20.0
Afari	5	4	80.0	1	20.0
Total	**65**	**47**	**72.31**	**18**	**27.69**

Source: DPCU Atwima Nwabiagya 2009



Source: Atwima Nwabiagya MTDP 2010-2013

Figure 9.1.9 Un-electrified Areas in Atwima Nwabigya

9.2 Review of Past and Existing Development Plans and Projects for Electricity Supply Sector

9.2.1 National Energy Policies and Development Plans

(1) Ghana Shared Growth and Development Agenda (GSGDA 2010-2013)

The country's national development policy framework, Ghana Share Growth and Development Agenda (GSGDA) acknowledges the energy sector as one of the major infrastructure in propelling the country's economic growth. GSGDA aims to achieve macro-economic stability and grow the economy to a middle income status by 2020. Energy sector plays a significant role in order to achieve this goal. In order to achieve this goal, the Ministry of Energy has set the goal and constructed plans for the energy sector to assist national development.

(2) National Energy Policy (2010)

The National Energy Policy covers eight areas within the energy sector including power sub-sector. The following tables summarize issues, challenges and policy directions of the power sub-sector.

Table 9.2.1 Goal, Challenges and Policy Directions for Power Sub-Sector

Goal	To Become a major exporter of power in the Western Africa Sub-Region by 2015	
Challenges	・ To Sustain power generation capacity expansion, as well as rehabilitate and reinforce the transmission and distribution infrastructure to meet the projected growth in power demand of 10% per year in the medium term ・ To Secure long-term reliable and cheaper fuel for the thermal power plants ・ To Increase access to electricity of consumers, especially in rural areas ・ To achieve cost recovery for electricity services in spite of relatively low income ・ To reduce power system losses and waste in electricity supply and consumption	
Policy Direction	Power Supply Infrastructure	To attract private investments to support the public sector to improve and expand the capacity of the existing infrastructure
	Securing Fuel Supply	To make efforts to increase and diversity the fuel mix in power generation
	Access to Electricity Supply	To achieve universal access to electricity by extending the reach of electricity infrastructure to all communities by 2020. The following are some of the policy actions which will be pursued by the Government. ・ To support private sector co-financing with Government for grid-extension to designated franchised zones ・ To provide street lighting infrastructure in all regional capitals and subsequently in all district capitals
	Electricity Pricing	To ensure that electricity pricing is efficient and competitive while providing rates that are affordable

(3) Energy Sector Strategy and Development Plan (2010)

The Energy Sector Strategy and Development Plan prepared by the Ministry of Energy features on the following six areas: Energy Sector Institutions; Power Sub-sector; Petroleum Sub-sector; Renewable Energy Sub-sector; Waste-to-Energy; and Energy and Gender.

1) Strategy Goals of Power Sub-Sector

Power sub-sector's strategy is intended to roll out initiatives that will guide the development of the power sub-sector in the medium term and seek also to achieve the following policy goals:

- To ensure adequate, reliable and improve supply of electricity to meet national requirement and for export through consolidation, rehabilitation and expansion of electricity generation, transmission and distribution infrastructure
- To increase access to electricity from the current 66% to at least 80% by 2015
- To secure sources of cost-effective and sustainable fuel supply for electricity generation
- To increase financing for electricity supply infrastructure development from Government source, development partners and the private sector
- To strengthen institutional and management capacity as well as regulatory regime for the smooth development and operation of the power sub-sector
- To ensure a cost-effective pricing regime for electricity services

2) Issues and Objectives of Power Sub-Sector

The following table summarizes strategies for each objective to be achieved for the issues on the sub-sector.

Table 9.2.2 Issues, Objectives and Key Projects of Power Sub-Sector

Issues	Objectives	Key Projects
Power Supply Shortage	To increase generation capacity to 5000MW by 2015	・ Operationalisation and expantions of the Osagyefo Power Barge Project (125MW) ・ Impleentation of the Aboadze TICO Power Plant steam turbine project (increase total capacity from 550MW to 660MW) ・ Development of Western Rivers Hydropower Project ・ Development of Juale Hydropower Project ・ Completion and expansion of all on-going GoG-financed power projects ・ Completion of IPP projects ・ Development of wind power projects
	To achieve gas-based generation from at least 50% of thermal power plant production by 2015	・ Completion of the West African Gas Pipeline Project to Tema ・ Acceleration of the use of natural gas from WAGPP in place of crude oil at Aboadze ・ Construction of pipelines from the Jubilee Field Gas Field Project to Osagyefo Power Plant at Effasu and the Takoradi Power Plant at Aboadze ・ Intensify Exploration for Gas and Oil
	To increase participation of IPPs in the power sector through transparent through transparent procurement	-

Issues	Objectives	Key Projects
	To improve and modernize electricity distribution infrastructure to reduce system losses from 25% to 18% by 2015	・ Upgrading and Rehabilitation of Electricity Distribution Network ・ Commercial Loss Reduction Programme ・ Prepaid Metering Programme to replace credit metering in residential and commercial sectors
	To develop non-congested electricity transmission network by 2015	・ Completion of On-going Substation Projects ・ Grid Extension Projects ・ Refurbishment of Supervisory Control and Data Acquisition (SCADA) System ・ Aboadze-Volta 330kV Project ・ Accra 3rd Bulk Supply Point Project ・ Kumasi 2nd Bulk Supply Point Project ・ Buipe Sub-station ・ Aboade-Prestea-Kumasi-Wa 330 kV Project ・ Tumu-Han-Wa ・ Development of Electricity Market Rules
	To strengthen regulatory agencies to perform their function effectively	-
Inadequate access to electricity	To achieve universal access by extending electricity to all communities by 2020	・ National Electrification Scheme ・ Self Help Electrification Programme ・ Intensification of electricity supply to households in already electrified community ・ Development and use of decentralized electricity generation souces for communities remote from national electricity grid ・ Productive Uses of Electricity (PUE) Programme
	Increase access to at least 80% by 2015	-
Restoration of financial health of VRA and ECG	Achieve economically efficient tariffs by 2011	・ Electricity Tariff Study ・ Financial Recovery Plan for VRA and ECG

(4) National Electrification Scheme (NES)

National Electrification Scheme (NES) was instituted as the government's principal instrument to achieve its policy of extending the reach of electricity to all parts of the country over a 30-year period from 1990 – 2020; 64 out of 110 administrative district capitals had been connected to grids, the last batch of 23 district capitals (Districts had then been increase to 130. There are now 160) were connected between 1996-1998.

The Self-Help Electrification Programme (SHEP) was introduced as a complementary programme. Rationale for the SHEP is:

- To accelerate grid connection for communities which felt their proposed projects on the programme of implementation were too far into the future.
- To reduce overall cost to the government.
- To introduce community ownership.

The criteria for joining the SHEP are as follows:

- The community must be within 20 km of an existing 11kV/33kV network;
- The community must be willing and able to procure and erect all the low voltage distribution poles required for the works
- A minimum of one-third of houses in the community should be wired and ready to be serviced as soon as electricity supply is connected to the communities.
-

Table 9.2.3 Achievements under National Electricfication Scheme

Completed Projects (1990 - 2000) –NES Phases 1&2		
	NEP	430 towns
	Other Projects	405
	SHEP1	50
	SHEP2	250
	SHEP3 Phase1	280
	SHEP3 Phase2	494
	Total	1,909
Projects (Oct. 2001 - 2005) - NES Phase 3		
	SHEP phase 3	573 towns
	SHEP 4 phase 1	46
	Volta lake resettlement township	144
	EU Funded Electrification	108
	(.R.) Elect of Nyinahim & 23 other towns	24
	Electrification in Amansie West	10
	Other NEP Projects	204
	Total	1099
Ongoing (2006 onward)		
	Complete SHEP3 phase3	
	Current SHEP4 to connect 2,500 communities at a cost of $350M,	
	To date, grid extension has been the main approach, with a few solar PV programmes as an off-grid option.	
Some facts and figures		
	# of towns connected before 1989	478
	# of towns connected to date	3,448
	# of towns connected through.'	1,900
	Accessibility at commencement (1989)	15%
	% of population have access to electricity	43% (as per census, 2000)
	Accessibility in 2004	54%
	Accessibility at present	> 60%

