2014 STATE OF ENERGY AT A GLANCE- GA EAST MUNICIPALITY

Dr. Simon Bawakyillenuo | Innocent S.K Agbelie

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SAMSET
Supporting Sub-Saharan Africa's Municipalities with Sustainable Energy Transitions

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Dr. Simon Bawakyillenuo & Innocent S.K Agbelie

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SAMSET Project

Supporting Sub-Saharan Africa's Municipalities with Sustainable Energy Transitions (SAMSET) is a 4-year project (2013-2017) supporting sustainable energy transitions in six urban areas in three African countries – Ghana, Uganda and South Africa. A fundamental objective is to improve the "knowledge transfer framework" so as to enhance research and capacity building efforts geared towards this challenging area.

SAMSET Ghana

This document is produced by the Ghana SAMSET team, led by Dr. Simon Bawakyillenuo and Mr. Innocent Komla Agbelie of the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana. Dr. Bawakyillenuo is the country project coordinator (Lead) of the SAMSET project and generally researches on energy and the environment, energy policy, renewable energy, environmental policy, climate change and green economy. Mr. Agbelie is an economist and project assistant on the SAMSET project. His research interest lies in sustainable development, energy and green economy.

Contacts:

Dr. Simon Bawakyillenuo

(bawasius@hotmail.com)

ISSER, University of Ghana, Legon

Mr. Innocent S.K Agbelie

(sefinno@gmail.com)

ISSER, University of Ghana, Legon

ES 1: Background Information

This State of Energy Report for the Ga East Municipality (GEM) is, along with the one for Awutu Senya East Municipality, the first of its kind in Ghana. Current energy surveys and statistics only focus on the national level and highly aggregated energy data, with little attention paid to the state of energy at lower levels – the regional, metropolitan, municipality and district. In the absence of such specific baseline information, effective planning for sustainable energy becomes highly problematic. Against this backdrop, the Supporting Sub-Saharan Africa's Municipalities with Sustainable Energy Transitions (SAMSET) project has among its objectives the production of reliable State of Energy (SoE) reports for all its municipal partners. The SoE reports for the six partner municipalities will provide platforms for the project team to support municipal assemblies to plan effective and sustainable energy transition pathways for the municipalities.

GEM[1] has a population of about 147,742, of which 49 percent are males and 51 percent are females (Ghana Statistical Service, 2014). About 82 percent of the population live in urban areas and the remaining 18 percent live in rural areas (Ghana Statistical Service, 2014). Agriculture, industry, commerce and services are the main economic activities, employing both indigenes and non-indigenes of the municipality. For the purposes of revenue collection and resource allocation, the Ga East Municipal Assembly (GEMA) has demarcated the entire municipality into first, second, and third-classes, depending on the availability of certain social amenities. First-class communities supposedly have the most facilities and third-class communities have the least. Water shortages, indiscriminate waste disposal, poor sanitation and electricity shortages are among the numerous developmental challenges faced in GEM.

[1] The map of Ga East Municipality in the Greater Accra Region is shown in Appendix 1

ES 2: The Macro Picture: Ghana and Greater Accra Regional Energy Picture

ES 2.1: Energy Picture of Ghana

Energy used in Ghana is supplied by three major sectors: electricity, petroleum and bioenergy. Electricity is generated from two main sources: hydro from Akosombo, Kpong and Bui hydro-power plants, and thermal, mainly from diesel fuel and natural gas. These together generated a total of 12,870GWh in 2013, a 7 percent increase over 2012 total generation of 12,024GWh and a 26.6 percent increase over 2010 total generation of 10,167GWh. Commercial oil production officially commenced in December 2010 and by the end of 2012, about 4,133.8 kilotonnes of crude oil was produced in Ghana (Energy Commission, 2012). This oil, however, was not consumed domestically and Ghana still depends on crude oil importation through the Ghana National Petroleum Corporation (GNPC) and private companies. The wood fuel component of bioenergy in the form of fuelwood and charcoal make up 75 percent or more of national energy consumption (GSS, 2013). However, the biomass consumption pattern in Ghana indicates a shift from firewood to charcoal for more urban households. Liquefied petroleum gas (LPG) usage in Ghana has increased significantly from 6.2 percent in 2000 to 18.2 percent in 2010. This is attributed to the increasing consumption rate in urban areas where about 42 percent of urban dwellers use LPG for cooking compared to only 5 percent of rural dwellers as of 2010 (GSS, 2013). Ghana is well endowed with renewable energy resources that are yet to be tapped. The average duration of sunshine Ghana receives varies from a minimum of 5.3 hours per day in Kumasi in the Ashanti Region, which is in the cloudy, semi-deciduous forest region, to 7.7 hours per day in Wa in the Upper West Region, which is in the dry savannah region, with monthly average solar irradiation ranging between 4.4 kWh/m2 /day and 5.6 kWh/m2 /day (16-20 MJ/m /day) and between 1,808 and 3,000 hours of sunshine per year (Hamlin and Ofori-Nyarko, 2005, cited in Bawakyillenuo, 2007). Currently, 2 MW capacity of solar PV has been installed at Navrongo in the Upper East Region, bringing the total national installed solar photovoltaic (PV) capacity to an estimated 2.5 MW due to the failure of some previously installed PVs. Ghana has potential for about 2,000 MW of wind energy while there are 22 exploitable mini-hydro sites in the country with potential output of between 5.6 MW and 24.5 MW.