9.2.2 Power Sector Development Project

(1) Power Development Plan by Ministry of Energy

Table 9.2.4 Ten Year Capacity Demand and Supply Balance

Unit; MW

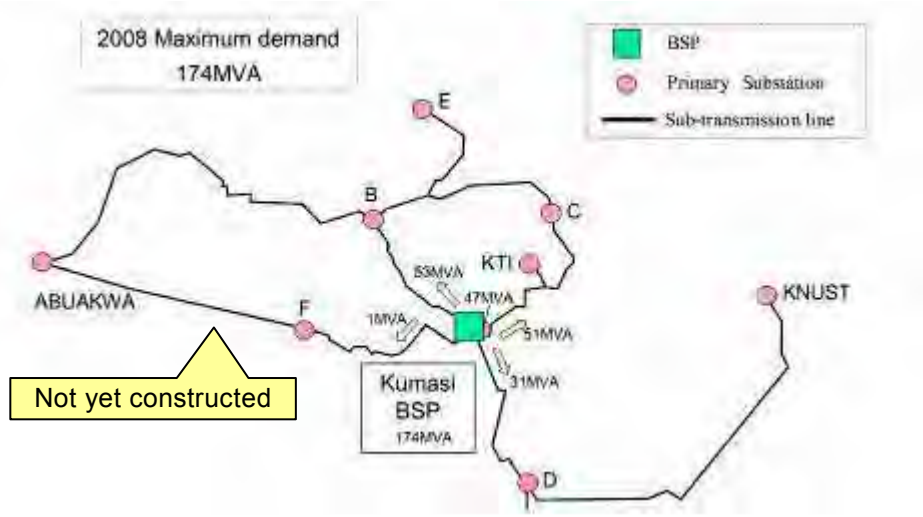
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Projected Demand	Capacity Demand (MW)										
	Domestic (including System Usage)	1,629	1,736	1840	1,959	2,089	2,250	2,405	2,548	2,695	2,854
	VALCO Mining	153	153	153	153	153	153	153	153	153	153
	Togo CEB Supply	90	90	90	120	120	120	150	150	150	150
	Burukina Faso SONABEL	41	46	51	77	107	107	107	107	107	107
	Total Projected Capacity	1,913	2,025	2,134	2,309	2,469	2,630	2,815	2,958	3,105	3,264
	20% Capacity Reserve Margin	383	405	427	462	494	526	563	592	621	653
	Projected Demand+Reserve Margin	2,296	2,430	2,561	2,771	2,963	3,156	3,378	3,550	3,726	3,917
Existing and Committed Generation	Capacity Supply (MW)										
	Hydro										
	Akosombo	900	870	870	870	870	870	870	870	870	870
	Kpong	140	140	140	140	140	140	140	140	140	140
	400MW Bui Hydro plant		340	340	340	340	340	340	340	340	340
	Total existing Hydro	1,040	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
	Thermal										
	Existing Generation Resources										
	TacoradiT1-Combine Cycle	300	300	300	300	300	300	300	300	300	300
	TacoradiT2-Combine Cycle	200	200	200	200	200	200	200	200	200	200
	TemaTT1TP	100	100	100	100	100	100	100	100	100	100
	Tema Harbour 200MW Sunon-Asogll (Phase 1)	180	180	180	180	180	180	180	180	180	180
	Tema for Mining Development Emergency MRP	40	40	40	40	40	40	40	40	40	40
	Tema TT2PP	45	45	45	45	45	45	45	45	45	45
	Power Imports	0	0	0	0	0	0	0	0	0	0
	Total Existing Thermal	865	865	865	865	865	865	865	865	865	865
	Committed Generation Resources										
	Efas (Barge) 125MW Osagyefo Barge	0	0	0	100	100	100	100	100	100	100
	Tema 126MW OSONOR Plant	0	100	100	100	100	100	100	100	100	100
	PoN Tema KTPP (Phase 1)	0	0	200	200	200	200	200	200	200	200
	Takoradi 3(T3)-Phase 1	120	120	120	120	120	120	120	120	120	120
	Takoradi 2 Expansion	0	0	100	100	100	100	100	100	100	100
	VRA Wind Power Plant Project	0	0	50	150	150	150	150	150	150	150
	VRA Solar Power Plant Project	0	10	10	10	10	10	10	10	10	10
	Total Committed Generation	120	230	580	780	780	780	780	780	780	780
	Total (Existing & Committed)	2,025	2,445	2,795	2,995	2,995	2,995	2,995	2,995	2,995	2,995
Candidate Generation	Candidate Generation Resources										
	Tema OSONOR+TT1PP Expansion	0	0	0	100	100	100	100	100	100	100
	Takoradi 3 (T3) - Phase 2	0	0	0	0	120	120	120	120	120	120
	Pwalugu Hydro Project	0	0	0	0	0	0	48	48	48	48
	Daboya Hydro Project	0	0	0	0	0	0	0	0	44	44
	Juale Hydro Project	0	0	0	0	0	0	0	0	87	87
	Additional Generation Requirement	0	0	0	0	0	450	450	450	900	900
	Total Candidate Generation	0	0	0	0	220	670	718	718	1299	1299
	Total Available Capacity	2,025	2,445	2,795	2,995	3,215	3,665	3,713	3,713	4,294	4,294
	Reserve Capacity Excluding Wind & Solar	6%	20%	28%	27%	24%	33%	26%	20%	33%	27%
	Required Reserve Capacity (5)	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

Table 9.2.4 shows the projection of demand and supply prepared by VRA based on realistic values. The prediction was done by assuming that the average growth rates of demand over the next decade would be over six percent per year. The aspirations of developing countries for higher living standards can only be satisfied through sustained development of their electricity power markets as part of their basic infrastructure. Electricity demand will grow much faster than overall economic growth or than population growth because continuing urbanization will allow newly urbanized segments of the population to expand their electricity consumption manyfold.

(2) Development Master Plan Study by JICA 2008 Study

JICA has carried out the "Power Distribution System Master Plan Study for Ghana" in 2008. This study proposed a countrywide Master Plan regarding the distribution facility development, including distribution network renewal, reinforcement, and extension plans, necessary for stable power supply in Ghana. As part of this project the distribution facility and network in KMA was looked at. Figure 9.2.1 shows a diagram for the current 33-kV system in the Kumasi area. In 2008, the maximum peak demand was 174 MVA. The Kumasi 33-kV system is supplied from the Kumasi BSP.

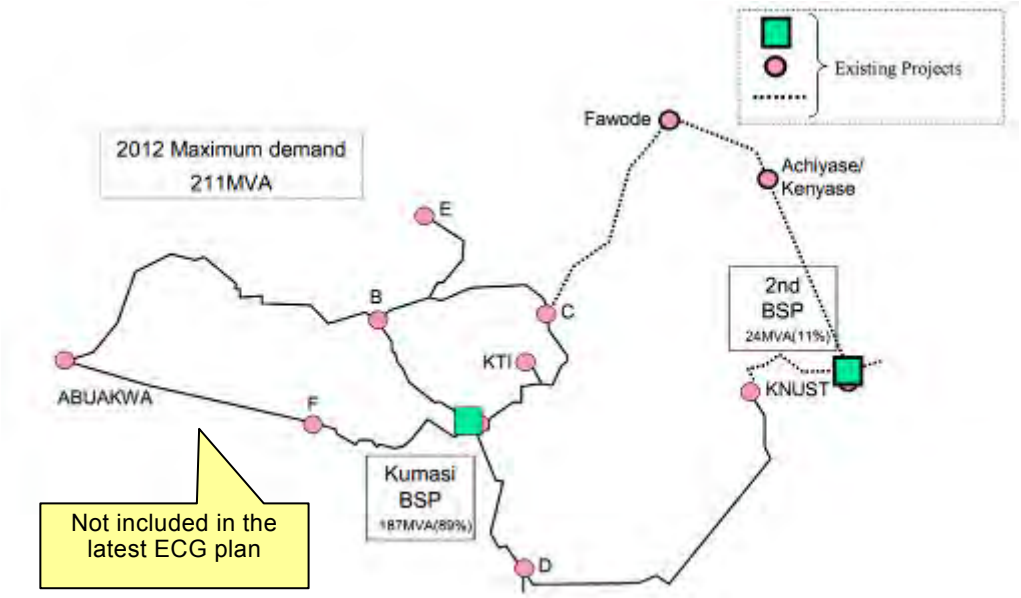
Figure 9.2.2 presents a diagram of the system as of 2012 upon implementation of the GEDAP in its entirety. In that year, the maximum peak demand would reach 211 MVA. GEDAP is anticipated to add a total of 120 MVA in transformer capacity and 52 km of sub transmission lines (through extensions). A second BSP is to be constructed in the eastern part of Kumasi.



Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

Figure 9.2.1 Diagram of Kumasi 33-kV System as of the year 2008

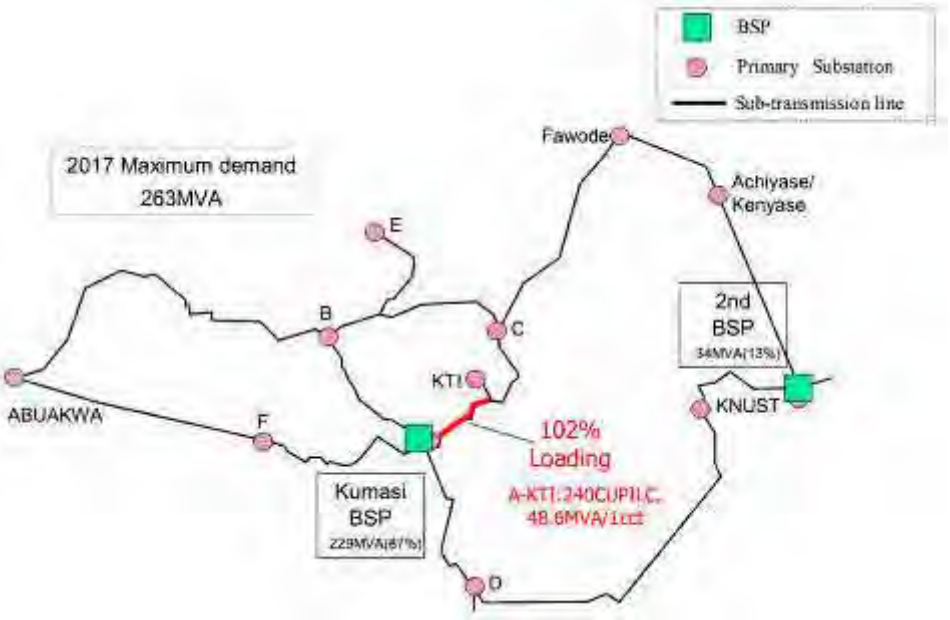
Analysis of the system as of 2012 found that there would not be any overload or voltage problems for the primary substations or sub transmission lines in the area of Kumasi. The existing future plans for primary substations and sub-transmission lines are adequate for the maximum demand in 2012.



Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

Figure 9.2.2 Prospective Diagram of Kumasi 33-kV System as of the year 2012

Although there are no additional plans for the years following 2012 in Kumasi, an analysis was made of the system over the years 2013 - 2017 to check bottlenecks. This analysis revealed an overload section on the sub transmission line between the A and KTI points in the system diagram for 2017 shown in Figure 9.2.3. As shown in Table 9.2.5, the installation of an additional sub transmission line at the overload point was maximum demand in 2008.



Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

Figure 9.2.3 Prospective Diagram of Kumasi 33-kV System for Year 2017

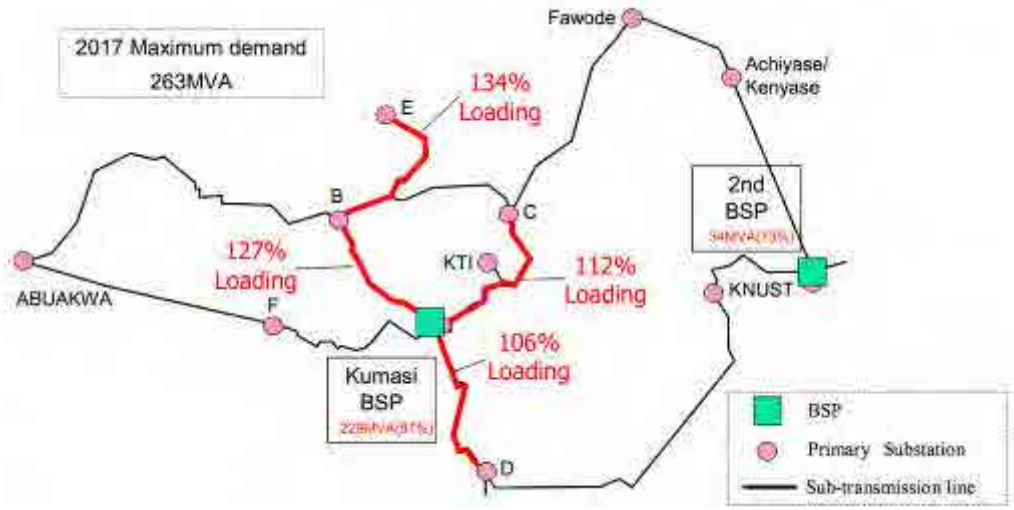
Table 9.2.5 Proposed Project for the Kumasi Distribution System

Facility Name	Bottleneck	Countermeasure	Cost (1,000 USD)	Start Year
A-KT1	Sub transmission line overload	Instillation of two new 630 ALXPE circuits between H and E (1 circuits × 5.0 km)	525	2017

Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

(3) Upgrading of the Existing Kumasi System Proposed by JICA 2008 Study

Figure 9.2.4 presents the results of analysis for the Kumasi system for 2017. The bold lines indicate locations in which the thermal capacity would exceed 100 percent in the event of failure of a single sub transmission line circuit. Table 9.2.6 presents resolution measures for these overload locations. The installation of a total of 16.5 km of underground cable and reinforcement of 5 km of overhead distribution lines would give the system an even higher degree of reliability. The cost of the countermeasures would total USD1.244 million.



Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

Figure 9.2.4 Results of Analysis for the Kumasi 33-kV System for Year 2017

Table 9.2.6 Countermeasures to Increase Supply Reliability for the Kumasi System

Facility name	Bottleneck	Countermeasure	Length	Cost (USD 1,000)	Year
A-C	Overloading of sub-transmission lime	New line A-C 240 LXLPE	7.0 km	348	2017
A-B	Overloading of sub-transmission lime	New line A-C 240 LXLPE	7.0 km	348	2017
B-E	Overloading of sub-transmission lime	New line B-E 240 LXLPE	7.0 km	348	2017
A-D	Overloading of sub-transmission lime	New line A-D 265 to 400 ALBARE	7.0 km	348	2017

Source: JICA Power Distribution System Master Plan Study for Ghana, 2008

(4) Other Projects of Electric Supply Sector for Greater Kumasi Sub-Region

1) High Voltage Distribution Scheme

The Electricity Company of Ghana (ECG) and World Bank, in collaboration with the government of Ghana started a project, High Voltage Distribution Scheme (HVDS) to reduce power congestion, and help boost voltage supply to its customers in Ashanti Region. This project began in November 2011 and was competed in February 2012 covering 15 suburbs of KMA in Suame Sub-Metropolitan area.

The project aim was to improve the existing power distribution network in about 15 communities, from Suame Magazine and its surroundings areas to Barekese, while replacing old equipment to improve the system to ensure safe, quality and reliable electricity delivery to the communities.

2) Construction of Waste-to-Energy Plant in KMA

Waste-to-energy plants are to be constructed for the Cape Coast and Kumasi metropolitan areas to process solid waste into energy. The two projects are estimated to cost $350 million and is to begin by the end of August 2012. The project will be undertaken by Everbright Company Limited of China. It is assumed that the Kumasi project would process 1,500 tonnes of solid waste daily.

The first phase of the project is expected to be completed by the end of December 2012. Once the project is completed by the end of February 2013, Everbright Company would operate the plants for 25 years after which the plants would be transferred to the government of Ghana.

9.3 Issues on the Electricity Supply Sector

According to the "Power Distribution System Master Plan Study for Ghana prepared by JICA in 2008" the reliability of power supply is extremely low.

Some other issues identified in the electricity supply sector are:

- Power supply shortage;
- Inadequate access to electricity;
- Financial health situation of VRA and ECG;
- Illegal connection of electricity; and
- Faulty meters and the high number of un-metered premises.

Most of these issues can be solved by replacing deteriorated facilities. The neglect to properly replace deteriorated feasibilities and troubles caused by voltage drop owing to the failure to adequately reinforce distribution lines.

The replacement of deteriorated facilities hasn't been done due to lack of budget. The reason for the ECG loss is neglect to replace deteriorated facilities. Replacement of deteriorated facilities is of utmost necessity.

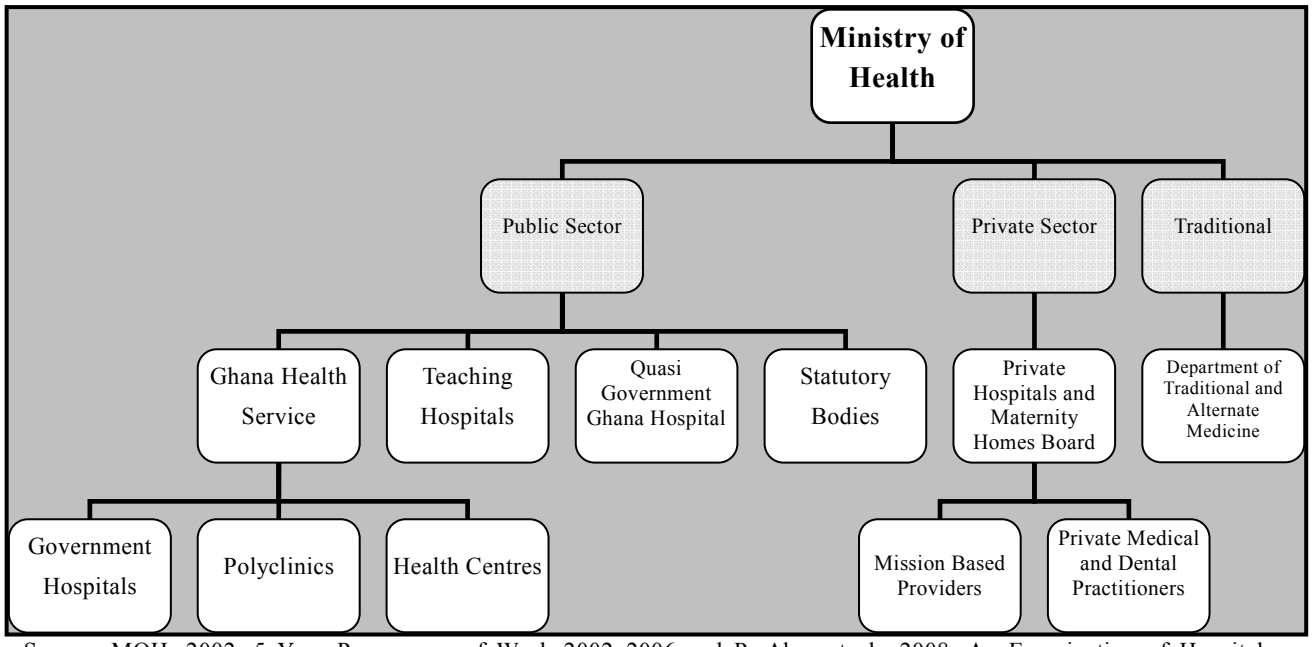
Chapter 10 Health Sector of Greater Kumasi Sub-Region

10.1 Present Situation of the Health Sector

10.1.1 Institutional Structure of Health Sector

The Ministry of Health (MOH) and its agencies including Ghana Health Service (GHS), teaching hospitals and the regulatory agencies are responsible for the formulation of health service policies, provision of health services and the regulation of activities in the health sector.

Figure 10.1.1 shows an organigram of the health sector in Ghana.



Source: MOH, 2002, 5 Year Programme of Work 2002–2006 and P. Abor et al., 2008, An Examination of Hospital Governance in Ghana, Emerald Group Publishing Limited

Figure 10.1.1 Organigram of Health Sector in Ghana

(1) Ministry of Health

The role of the MOH is to translate government policies on health into sector policies to guide implementation by the agencies. It also has the responsibility to monitor the implementation of such policies from a sector-wide perspective.

The mission of the MOH is to contribute to socio-economic development and wealth

creation by promoting health and vitality, ensuring access to quality health, population and nutrition services for all people living in Ghana and promoting the development of a local health industry.

(2) Ghana Health Service

The Ghana Health Service (GHS) is a public service body and an autonomous executive agency responsible for implementation of national policies under the control of the Minister of Health through its governing Council - the Ghana Health Service Council.

"The GHS is responsible for the delivery of primary and secondary care services in Ghana. These services are provided through government-owned health institutions such as maternity homes, clinics, health centres, polyclinics and hospitals. Specialized hospitals such as the psychiatric hospitals and the leprosaria are also included in the service outlets of the GHS. As part of the effort to improve access to health services, the Community-Based Health Planning and Services has been designated as another level of health care delivery which combines public health and basic clinical care activities." (MOH, 2007)

(3) Teaching Hospitals

There are currently three teaching hospitals in Ghana, which are Korle Bu Teaching Hospital (KBTH) located in Accra, Greater Accra Region, Konfo Anokye Teaching Hospital (KATH) located in Kumasi, Ashanti Region and Tamale Teaching Hospital located in Tamale, Northern Region. "The teaching hospitals provide tertiary and specialist services and act as the main referral centres in the country. Apart from their teaching responsibilities, each of the teaching hospitals has a number of centres of excellence that provide services to patients from Ghana and other countries. The teaching and service delivery responsibilities of the teaching hospitals shall be adequately segregated and shall be managed through a contractual arrangement between the Ministry of Health and the Ministry of Education." (MOH, 2007)

10.1.2 Existing Condition of Health Facilities

(1) Teaching Hospitals

1) Korle Bu Teaching Hospital

Korle-Bu Teaching Hospital (KBTH), located in Accra, is the leading national referral hospital in Ghana with a bed capacity of 2,000 and 3,000 members of staff. It is currently the third largest hospital in Africa.

Clinical and diagnostic departments of the hospital include Medicine, Child Health, Obstetrics and Gynaecology, Pathology, Laboratories, Radiology, Anaesthesia, Surgery, Polyclinic, Accident Centre and Surgical/Medical Emergency. Other departments include, Pharmacy, Finance, Engineering, and General Administration.

2) Komfo Anokye Teaching Hospital

Komfo Anokye Teaching Hospital (KATH) is located in Kumasi, the Regional Capital of

Ashanti Region.

With only three hospitals that provide tertiary and specialist services in the whole of Ghana, and KATH being located in the centre of the country, it has been providing advanced medical treatment not only for the Ashanti Region, but also for the whole of Ghana. Therefore, KATH has been facing a crucial issue of extreme overcrowding. KATH has been planning an expansion to the old military barrack area.

3) Tamale Teaching Hospital

The Tamale Teaching Hospital, which was a Regional Referral Hospital, gained accreditation as a teaching hospital in 2007.

(2) Regional Hospitals

The regional hospitals of Ghana are government hospitals under the supervision of GHS. They deliver secondary care services and supervise district hospitals. It is mandatory for each region to have a regional hospital. However, in Ashanti Region, KATH has been taking over the role of regional hospital, which adds more pressure to the overcrowded facility.

Table 10.1.1 Health Facility by Type and Ownership in Regions, 2009

Region	Teaching Hospitals	Regional Hospitals	Other Hospitals			Polyclinic	Health Centres & Clinics		
	Gov't	Gov't	Gov't	Private	Others	Gov't	Gov't	Private	Others
Ashanti	1	0	22	48	22	0	141	161	43
Brong Ahafo	0	1	8	6	12	1	149	24	13
Central	0	1	10	7	6	0	80	75	11
Eastern	0	1	12	5	8	0	166	63	26
Greater Accra	1	1	9	79	11	7	44	232	23
Northern	1	1	9	0	8	0	122	20	36
Upper East	0	1	4	0	1	0	54	11	16
Upper West	0	1	3	1	4	0	60	4	17
Volta	0	1	11	7	9	1	192	23	9
Western	0	1	11	3	10	2	98	119	51

Source: MOH, The Health Sector in Ghana, Facts and Figures 2010

(3) District Hospitals

District hospitals are the facilities for clinical care at the district level. District hospitals serve an average population of 100,000–200,000 people in a clearly defined geographical area. They are the first referral hospitals and form and integral part of the district health system.