The major demand sectors for energy are the residential, non-residential (comprising of commercial and services, agriculture, transport and industrial sub-sectors) and the industrial sectors. Rural and urban communities make up the residential demand side of energy. The total number of households in Ghana was about 4 million in 2000, 5,467,136 in 2010 and is expected to reach 6 million by 2020.

Energy in the residential sector is mainly used for lighting and cooking, with biomass being the main energy source for most households, especially in rural communities. The commercial and services sector share of total national energy use has on average been less than 3 percent per annum since 2000. The informal sector – including chop bars (restaurants) and street food vendors – has had the largest share (over 55 percent) of energy use since 2000, followed by the tourism sub-sector (10-12 percent) and the education sub-sector (more than 5 percent).

The road transport sub-sector accounted for about 92 - 94 percent of total fuel use within the period 2000 to 2012. The remaining fuel used by the transport sector (6-7 percent) is accounted for by the air transport sub-sector (Energy Commission, 2014). Energy use by the rail and the maritime sub-sectors is comparatively negligible, averaging 0.3 percent and 0.1 percent respectively over the same period. The transport sector accounted for about 80% percent of petroleum product consumption in the economy as at 2013, with the remaining 20 percent going into industry, residential and fisheries sectors (Energy Commission, 2014). The industrial sector excluding the Volta Aluminium Company Limited (VALCO) accounted for about 22 percent of total national energy use annually since 2000. However, with the inclusion of VALCO, the industrial sector's total energy share increased slightly to about 23 percent per annum (ibid).

ES 2.2: Energy Picture of Greater Accra Region

Various sources of energy are used in Greater Accra Region but the three dominant energy sources are electricity, petroleum and biomass (in the form of wood fuel and charcoal). About 95.8 percent of the regional population has access to electricity from the national grid which serves as the main source of lighting for 87.1 percent of the households in this region. However, few households use kerosene lamps (5.9 percent), flashlight/torches (3.9 percent) and generators (0.6 percent). The use of generators is a recent phenomenon resulting from the frequent power outages and load shedding that have gripped the entire country. Charcoal is the main fuel used for cooking (45.4 percent), followed by LPG (41.4 percent), wood (3.5 percent), kerosene (1.1 percent). The sources of charcoal and wood fuel are outside the region, mainly from the Afram Plains in the Eastern Region.

ES 3: Ga East Municipality Energy Picture and Energy Breakdown, by Sector

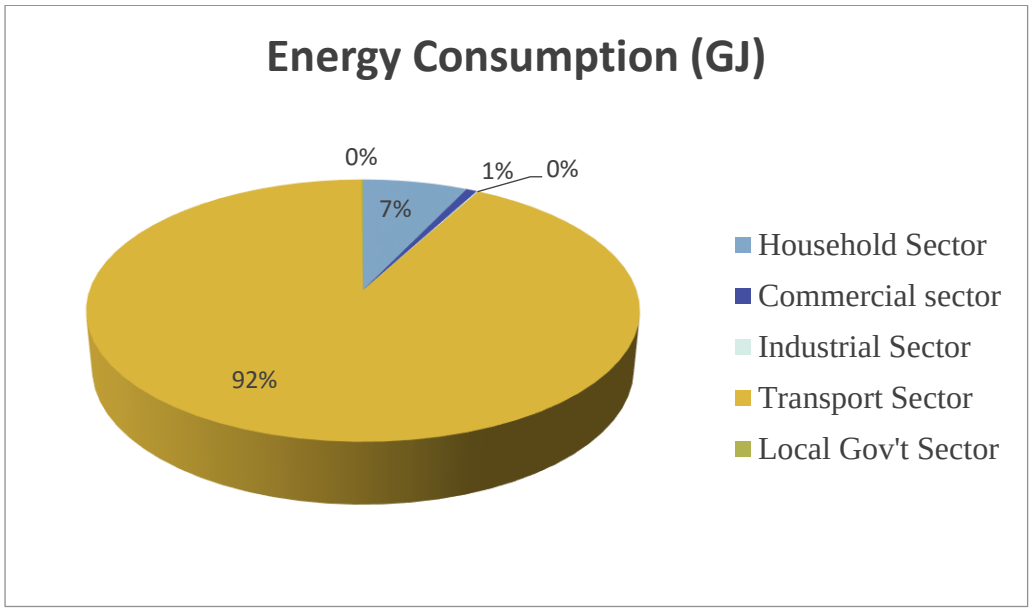
ES 3.1: GEM Energy Picture

GEM depends largely on fuels produced in other parts of the country and imported into the municipality. Electricity consumed in the municipality is primarily generated by the Volta River Authority (VRA) from hydro and thermal plants. The Electricity Company of Ghana (ECG) is responsible for the distribution of electricity to all sectors within the municipality. According to experts present during the state of energy focus group discussion in GEM, about 36.7 MW out of about 51.2 MW of electricity available for importation, was actually imported into the municipality in 2013 and distributed among the various demand sectors.

All petroleum products are obtained from the national stock at Bulk Oil Storage and Transport Limited (BOST), which stores and transports refined petroleum products that are either obtained from the Tema Oil Refinery or imported already processed. Neither charcoal nor wood fuel is generated directly in the municipality but comes from neighbouring districts and sometimes from other regions. The quantity of wood fuel and charcoal available for importation to GEM was 1,535 ktoe and 1,989 ktoe respectively as revealed in the state of energy survey. In 2013, about 105,000 kg (0.0378 ktoe) of wood fuel and 182,000 kg (0.16016 ktoe) of charcoal were brought into the municipality. Charcoal used to be produced in Kintampo, Wenchi, Atebubu, Mampong and Techiman but it is currently transported all the way from Bole.

With reference to the total number of households, commercial and industrial activities in the municipality, the total energy consumed in GEM is estimated at around 9,556,739.85 Gigajoules (GJ). The transport sector takes the largest share (92 percent) of the total energy consumed in the municipality. The main energy sources in this sector are diesel, petrol and LPG fuels. Diesel constitutes about 75 percent of the fuels consumed within the transport sector, followed by petrol (23.5 percent) and LPG (1.5 percent). Households are the second largest energy consumers in GEM (about 7 percent), followed by commerce (1 percent). Local government and industry consume about 11,909.3 GJ and 10,215.68 GJ respectively, representing less than 1 percent of total energy consumed in the municipality (Figure ES 1).

Figure ES 1: Total energy consumption in GEM, by sector



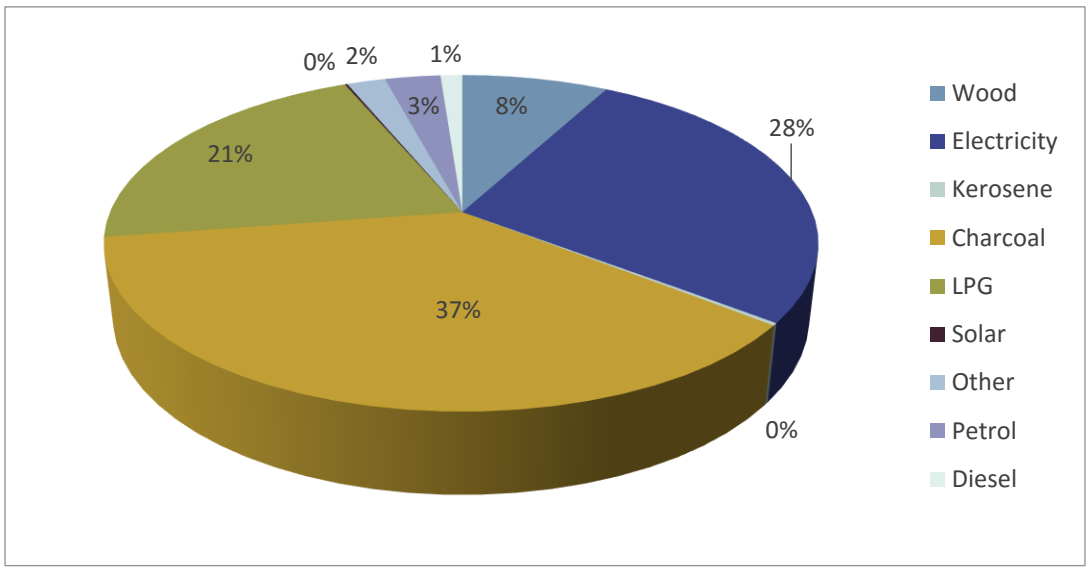
Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 3.2: Energy Picture of the Residential Sector in GEM

The residential sector in GEM is composed of 85 percent first-class households followed by third class (10 percent) and second class (5 percent). About 78 percent of total households in GEM are electrified. Most electrified first-class households live in detached houses while most second- and third-class households are in compound houses. Most electrified households in GEM have louvre blade windows. The majority of non-electrified first- and second-class households live in kiosks/containers while the majority of third-class non-electrified households live in uncompleted buildings. Most non-electrified households in GEM have wooden windows in their dwelling units. The majority of electrified households that have wooden windows in the municipality depend on natural air for ventilation. For households with louvre blade windows, 46 percent, 21 percent and 86 percent of first-, second- and third-class electrified households respectively use natural ventilation while 53 percent, 79 percent and 14 percent of first-, second- and third-class households respectively use fans as their main ventilation system. About 0.33 percent of first-class electrified households that have louvre blade windows use air conditioners (AC) as their main ventilation system. About 26 percent, 52 percent and 23 percent of first-class households that have sliding glazed windows use natural air, fans and AC respectively as their main ventilation systems.

The residential sector accounts for 7 percent of total energy consumed in GEM and was the second largest consumer of energy after the transport sector in 2013. Charcoal fuel took the largest share (37 percent) of total energy consumed by the household sector in GEM, followed by electricity (28 percent), LPG (21 percent), firewood (8 percent), petrol (3 percent) and diesel (2 percent). Dry cell batteries and candles, which make up the other fuel type, constitute 2 percent of total energy consumed by the residential sector in the municipality (Figure ES 2).