According to GHS, district hospitals should provide the following:

- Curative care, preventive care, and promotion of heath of the people in the district
- Quality clinical care by more skilled and competent staff than those of the health centers and polyclinics
- Treatment techniques, such as surgery not available at health centers

- Laboratory and other diagnostic techniques appropriate to the medical, surgical, and outpatient activities of the district hospital

(4) Health Centres and Polyclinics

The health centre has traditionally been the first point of contact between the formal health delivery system and the client. It is headed by a Medical Assistant and staffed with program heads in the areas of midwifery, laboratory services, public health, environment, and nutrition. Each health centre serves a population of approximately 20,000. They provide minor surgical services such as incision and drainage. The polyclinic is the urban version of the rural health centre. Polyclinics are usually larger, offer a more comprehensive array of services, are manned by physicians, and can offer complicated surgical services. They are located mainly in metropolitan areas.[1]

10.1.3 Present Situation of Greater Kumasi Sub-Region in the Health Sector

(1) Current Situation of Regional Hospital in Ashanti Region

Ashanti Region has the largest population in Ghana out of the ten regions; however, in 2009, Ashanti Region was the only region that did not have a regional hospital. KATH, which has been functioning as the regional hospital, has been experiencing extreme pressure caused by factors such as rapid population increase in the region, especially in KMA, as well as lack of a hospital with intensive care service in the area.

To resolve this situation, a regional hospital for Ashanti Region has been proposed for Sawuah in Bosomtwe District.

(2) Current Situation of Hospitals and Health Centres in Greater Kumasi Sub-Region

Table 10.1.2 shows the distribution of health facilities in Greater Kumasi Sub-Region. The distribution of hospitals and health centres in each district in Greater Kumasi Sub-Region is unbalanced with most of the government hospitals located in either KMA or Ejisu-Juaben Municipality, both of which have enough private hospitals for the current population, while Atwima Kwanwoma currently does not have any and some other districts have only one. The health centre in Trabuom or the one in Foase in Atwima Kwanwoma has been proposed to be upgraded to a hospital in the MTDP 2008–2012.

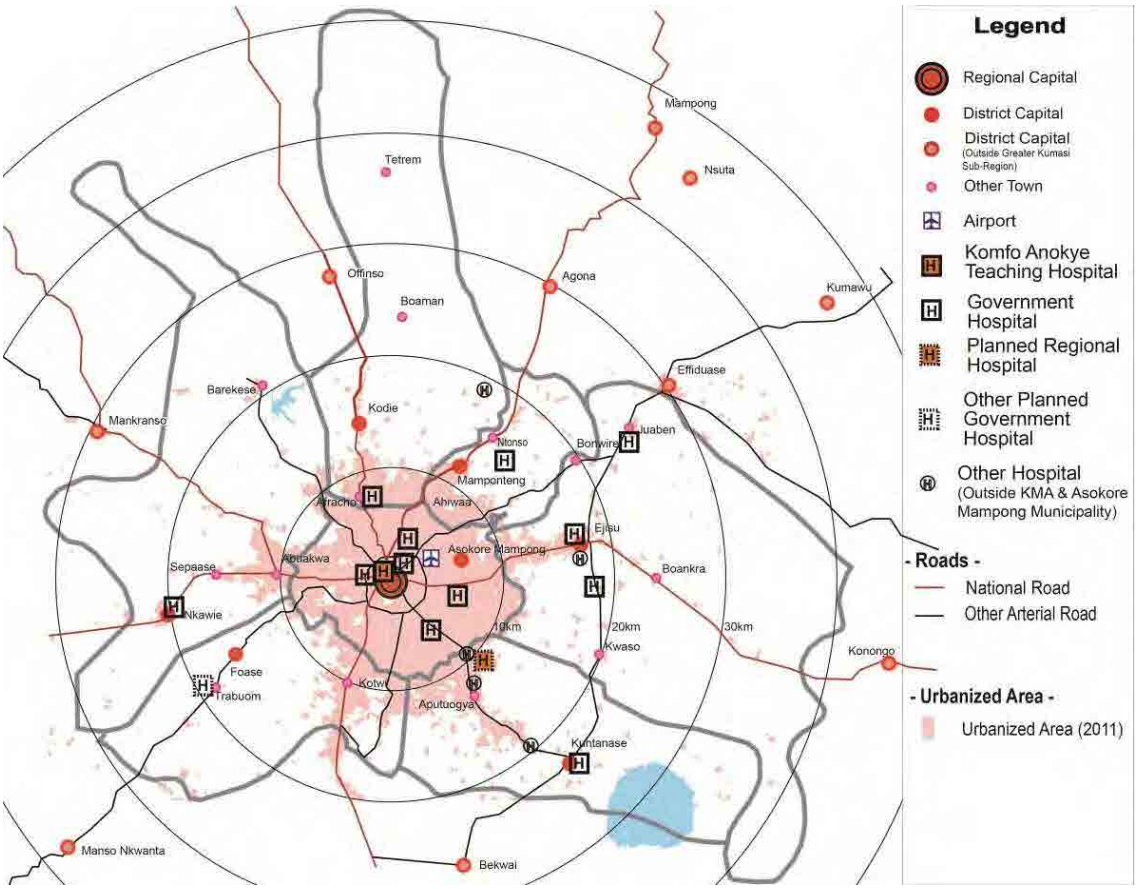
The locations of the hospitals in the Sub-Region outside KMA are concentrated along or close to Lake Road while there is only one hospital between Atwima Nwabiagya and Atwima Kwanwoma (western side of KMA).

[1] GHS, www.ghanahealthservice.org/

Table 10.1.2 Health Facility by Type and Ownership in Greater Kumasi Sub-Region

District	Hospital		Health Centre	
	Gov't	Other	Gov't	Other
KMA	6	35	2	0
Asokore Mampong	0		0	0
Ejisu-Juaben	3	5	3	1
Bosomtwe	1	3	2	0
Atwima Kwanwoma	0	0	4	0
Atwima Nwabiagya	1	0	4	0
Afigya Kwabre	1	1	10	0
Kwabre East	1	0	5	0

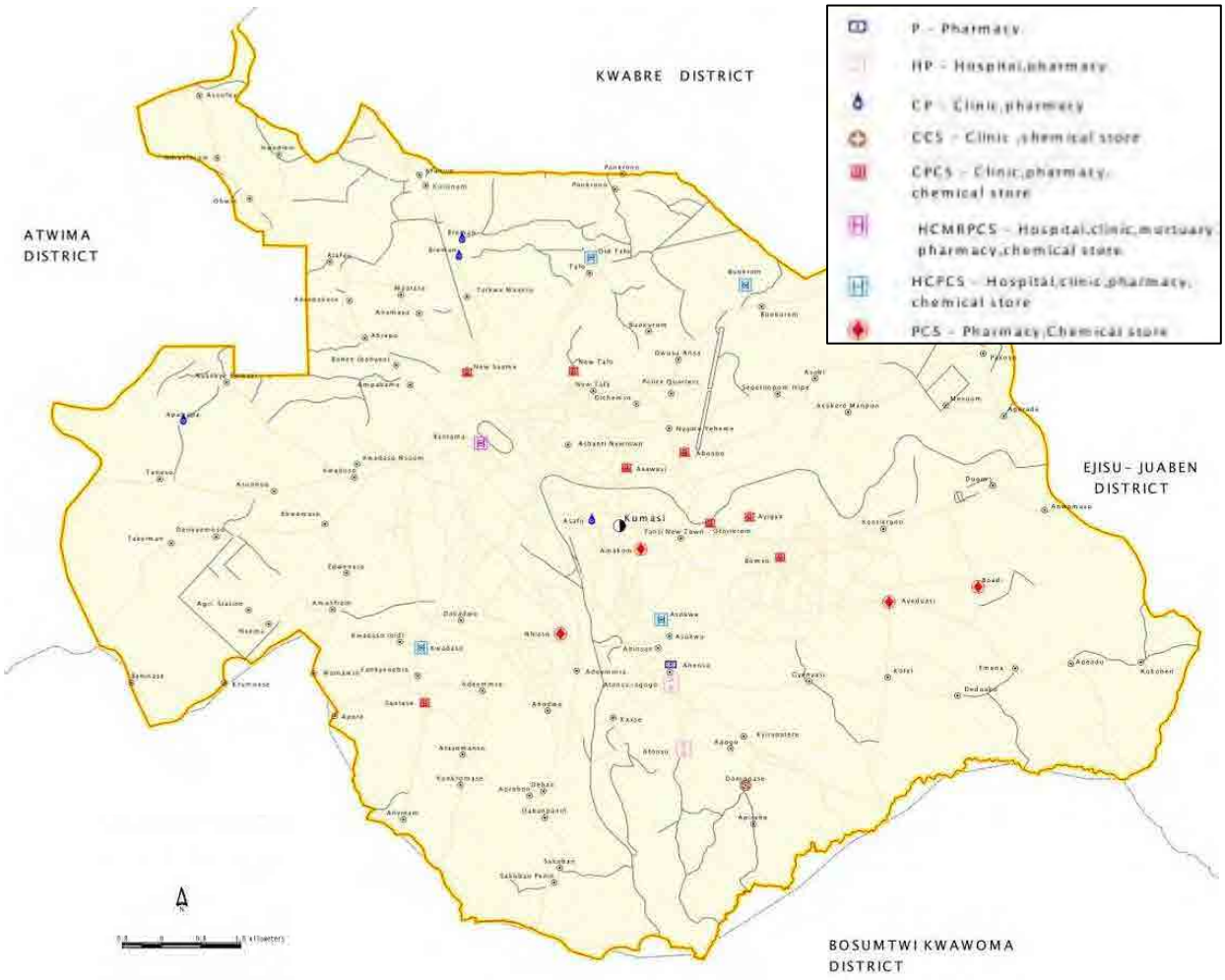
Source: JICA Study Team based on data from Ghana Health Service (http://www.ghanahealthservice.org/index.php), 2013 and MTDP 2010–13



Source: JICA Study Team based on data from Ghana Health Service (http://www.ghanahealthservice.org/index.php), 2013 and MTDP 2010–13

Figure 10.1.2 Location of Hospitals in Greater Kumasi Sub-Region

The locations of the hospitals in KMA are shown in Figure 10.1.3. The six government hospitals are located mostly along the major urban roads, two in the northern area (Suame Sub-Metro and Manhyia Sub-Metro) and four in th southern area (three in Asokwa Sub-Metro and Nhyiaeso Sub-Metro). However there is no government hospital nor health clinic in the eastern and western area of KMA.