Figure ES 2: Share of total energy consumption, per energy carrier, 2013



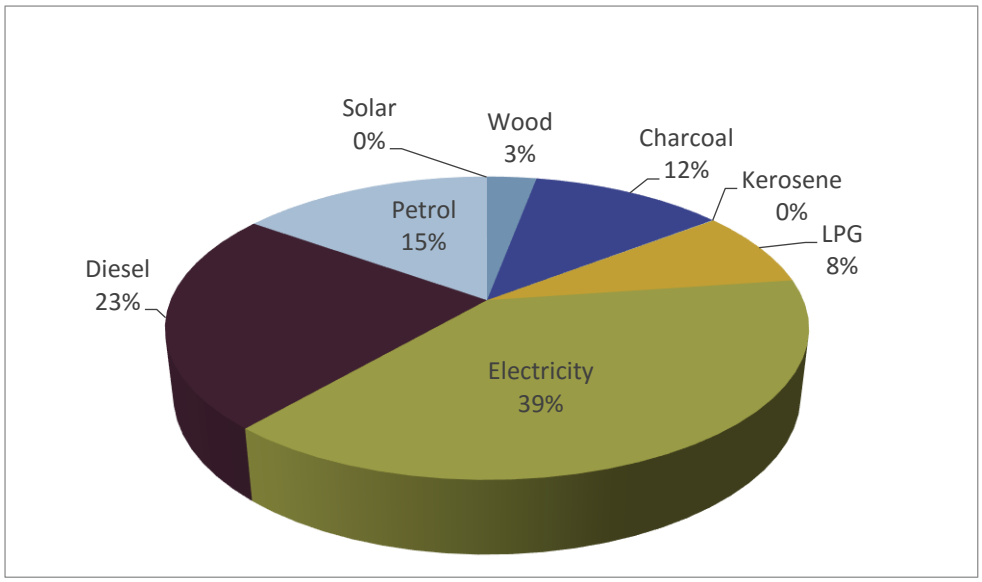
Source: ISSER SoE Surveys in ASEM and GEM, 2014

Cooking activities consume the most energy in the residential sector, followed by lighting and water heating in all three classes of settlements in the municipality. LPG is the main cooking and water heating energy source in most first- and second-class electrified households while charcoal is the primary energy source for cooking and water heating in most third-class electrified and non-electrified households. Some electrified households use electricity as a supplementary source while some non-electrified households use firewood as a supplementary energy source for their cooking and water heating activities. Electricity is the main energy source for lighting in electrified households while non-electrified households depend on dry cell batteries and candles.

ES 3.3: Energy Picture of the Commercial Sector in GEM

The commercial sector accounts for about 1 percent of total energy consumed in the municipality. Electricity and diesel take the largest shares of total energy consumed in the commercial sector in GEM. About 39 percent of the total energy consumed by the commercial sector is electricity while 23 percent is diesel fuel (Figure ES 3). The remaining 38 percent is shared between charcoal, wood, LPG and petrol. Kerosene and solar energy are consumed in small quantities by the commercial sector in the municipality.

Figure ES 3: Share of energy consumed by the commercial sector among energy carriers, in 2013



Source: ISSER SoE Surveys in ASEM and GEM, 2014

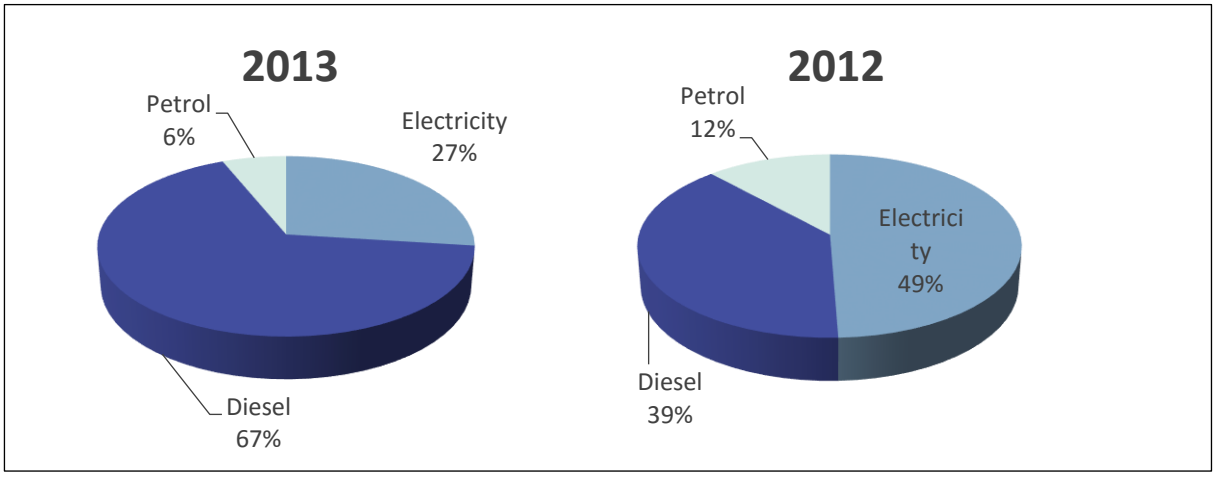
Electricity contributes about 40 percent of total energy consumed by formal commercial activities in the municipality while diesel contributes 34 percent. Petrol, LPG and charcoal provide 13 percent, 7 percent and 6 percent respectively of total energy consumed by the formal sector. Solar energy, wood and kerosene fuels contribute less than 1 percent of the total energy consumed. Lighting consumes the most energy within formal commercial activities, accounting for 24 percent of total energy consumed in the sector, followed by HVAC (20 percent), machine operations (19 percent), cooking/water heating (15 percent) and entertainment, refrigeration and transportation (7 percent each).

In the informal commercial sector, electricity and charcoal are the most consumed fuels. Electricity constitutes 36 percent of total energy consumed while charcoal constitutes 21 percent. Petrol, LPG, wood and diesel constitute 20 percent, 11 percent, 7 percent and 5 percent of the total energy consumed by the informal commercial sector respectively. Cooking/water heating is the most energy-intensive activity in the informal commercial sector, consuming about 36 percent. This is followed by machine operations (31 percent), lighting (13 percent), entertainment (8 percent), refrigeration (6 percent) and ventilation (5 percent).