Source: CERSGIS, Local Government Poverty Reduction Support Programme, MLGRD

Figure 10.1.3 Location of Hospitals, Clinics and Pharmacies in KMA

10.2 Review of Past and Existing Development Plans and Projects for Health Sector

10.2.1 National Health Policies and Development Plans

(1) Ghana Poverty Reduction Programme

The country's national development policy framework, Ghana Share Growth and Development Agenda (GSGDA) acknowledges the health sector as one of the five areas for policies, programmes and projects to be prioritized for expenditure along with agriculture, infrastructure, water and sanitation, and education.

Even though the health status of Ghanaians has generally improved over the years, there are still policy-related issues that need to be addressed. To improve access to quality health care, the policy objectives noted in GSGDA are to:

- Bridge equity gaps inaccess to health care and nutrition services
- Improve governance and strengthen efficiency inhealth service delivery, including

medical emergencies
- Improve access to quality maternal and child health services
- Intensify prevention and control of non-communicable and communicable diseases (malaria, HIV and AIDS/STI/TB)
- Promote healthy lifestyle as well as strengthen mental health service delivery and make health services youth friendly at all levels.

(2) National Health Policy

The National Health Policy places the national efforts within the global context for health development and aims to provide a comprehensive and holistic framework that builds on progress made in previous years. Medium-term health strategy documents have been prepared to guide health development in Ghana.

The ultimate goal of the health sector is to ensure a healthy and productive population that reproduces itself in safe conditions.

This goal will be achieved through the following objectives:

- To ensure that people live long, healthy and productive lives and reproduce without an increased risk of injury or death.
- To reduce the excessive risk and burden of morbidity, mortality and disability, especially in the poor and marginalized groups.
- To reduce inequalities in access to health, populations and nutrition services and health outcomes.

(3) Community-Based Health Planning and Services

Community-Based Health Planning and Services (CHPS) is a process of health care provision in which community members are actively engaged as primary health care.

10.2.2 Health Sector Development Project

Current health sector development projects are mostly formulated to achieve the Millennium Development Goals (MDGs). MDGs are goals officially established following the Millennium Summit of the UN in 2000. MDGs consist of eight goals ranging from halving extreme poverty to halting the spread of HIV/AIDS and providing universal primary education, all by the target date of 2015. The following are three goals related to the health sector:

- Reducing child mortality rates,
- Improving maternal health,
- Combating HIV/AIDS, malaria, and other diseases

Under-five mortality is one of the major public health concerns in Ghana. The first child health policy and strategies for children under five years was produced in Ghana in 1999. This was followed by Child Health Policy and Child Health Strategy 2007-2015. However the latest 2008 Ghana Demographic and Health Survey indicates that the under-five mortality rate has only improved from 111 deaths per 1,000 lives in 2003 to 80 deaths per

1,000 lives in 2008. In order to achieve MDGs it is necessary to reduce the rate to 41 deaths per 1,000 lives by 2015.

A number of interventions were also introduced by the government to improve maternal healthcare. However the maternal mortality ratio is still 164 deaths per 100,000 live births in 2010 and it remains a challenge to achieve the 2015 goal of 54 deaths per 100,000 live births.

1) Ghana Focus Region Health Project

The Ghana Focus Region Health Project (FRHP) is a four-year integrated maternal, newborn, and; child health, family planning and HIV&AIDS (MNCH/FP and HIV/AIDS) project with the goal of improving the health status of communities in three specific regions of Ghana (Greater Accra, Central, and Western Regions).

2) Action Plan for the United Nations Development Assistance Framework 2012-2016

The United Nations Development Assistance Framework (UNDAF) 2012 – 2016 was signed between the Government of Ghana and the United Nations (UN) system in April 2011. This presents the coherent vision and collective programme results the UN system seeks to achieve in support of key priorities of the government's development agenda.

(2) Ghana Health Sector Support Project

The purpose of the Health Sector Programme Support Project is to support the government's sector reforms through implementation of its Medium Term Health Strategy (MTHS) as described in the Health Sector Five Year Program of Work (POW). The ultimate aim is to improve the health sector status of Ghanaians. The two main goals of the sector program to support this aim are:

- Provide universal access to a basic package of health services, and improve the quality and efficiency of health services
- Foster linkages with other sectors to: reduce population growth rate; reduce the level of malnutrition; increase female education; increase access to water and sanitation; and reduce poverty.

10.3 Issues on the Health Sector

(1) Unbalanced Number of Hospitals by Districts

Population per hospital by district in Greater Kumasi Sub-Region by district differs greatly with the lowest ratio of 18 thousand people per hospital in Ejisu-Juaben and 149 thousand in Atwima Nwabiagya. Population per hospital in KMA (including Asokore Mampong) is 50 thousand people per hospital. (see Table 10.3.1) Atwima Kwanwoma, which is a new district, does not have a hospital within its district.

Table 10.3.1 Population Hospital Ratio by Districts in Greater Kumasi Sub-Region (2010)

District	Population[1]	District Hospital & Private Hospital[2]	Population / Hospital
KMA (incl. Asokore Mampong)	2,035,064	40	49,636
Ejisu-Juaben	143,762	8	17,970
Bosomtwe	93,910	4	23,478
Atwima Kwanwoma	90,634	0	-
Atwima Nwabiagya	149,025	1	149,025
Afigya Kwabre	136,140	2	68,070
Kwabre East	115,556	1	115,556

Source 1: GSS, 2012, 2010 Population and Housing Census
Source 2: Ghana Health Service, 2010, The Health Sector in Ghana Facts and Figures

(2) Unbalanced Distribution of Health Centres

According to the Zoning Guidelines and Planning Standards of Ghana (TCPD, 2011), one health centre is meant to serve up to population of 25,000. However, the populations per health centre in Ejisu-Juaben, Bosomtwe and Atwima Nwabiagya area are larger than this figure. Atwima Kwanwoma is planning to upgrade one of the health centres to a district hospital. Therefore, after the upgrade there will be a shortage of primary care centres as well in Atwima Kwanwoma with a hospital for approximately every 30,000 people.

Table 10.3.2 Population Health Centre Ratio by Districts in Districts surrounding KMA (2010)

District	Population[1]	Polyclinic / Health Centre[2]		Population/ Health Centre
		Gov't	Other	
Ejisu-Juaben	143,762	3	1	36,691
Bosomtwe	93,910	2	0	46,955
Atwima Kwanwoma	90,634	4	0	22,659
Atwima Nwabiagya	149,025	4	0	37,256
Afigya Kwabre	136,140	12	0	11,345
Kwabre East	115,556	5	0	23,111

Source 1: GSS, 2012, 2010 Population and Housing Census
Source 2: Ghana Health Service, 2010, The Health Sector in Ghana Facts and Figures

(3) Insufficient Number of Highly-Specialized Hospitals with Tertiary Care

KATH is the only highly specialized hospital in the whole of Ashanti Region. This is not sufficient to service a region with a population of almost five million.

Chapter 11 Education Sector of Greater Kumasi Sub-Region

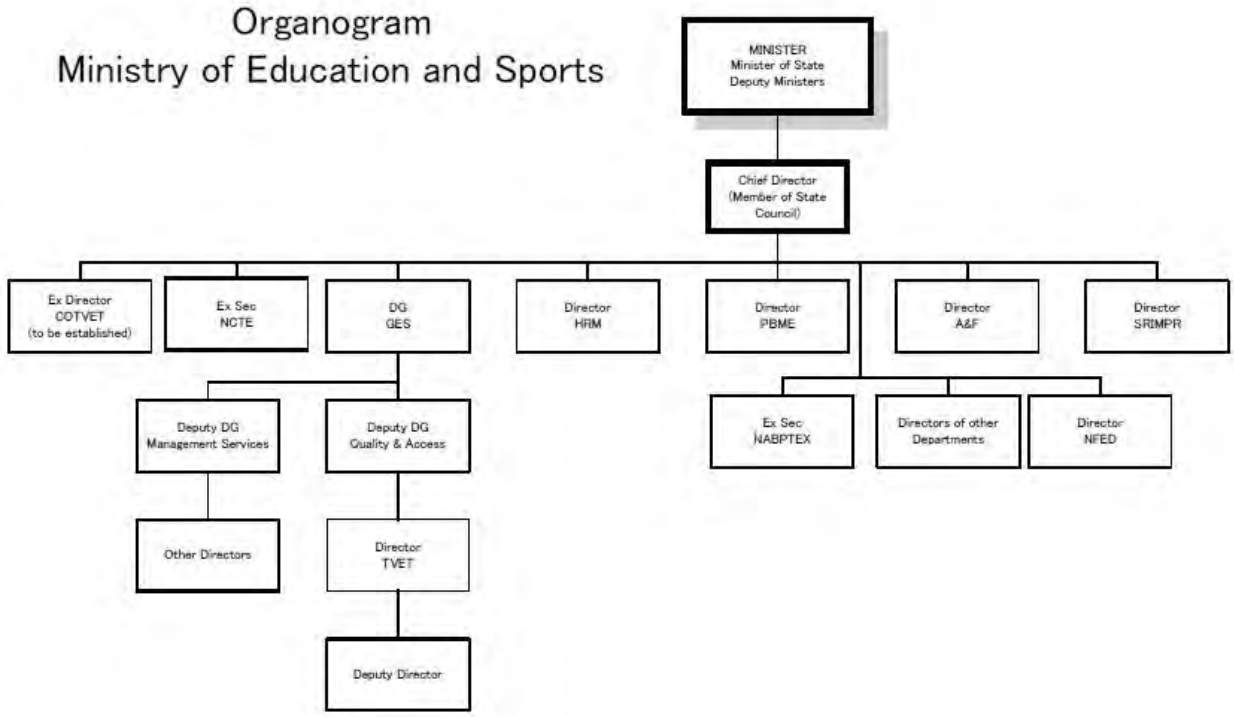
11.1 Present Situation of the Education Sector

11.1.1 Institutional Structure of Education Sector

(1) Ministry of Education

The Ministry of Education, Science and Sports (MoE) has the overall responsibility for education sector policy, planning and monitoring. Education delivery and implementation is devolved to institutions, districts and regions through various agencies of the MoE. (MoE, 2003, Education Strategic Plan 2003 to 2015)

The Ministry is committed to establishing an education system focused on promoting creativity and problem solving through the development of academics, technical and vocational programmes that will improve the acquisition of skills and assure job-market readiness.