ES 3.4: Energy Picture of the Industrial Sector in GEM

The industrial sector is the lowest energy consumer in the municipality and accounted for less than 1 percent of total energy consumed in 2013. From 2012, the consumption of petrol and diesel increased at the expense of electricity consumption when the power shortages became acute. Electricity constituted about 49 percent of total energy consumed by the industrial sector in 2012 while petrol and diesel accounted for 39 percent and 12 percent respectively. In 2013, petrol constituted about 67 percent of total energy consumed by the industrial sector while electricity and diesel accounted for 27 percent and 6 percent respectively (Figure ES 4). About 90 percent of the energy consumed in the industrial sector is used on machinery. Lighting accounts for about 8 percent of total energy consumption in the industrial sector while the remaining 2 percent is consumed by cooling systems and other machines.

Figure ES 4: Share of energy sources consumed by the industrial sector in GEM, 2010-2013

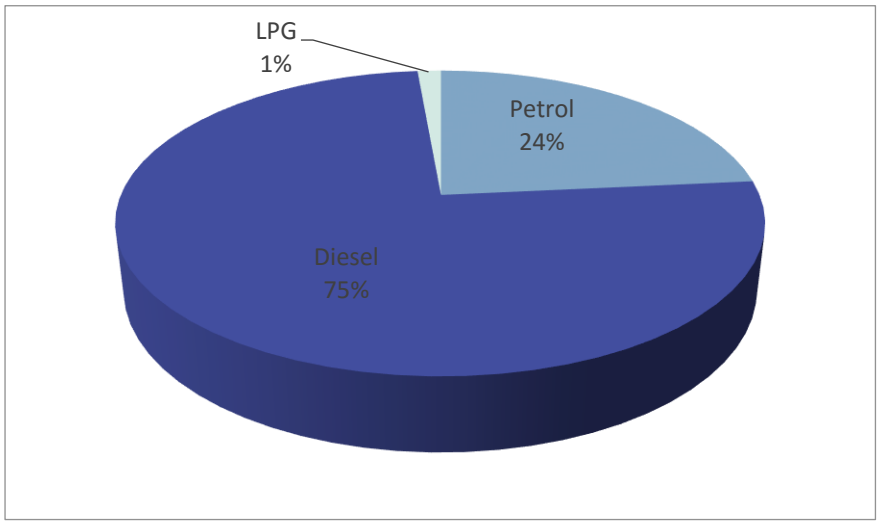


Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 3.5: Energy Picture of the Transport Sector in GEM

The transport sector is the most energy-intensive sector in the municipality, accounting for 92 percent of total energy consumed. The vehicle population in the municipality in 2013 was 23,315, consisting of 3 public vehicles (Metro Mass Transit buses), 18,804 private vehicles and 4,508 commercial vehicles. The MMT buses transport about 8,640 people per week from various locations to and from the municipality. Mini-buses (*trotro*) transport about 3,454,800 people per week in the municipality while taxis transport about 322,056 people per week. About 75 percent of total energy consumed by the transport sector in the municipality is from diesel fuel (Figure ES 5). Petrol constitutes about 24 percent of total energy used by the transport sector. The remainder is from LPG, consumed mainly by taxis which have converted from either petrol or diesel because it is considered to be more economical.

Figure ES 5: Share of fuel type consumed by the transport sector in GEM



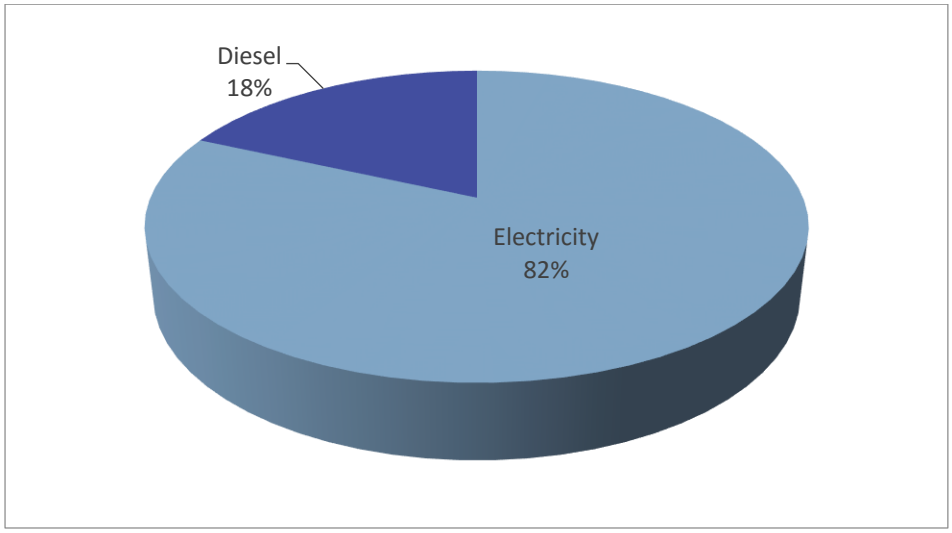
Source: ISSER SoE Surveys in ASEM and GEM, 2014

Medium and heavy trucks consume the most energy (38 percent) in the transport sector, followed by light passenger vehicles (30 percent). Light trucks consume about 15 percent while *trotro* (mini-buses) consume about 13 percent. Energy consumption by taxis constitutes only 4 percent of total fuel consumption in the transport sector while motorbikes and heavy passenger vehicles consume less than 1 percent of total energy in the transport sector in GEM.