Source: JICA, 2005, Project Document for the Pilot CBT Project for TVET in Ghana (Draft Final), GoG

Figure 11.1.1 Organogram of Ministry of Education, Science and Sports

(2) Ghana Education Service (GES)

The Ghana Education Service (GES), an agency within the MoE, implements the basic and senior secondary education components, including technical and vocational institutes. GES is therefore responsible for schools and, by virtue of the size of these sub-sectors, about four-fifths of the annual expenditure on education.

The Vision of GES is as below:

To create an enabling environment in all educational institutions and management positions that will sustain effective teaching and learning in school and promote management efficiency within the Service.

The GES is charged with the responsibility of implementing pre-tertiary education policies of government. This is to ensure that all school-age Ghanaian children are provided with quality formal education and training.

(3) National Council for Tertiary Education (NCTE)

The National Council for Tertiary Education (NCTE) is the body that oversees the proper administration of institutions designated as institutions of tertiary education in Ghana. NCTE serves as the supervisory and regulatory body that advises the government through the Minister responsible for education on policies relating to tertiary education.

11.1.2 Existing Condition of Education Facilities

(1) Basic Education Facilities in Ghana

The population of Ghana has been increasing as a whole over the last few decades with an annual growth rate of over 2.6% due mostly to natural growth. This natural growth is one of the factors that have resulted in an increase in the number of pupils and students in primary and junior high schools across the nation with an average annual growth rate of 4.9% between 2001/02 and 2010/11. (Tables 11.1.1 and 11.1.2)

The Government of Ghana recognizes basic education, which includes kindergarten, primary school and secondary school education, as the fundamental building block of the country and has been trying to implement measures, such as the free compulsory universal basic education policy, to increase the enrolment rate.

Table 11.1.1 Number of Primary Schools and Pupils by Region

		Public			Private			Total		
Region	Year	No. of Pupils	No. of Schools	Pupil School Ratio	No. of Pupils	No. of Schools	Pupil School Ratio	No. of Pupils	No. of Schools.	Pupil School Ratio
Ashanti	2001/02	360,477	1,862	194	123,819	732	169	484,296	2,594	187
	2010/11	518,379	2,192	236	192,519	1,177	164	710,898	3,369	211
	Growth Rate	4.1% p.a.	1.8% p.a.	2.2% p.a.	5.0% p.a.	5.4% p.a.	-0.4% p.a.	4.4% p.a.	2.9% p.a.	1.4% p.a.
Brong Ahafo	2001/02	218,951	1,434	153	40,860	227	180	259,811	1,661	156
	2010/11	326,902	1,598	205	71, 1346	432	165	398,248	2,030	196
	Growth Rate	4.6% p.a.	1.2% p.a.	3.3% p.a.	6.4% p.a.	7.4% p.a.	-1.0% p.a.	4.9% p.a.	2.3% p.a.	2.5% p.a.
Central	2001/02	216,990	1,213	179	45,078	286	158	262,068	1,499	175
	2010/11	311,979	1,401	223	109,067	846	129	421,046	2,247	187
	Growth Rate	4.1% p.a.	1.6% p.a.	2.5% p.a.	10.3% p.a.	12.8% p.a.	-2.2% p.a.	5.4% p.a.	4.6% p.a.	0.8% p.a.
Eastern	2001/02	280,698	1,899	148	46,599	329	142	327,297	2,228	147
	2010/11	335,813	1,877	179	73,116	627	117	408,929	2,504	163
	Growth Rate	2.0% p.a.	-0.1% p.a.	2.1% p.a.	5. % p.a.	7.4% p.a.	-2.1% p.a.	2.5% p.a.	1.3% p.a.	1.2% p.a.
Greater Accra	2001/02	193,944	780	249	132,687	773	172	326,631	1,553	210
	2010/11	357,459	916	390	154,596	1,030	150	512,055	1,946	263
	Growth Rate	7.0%p.a.	1.8% p.a.	5.1% p.a.	1.7% p.a.	3.2% p.a.	-1.5% p.a.	5.1% p.a.	2.5% p.a.	2.5% p.a.
Northern	2001/02	215,262	1,447	149	5,065	48	106	220,327	1,495	147
	2010/11	392,624	1,990	197	16,345	166	98	408,969	2,156	190
	Growth Rate	6.9% p.a.	3.6% p.a.	3.2% p.a.	13.9% p.a.	14.8% p.a.	-0.8% p.a.	7.1% p.a.	4.2% p.a.	2.8% p.a.
Upper East	2001/02	117,080	460	255	2,811	17	165	119,891	477	251
	2010/11	194,981	630	309	15,421	71	217	210,402	701	300
	Growth Rate	5.8% p.a.	3.6% p.a.	2.2% p.a.	20.8% p.a.	17.2% p.a.	3.1% p.a.	6.4% p.a.	4.4% p.a.	2.0% p.a.
Upper West	2001/02	66,700	380	176	1,610	7	230	68,310	387	177
	2010/11	132,858	552	241	3,753	29	129	136,611	581	235
	Growth Rate	8.0% p.a.	4.2% p.a.	3.6% p.a.	9.9% p.a.	17.1% p.a.	-6.2% p.a.	8.0% p.a.	4.6% p.a.	3.2% p.a.
Volta	2001/02	212,127	1,484	143	21,271	156	136	233,398	1,640	142
	2010/11	288,982	1,709	169	45,536	365	125	334,518	2,074	161
	Growth Rate	3.5% p.a.	1.6% p.a.	1.9% p.a.	8.8% p.a.	9.9% p.a.	-1.0% p.a.	4.1% p.a.	2.6% p.a.	1.4% p.a.
Western	2001/02	231,520	1,376	168	52,885	375	141	284,405	1,751	162
	2010/11	338,543	1,566	216	82,560	549	150	421,103	2,115	199
	Growth Rate	4.3% p.a.	1.4% p.a.	2.8% p.a.	5.1% p.a.	4.3% p.a.	0.7% p.a.	4.5% p.a.	2.1% p.a.	2.3% p.a.
Ghana	2001/02	2,113,749	12,335	171	472,685	2,950	160	2,586,434	15,285	169
	2010/11	3,198,520	14,431	222	764,259	5,292	144	3,962,779	19,7023	201
	Growth Rate	4.7% p.a.	1.8% p.a.	2.9% p.a.	5.5% p.a.	6.7% p.a.	-1.1% p.a.	4.9% p.a.	2.9% p.a.	1.9% p.a.

Source: MoE, Basic Regional Profile 2001/02 and 2010/11

In most regions, the numbers of pupils and students at private school have been increasing at a higher rate than at public schools. Although the number of private schools is still much lower than the number of public schools, the importance of private schools is increasing, especially in the urban areas. In the Greater Accra Region, the number of private schools exceeded the number of public schools in 2010/11.

The number of public primary schools is especially increasing in the three northern regions, Northern, Upper East and Upper West Region.

Table 11.1.2 Number of Junior High Schools and Students by Region

		Public			Private			Total		
Region	Year	Students	Schools	Student School Ratio	Students	Schools	Student School Ratio	Students	Schools	Student School Ratio
Ashanti	2001/02	142,942	1,038	138	29,370	276	106	172,312	1,314	131
	2010/11	212,872	1,454	146	54,396	692	79	267,268	2,146	125
	Growth Rate	4.5%p.a.	3.8%p.a.	0.7%p.a.	7.1%p.a.	10.8%p.a.	-3.3%p.a.	5.0%p.a.	5.6%p.a.	-0.6%p.a.
Brong Ahafo	2001/02	71,877	718	100	9,366	77	122	81,243	795	102
	2010/11	108,832	929	117	21,633	259	84	130,465	1,188	110
	Growth Rate	4.7% p.a.	2.9% p.a.	1.8% p.a.	9.7% p.a.	14.4% p.a.	-4.1% p.a.	5.4% p.a.	4.6% p.a.	0.8% p.a.
Central	2001/02	82,007	861	95	9,930	111	89	91,937	972	95
	2010/11	116,096	1,087	107	32,935	510	65	149,031	1,597	93
	Growth Rate	3.9% p.a.	2.6% p.a.	1.3% p.a.	14.3% p.a.	18.5% p.a.	-3.6% p.a.	5.5% p.a.	5.7% p.a.	-0.1% p.a.
Eastern	2001/02	101,107	1,026	99	9,948	102	98	111,055	1,128	98
	2010/11	124,193	1,145	108	20,472	389	53	144,665	1,534	94
	Growth Rate	2.3% p.a.	1.2% p.a.	1.1% p.a.	8.3% p.a.	16.0% p.a.	-6.6% p.a.	3.0% p.a.	3.5% p.a.	-0.5% p.a.
Greater Accra	2001/02	105,825	536	197	47,637	416	115	153,462	952	161
	2010/11	125,547	681	184	56,560	714	79	182,107	1,395	131
	Growth Rate	1.9% p.a.	2.7% p.a.	-0.8% p.a.	1.9% p.a.	6.2% p.a.	-4.0% p.a.	1.9% p.a.	4.3% p.a.	-2.3% p.a.
Northern	2001/02	42,567	327	130	352	4	88	42,919	331	130
	2010/11	105,708	554	191	1,287	45	29	106,995	599	179
	Growth Rate	10.6% p.a.	6.0% p.a.	4.3% p.a.	15.5% p.a.	30.9% p.a.	-11.7% p.a.	10.7% p.a.	6.8% p.a.	3.6% p.a.
Upper East	2001/02	24,910	189	132	405	11	37	25,315	200	127
	2010/11	59,992	332	181	2,028	25	81	62,020	357	174
	Growth Rate	10.3% p.a.	6.5% p.a.	3.6% p.a.	19.6% p.a.	9.6% p.a.	9.2% p.a.	10.5% p.a.	6.6% p.a.	3.6% p.a.
Upper West	2001/02	17,254	233	74	348	4	87	17,602	237	74
	2010/11	38,939	357	109	1,002	15	67	39,941	372	107
	Growth Rate	9.5% p.a.	4.9% p.a.	4.4% p.a.	12.5% p.a.	15.8% p.a.	-2.9% p.a.	9.5% p.a.	5.1% p.a.	4.2% p.a.
Volta	2001/02	77,014	757	102	5,374	53	101	82,388	810	102
	2010/11	97,691	1,029	95	15,742	231	68	113,433	1,260	90
	Growth Rate	2.7% p.a.	3.5% p.a.	-0.8% p.a.	12.7% p.a.	17.8% p.a.	-4.3% p.a.	3.6% p.a.	5.0% p.a.	-1.3% p.a.
Western	2001/02	76,392	729	105	11,011	124	89	87,403	853	102
	2010/11	110,801	894	124	28,674	367	78	139,475	1,261	111
	Growth Rate	4.2% p.a.	2.3% p.a.	1.9% p.a.	11.2% p.a.	12.8% p.a.	-1.4% p.a.	5.3% p.a.	4.4% p.a.	0.9% p.a.
Ghana	2001/02	741,895	6,414	116	123,741	1,178	105	865,636	7,592	114
	2010/11	1,100,671	8,462	130	234,729	3,247	72	1,335,400	11,709	114
	Growth Rate	4.5% p.a.	3.1% p.a.	1.3% p.a.	7.4% p.a.	11.9% p.a.	-4.1% p.a.	4.9% p.a.	4.9% p.a.	0.0% p.a.