ES 3.6: Energy Picture of GEMA

GEMA, the local government authority was the fourth largest energy-consuming sector in the municipality in 2013. The predominant energy source consumed by GEMA is electricity (82 percent) from the national grid in 2013 (Figure ES 6). The remaining 18 percent of the energy consumed came from diesel fuel, which is used in the municipal vehicle fleet and also for powering the municipal-owned back-up generator. Ventilation and air conditioning (VAC) is the largest energy end-user within the municipal buildings, accounting for about 38 percent of the total energy consumed by the Assembly in 2013 (Figure 52). Refrigeration accounts for about 18 percent of the Assembly's total energy consumption, similar to transport services, while office machines account for about 16 percent of total energy consumed and lighting and water treatment each account for approximately 5 percent. Electricity is the main source of energy for lighting but GEMA also depends on a 60kv capacity diesel-powered generator which uses about 125.22 litres of diesel per month during blackout periods.

Figure ES 6: Share of total energy consumed by carriers in GEMA



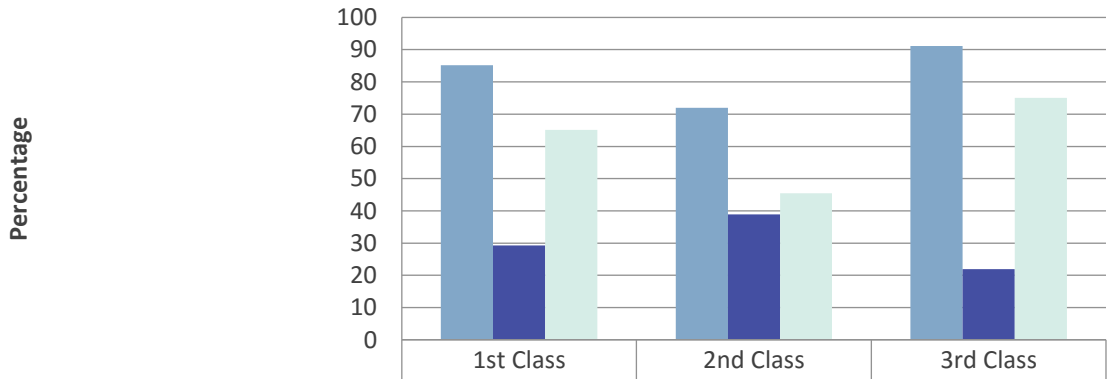
Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 4: Energy Efficiency Programmes: Knowledge-Based Evidence at Municipal Level

ES 4.1: Energy Efficient Cook Stoves and Light Bulbs

From the survey, about 99 percent of first-class households strictly use energy efficient bulbs for lighting while 96 percent and nearly all of second- and third-class households use efficient lighting bulbs respectively. Knowledge of the existence of *Gyapa* energy-efficient stoves in the municipality is very high as more than 70 percent of electrified households across all three household classes indicated their awareness of the stoves. Conversely, a very low percentage of these households currently use the efficient stoves despite their high level of awareness (Figure ES 7). Meanwhile, the percentage of electrified households that wish to use efficient stoves is also high, especially in first- and third-class electrified households, implying the possibility of an increase in use of the technology in the municipality in future. Among non-electrified households, more than 75 percent indicated their awareness of energy-efficient stoves. However, less than 50 percent of such households with a highly perceived awareness rate have used these efficient cook stoves. Over 75 percent expressed willingness to use these stoves (Figure ES 8).

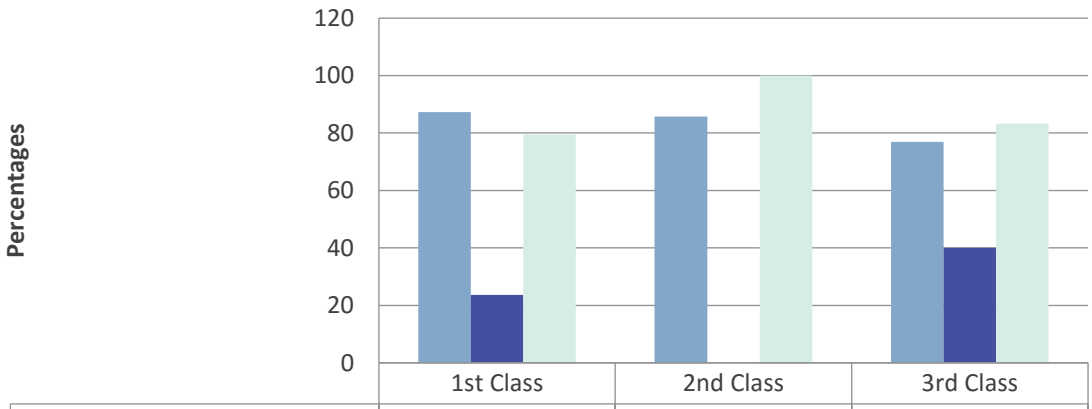
Figure ES 7: Percentage of electrified households that have knowledge of, are using or wish to use efficient cook stoves in GEM



	1st Class	2nd Class	3rd Class
% that have knowledge of efficient cook stove	85.13	72	91.11
% that use efficient cook stove	29.22	38.89	21.95
% that wish to use efficient cook stove	65.11	45.45	75

Source: ISSER SoE Surveys in ASEM and GEM, 2014

Figure ES 8: Percentage of non-electrified households that have knowledge, are using or wish to use efficient cook stoves in GEM



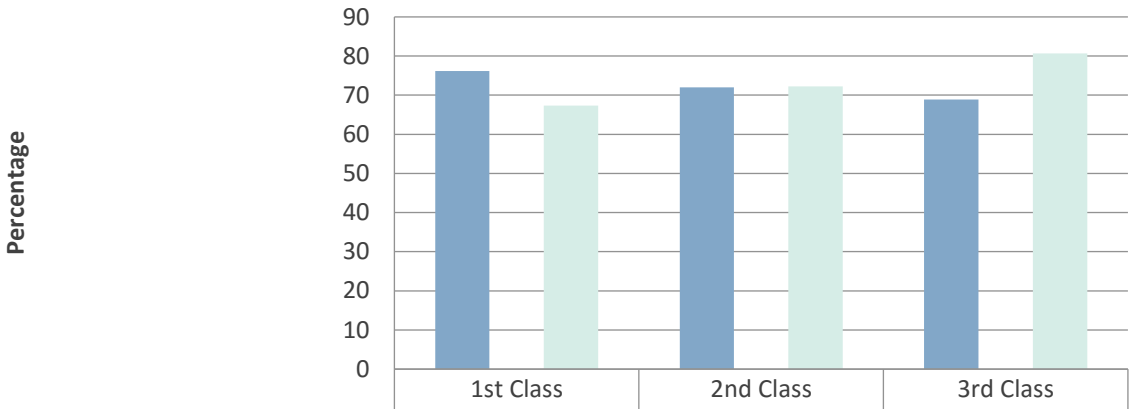
	1st Class	2nd Class	3rd Class
% that have knowledge of efficient cook stove	87.27	85.71	76.92
% that use efficient cook stove	23.71	0	40
% that wish to use efficient cook stove	79.45	100	83.33

Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 4.2: Penetration Levels of the Energy Commission's Fridge Replacement Programme

With respect to the Energy Commission (EC) fridge replacement programme, the survey results show that it is well known in the municipality. Over 60 percent of households across all three settlement classes have knowledge of the programme (Figure ES 9). Regardless of the high awareness, patronage of the programme is rather abysmal. None of the households in all three settlement classes has benefited from the programme. Meanwhile, a significant percentage (over 65 percent) of households that indicated their awareness of the programme wish they could benefit from it in the future.

Figure ES 9: EC fridge replacement programme: knowledge and accessibility



	1st Class	2nd Class	3rd Class
% that have knowledge on EC's fridge replacement programme	76.15	72	68.89
% that use EC's fridge replacement programme	0	0	0
% that wish to benefit from EC's fridge replacement programme	67.34	72.22	80.65

Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 4.3: Energy Commission (EC) appliance efficiency labels

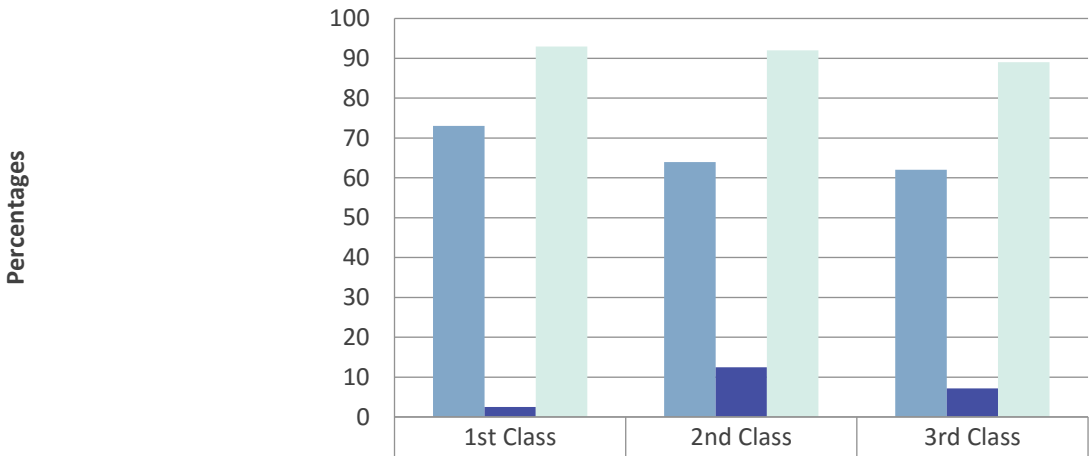
In the survey, households in the municipality were asked whether the new appliances they bought had the energy efficiency labels on them or not. For those who use air conditioners (AC), in first-class households, about 88 percent of them bought their AC with the EC energy efficiency labels on them while 12 percent of them bought new AC without the energy efficiency labels. Among first-class households that bought new refrigerators, 59 percent indicated that they bought those that displayed the EC energy efficiency labels. Only 10 percent and 40 percent of second- and third- class refrigerator users bought new refrigerators with the efficiency labels displayed on them.

ES 4.4: Knowledge and Use of Renewable Energy Technologies (RETs) in GEM

Public knowledge of RETs is quite encouraging in the municipality. About 73 percent and 42 percent of first-class electrified and non-electrified households respectively have knowledge of renewable energy. About 64 percent and 57 percent of second-class electrified and non-electrified households have knowledge of renewable energy while 62 percent and 54 percent of third-class electrified and

non-electrified households respectively are also aware of renewable energy (Figures ES 10 and ES 11). The most common RETs known to these households are rooftop solar PVs and wind. Despite the high awareness levels, more than 80 percent of these households across all three settlement classes do not get energy from these RETs. Meanwhile, there is high willingness to pay for these RETs insofar as they are reliable (Figure ES 10).