Source: MoE, Basic Regional Profile 2001/02 and 2010/11

The trend of junior high school is similar to that of primary school. However, the numbers of private junior high schools as well as the numbers of students have both been increasing at a higher rate than those of primary schools.

In the three northern regions, the number of students enrolled in junior high school has more than doubled. This means that more people are starting to continue the education after primary school in the rural regions of Ghana as well.

(2) Secondary Education Facilities in Ghana

Although the numbers of pupils and students in primary schools and junior high schools have both been increasing rapidly in the past decade, the number of students in senior high school is still not high at approximately 350 thousand students, which is 13.7% of the population aged between 15 and 19. The two regions that have the highest enrolment rates are Greater Accra Region and Ashanti Region, which were 19.4% and 17.1%, respectively

in the year 2010/11. (Table 11.1.3)

Comparing the figures of Ghana with some countries around the world, the gap is still quite large. For example, Turkey had an enrolment rate of around 30% in 1995 that increased to almost 60% in 2010. In general, the enrolment rate of senior high school level education increases along with economical development. Therefore, the number of SHS students in Ghana is assumed to increase rapidly over the next decades due to economical development and the natural increase in population.

Table 11.1.3 Number of Senior High School Sutdents and Senior High School Enrolment Ratio by Region (School Year 2010/11)

	SHS Students	Pop. 15–19	Ratio of SHS Student in Pop. Age 15–19
Ashanti	88,035	514,803	17.1%
Brong Ahafo	30,484	253,449	12.0%
Central	34,219	244,020	14.0%
Eastern	32,108	279,234	11.5%
Greater Accra	75,337	388,403	19.4%
Northern	21,675	261,935	8.3%
Upper East	10,254	115,952	8.8%
Upper West	6,532	78,336	8.3%
Volta	26,338	222,553	11.8%
Western	33,282	251,304	13.2%
Ghana	358,264	2,609,989	13.7%

Source: JICA Study Team based on data from MoE and GSS

The student school ratio for senior high school in year 2010/11 by region shows that the regions that have higher enrolment rates have higher student school ratios such as Ashanti Region and Greater Accra Region. (Table 11.1.4) The student school ratios are also larger in the regions where there are larger cities, which are Accra (Greater Accra Region), Kumasi (Ashanti Region), Sekondi-Takoradi (Western Region) and Tamale (Northern Region).

Table 11.1.4 Student School Ratio of Senior High School by Region in Year 2010/11

Region	Number of Senior High Schools	Number of SSS/SHS Students	Student School Ratio
Ashanti	126	88,035	699
Brong Ahafo	82	30,484	372
Central	91	34,219	376
Eastern	102	32,108	315
Greater Accra	79	75,337	954
Northern	49	21,675	442
Upper East	28	10,254	366
Upper West	19	6,532	344
Volta	93	26,338	283
Western	51	33,282	653
Total	720	358,264	498

Source: MoE, SHS Regional Parameters 2010/2011 School Year Data

On the other hand, the number of senior high schools tends to be larger in rural areas where

there is more space available (Table 11.1.5).

Table 11.1.5 Senior High School by Ownership and Location by Region in Year 2010/11

Region	Public		Private		Total	
	Urban	Rural	Urban	Rural	Urban	Rural
Ashanti	38	54	11	23	49	77
Brong Ahafo	25	31	10	16	35	47
Central	24	27	12	28	36	55
Eastern	41	39	8	14	49	53
Greater Accra	6	34	4	35	10	69
Northern	13	24	5	7	18	31
Upper East	21	2	3	2	24	4
Upper West	12	6	0	1	12	7
Volta	58	15	10	10	68	25
Western	18	23	2	8	20	31
Ghana	256	255	65	144	321	399

Source: MoE, SHS Regional Parameters – 2010/2011School Year Data

(3) Tertiary Education and Vocational Education Facilities in Ghana

There are currently six public universities in Ghana, distributed from Accra, the capital of Ghana to Tamale, which is the largest city in the northern area of Ghana. In addition to the national public universities, there are professional national institutes all located in Accra.

On the other hand, private university colleges and polytechnic institutes are located across the country. Other tertiary education facilities such as colleges of education and nurses' training colleges are mostly located in the major cities of Ghana.

11.1.3 Present Situation of Greater Kumasi Sub-Region in the Education Sector

(1) Basic Education

Regarding the schools in the Greater Kumasi Sub-Region, there are more private schools than public schools in KMA, which follows the development trend in Greater Accra Region. The average pupil-school ratio and student-school ratio in the Greater Kumasi Sub-Region are both larger than the national average. The highest pupil-school ratio in the Greater Kumasi Sub-Region is for public primary schools with one public primary school for every 372 pupils. (Table 11.1.6 and Table 11.1.7) The location of each school's service area should be discussed at the district level for primary and junior high schools.

Table 11.1.6 Number of Primary Schools and Pupils by District in Greater Kumasi Sub-Region (Year 2010/11)

	Public			Private			Total		
	Pupils	Schools	Pupil School Ratio	Pupils	Schools	Pupil School Ratio	Pupils	Schools	Pupil School Ratio
Atwima Nwabiagya	25,290	86	294	12,567	74	170	37,857	160	237
Bosomtwe	12,362	59	210	4,556	44	104	16,918	103	164
Ejisu-Juaben	22,343	91	246	3,986	44	91	26,329	135	195
Kumasi	92,319	248	372	88,925	428	208	181,244	676	268
Kwabre East	14,778	64	231	8,170	80	102	22,948	144	159
Afigya-Kwabre	16,666	65	256	5,441	32	170	22,107	97	228
Atwima Kwanwoma	12,961	50	259	6,390	38	168	19,351	88	220
Greater Kumasi Sub-Region	196,719	663	297	130,035	740	176	326,754	1,403	233

Source: MoE, Basic District Profile 2010/2011 School Year Data

Table 11.1.7 Number of Junior High Schools and Students by District in Greater Kumasi Sub-Region (Year 2010/11)

	Public			Private			Total		
	Students	Schools	Student School Ratio	Students	Schools	Student School Ratio	Students	Schools	Student School Ratio
Atwima Nwabiagya	11,484	65	177	3,572	46	78	15,056	111	136
Bosomtwe	5,726	50	115	1,260	24	53	6,986	74	94
Ejisu-Juaben	8,892	61	146	963	24	40	9,855	85	116
Kumasi	51,801	195	266	27,283	275	99	79,084	470	168
Kwabre East	7,360	52	142	2,146	52	41	9,506	104	91
Afigya-Kwabre	8,040	59	136	1,184	15	79	9,224	74	125
Atwima Kwanwoma	6,090	40	152	1,463	20	73	7,553	60	126
Greater Kumasi Sub-Region	99,393	522	190	37,871	456	83	137,264	978	140

Source: MoE, Basic District Profile – 2010/2011 School Year Data

(2) Senior High School

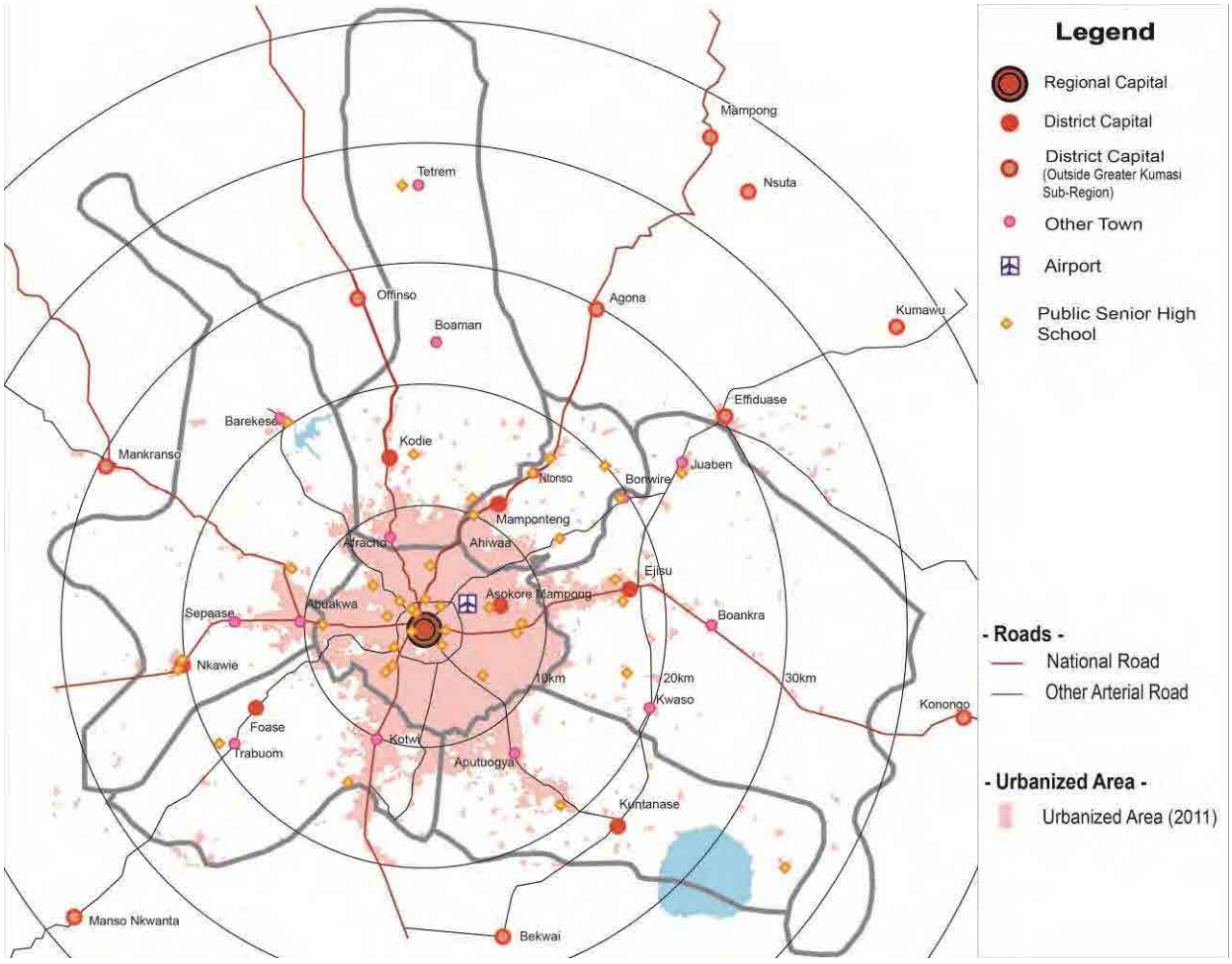
Within Ashanti Region, the distribution of public senior high schools is concentrated in KMA (including Asokore Mampong Municipality) with 19 out of 92 senior high schools in KMA, due to the extreme population concentration in KMA. Additionally, 40 public senior high schools within Ashanti Region are located in the Greater Kumasi Sub-Region, which is almost half of the public senior high schools in the region. As for private schools, the number of private secondary education level schools acknowledged by the Ministry of Education at the national level and regional office differ greatly. One of the reasons may be because the figures from the regional office are one year newer than the data available at the national level. Other reasons may be that some of the private schools may not be currently recognized or registered at the national level and the unclear definition of categories among the types of secondary education schools. Overall, it can be said that there is a concentration of private senior high schools in KMA, but some private SHS are located in rural areas, for example, Bosomtwe District. (Table 11.1.8)

Table 11.1.8 Senior High Schools by Ownership by District in Greater Kumasi Sub-Region (School Year 2011/12)

District	Public SHS	Private SHS	Total SHS
KMA (incl. Asokore Mampong)	19	53	73
Ejisu-Juaben	5	2	7
Kwabre East	6	1	7
Afigya Kwabre	2	0	2
Atwima Kwanwoma	2	1	3
Atwima Nwabiagya	4	1	5
Bosomtwe	2	8	10
Greater Kumasi Sub-Region	40	66	106

Source: Ministry of Education (Ashanti Regional Office)

The locations of public SHS in the Greater Kumasi Sub-Region are shown in Figure 11.1.2. In most districts, the public SHS are located in the rural areas of their districts such as Tetrem (Atwima Kwanwoma), Trabuom (Afigya Kwabre), Adanwomase (Kwabre East) and Beposo (Bosomtwe).



Source: JICA Study Team

Figure 11.1.2 Location of Public Senior High Schools in Greater Kumasi Sub-Region (Year 2011/12)

(3) Higher Education

In Ghana, the percentage of people who have finished university and postgraduate degree courses was only 3.2% out of those who attended formal schools. In 2011, the net enrolment ratio was 12% of those of tertiary education age. Because Ghana hopes to achieve middle-income status, the number of university graduates is expected to increase.

In the Greater Kumasi Sub-Region, there are currently one public university, Kwame Nkrumah University of Science and Technology (KNUST), one private university college, and one polytechnic institute all located in Kumasi, and some KNUST affiliated institutions located in Kumasi and Ejisu.

11.2 Review of Past and Existing Development Plans and Projects for Education Sector

11.2.1 National Education Policies and Development Plans

(1) Education Strategic Plan (ESP)

The Education Strategic Plan (ESP) is a plan that provides an overview of education sector policies, targets and strategies for the plan as well as the work programme. The fourth ESP was published in 2003 for the period from 2003 to 2015 followed by the fifth ESP, which was published in 2009 for the period of 2010 until 2020.

The policy basis of the ESP 2010 – 2020 is as follows:

- To put into effect the key provisions of the 2008 Education Act that relate to access, decentralisation, inclusion, quality, and system monitoring.
- To implement Science and Technology and Mathematics Education, ICT, Technical and Vocational Education and Training, Special Education Division, Tertiary Education, and Teacher Education policies as they relate to enrichment of education provision, improvement in quality, and personal and national development.
- Following the enactment of the appropriate laws and measures, to implement the government commitment to fee abolition and other poverty alleviation measures, the provision of teaching incentives, and increased study opportunities at secondary and tertiary levels.
- To continue to subscribe and commit to the principles that relate to Education for All and the Millennium Development Goals.

(2) Ghana Shared Growth and Development Agenda (GSGDA), 2010–2013

The Ghana Shared Growth and Development Agenda (GSGDA), 2010–2013 states that the priority policies and strategies to be implemented for the education sector will aim at promoting the achievement of structural poverty reduction, facilitating the attainment of the Education For All goals and the Millennium Development Goals (MDGs), and contributing towards the attainment of middle-income status, with an emphasis on addressing quality issues in education, infrastructure and service conditions of education workers.

The overall policies for the education sector are:

- Increasing equitable access to, and participation in quality education at all levels
- Improving the quality of teaching and learning
- Bridging the gender gap in access to education
- Improving access to quality education for persons with disabilities
- Promoting science and technical education at all levels
- Strengthening the linkages between tertiary education and industry
- Integrating essential knowledge and life skills into school curriculum
- Improving the management of education service delivery

These eight policies are also policy objectives for the education sector stated in the Sector Medium-Term Development Plan 2010–2013 as well as the ESP 2010–2020.

11.2.2 Education Sector Development Project

(1) Basic Education Sector Improvement Project

The Basic Education Sector Improvement Program was designed to support the government's policy of "Free Compulsory Universal Basic Education" financed as a loan project by the WB.

The objectives of the project were to:

- Improve the teaching process and learning outcomes
- Strengthen management of the basic education system through better planning, monitoring and evaluation by the Ministry of Education and Ghana Education Service at central, regional and district levels, and by promoting active involvement of communities in the management of schools
- Improve access to basic education, especially for girls, the poor and other disadvantaged segments of the population
- Ensure financial sustainability of the government program for basic education over the longer term.

Over 2,000 classrooms were rehabilitated between the period of 1996 and 2002.

(2) Development of Senior Secondary Education Project

This project has been formulated in response to the determination of the Government of Ghana to provide relevant education to all Ghanaians at all levels, thus facilitating poverty reduction and promoting socio-economic growth and national development.

The specific project objectives are:

- To contribute significantly to improving access to quality senior secondary education to Ghanaian Junior Secondary School graduates.
- To enhance HIV/AIDS and environment protection awareness and integrate their prevention into school life.

- To strengthen the management capacity and governance of the Ministry of Education at the central and decentralized levels.

The overall project will be jointly financed by an African Development Fund loan and grant and the Government of Ghana.

(3) Support to the Education Strategic Plan

This project is sponsored by UK-aid consisting of six components as follows:

- Procurement of services for support to the Education Strategic Plan
- Technical assistance for support to the Education Strategic Plan
- Sector budget support for support to the Education Strategic Plan
- Accountable grant
- Support for 2010/2011 Education Census
- Strategic education staff costs

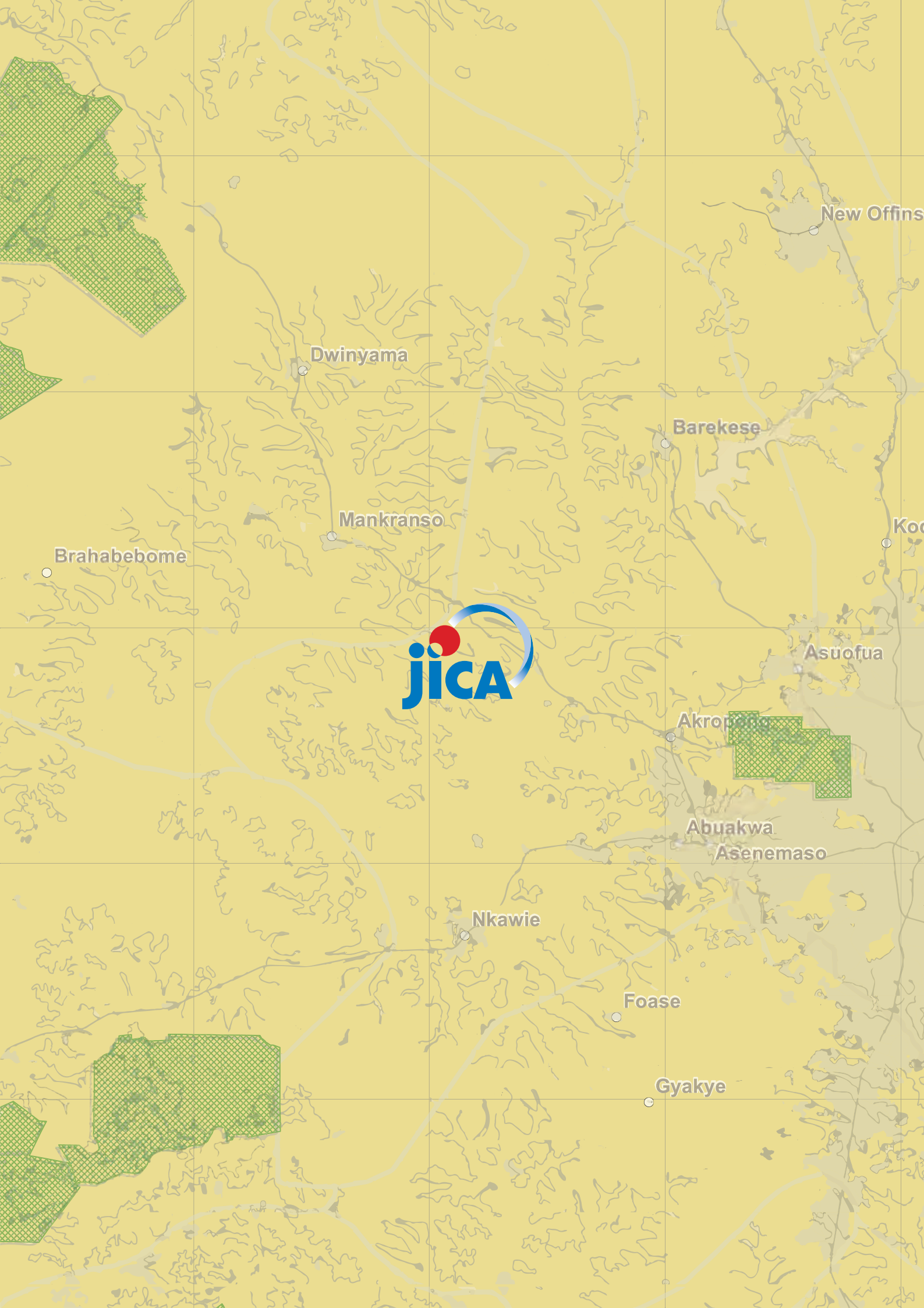
The project started in 2006 and will conclude at the end of 2013.

11.3 Issues on the Education Sector

Ghana has a vision of becoming a middle-income status country by 2020. Income status and education level is closely related.

Issues on the education sector to be addressed at the sub-regional level are as follows:

- The number of senior high schools within commutable distance is lacking within the Greater Kumasi Sub-Region.
- The spatial distribution of senior high schools is skewed to KMA.
- Lack of senior high schools and junior high schools in suburban areas for the future demand, which can be one of the factors delaying the promotion of orderly suburbanization.
- More universities and polytechnic institutes should be located in suburban areas of adjoining districts.
- The linkage of higher education and local economic sectors is weak.


New Offins
Dwinyama
Barekese
Mankranso
Brahabebome
Asuofua
Akropong
Abuakwa
Asenemaso
Nkawie
Foase
Gyakye