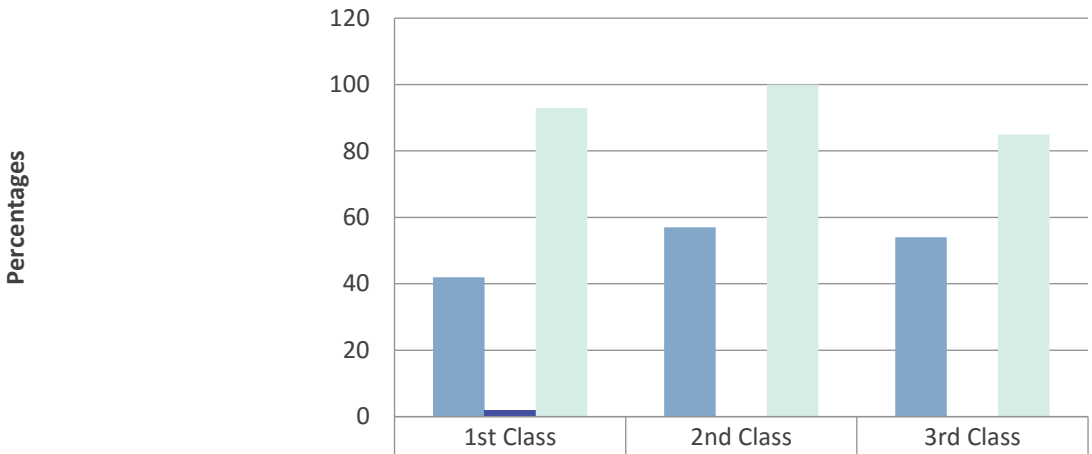
Figure ES 10: Percentage of electrified households that have knowledge of renewable energy, are supplied energy from RETs and are willing to pay for RET



	1st Class	2nd Class	3rd Class
% that have knowledge of RE	73	64	62
% that are supplied energy from any RET	2.5	12.5	7.14
% that are willing to pay for a reliable RET	93	92	89

Source: ISSER SoE Surveys in ASEM and GEM, 2014

Figure ES 11: Percentage of non-electrified households that have knowledge of renewable energy, are supplied energy from RETs and are willing to pay for RET



	1st Class	2nd Class	3rd Class
% that have knowledge of RE	42	57	54
% that are supplied energy from any RET	2	0	0
% that are willing to pay for a reliable RET	93	100	85

Source: ISSER SoE Surveys in ASEM and GEM, 2014

ES 5: Municipal Strategic Energy Issues

ES 5.1: Mandates of GEMA in Influencing Energy Supply, Demand and Efficiency

GEMA does not produce nor distribute any form of energy to demand sectors in the municipality. All of the conventional energy carriers consumed in the municipality including by the Assembly itself are supplied by national institutions. In the area of renewable energy technologies (RETs), the Assembly has made some progress in terms of energy production. GEMA is partnering with La Nkwantanang-Madina municipality and a private investor to produce energy out of the waste that is deposited at the Abokobi landfill site. There are also some street lights under the Assembly's management that are powered by solar photovoltaic (PV) systems.

GEM oversees the general planning of the municipality before power is extended to the various dwelling units (houses and structures). In terms of residential buildings and other structures that are put up in the municipality, the Assembly has no mandate to impose building plans on individual property owners. However, all building plans go through vetting procedures at the Assembly to ensure

the plans provide for proper ventilation systems and minimal use of lights. Regarding spatial planning, the Assembly has prepared town layouts (schemes) for specific areas in the municipality. Based on these town schemes, permits are issued to individual land developers who wish to put up residential buildings, office structures, warehouses or other structures. In terms of transport management, there are 45 urban passenger transport operator unions in the municipality that are regulated by the Assembly. The Assembly, however, does not determine which vehicles are roadworthy or which ones can operate in the municipality. The Assembly only levies passenger vehicle operators in the municipality for their operations.

ES 5.2: GEMA Control over new Developments in the Municipality

Electricity extension to new communities and also to new residential buildings and other structures in already connected communities is an ongoing activity in the municipality. The Assembly has no direct control over such connections, but indirectly provides information regarding such communities. GEMA has full control over spatial layouts of the municipality and building structures. In 2013, 168 development permit applications were received at GEMA. A total of 224 development applications were approved in that same year which included the outstanding applications of the previous years. It is, however, not uncommon to see people putting up permanent and temporary structures at unauthorized locations without permits from the Assembly. This often attracts fines and demolition of the structures once the Assembly finds out about such activities.

With respect to the transport sector, the Assembly has no control over construction and maintenance of roads in the municipality (which are mandates of the National Urban Roads Department). The Assembly, however, supervised the setting up of some new bus terminals in the municipality and also the upgrade of some existing ones in the past year. About five liquid/LPG fuel service stations were granted permits to operate in the municipality in 2013. The Assembly ensured that the location of these fuel service stations conformed to the general layouts of the area.

ES 6: Implications of Major Findings for Sustainable Energy Transitions

- The architectural designs of buildings and specifically, window designs, have implications for energy consumption in the municipality. Without building codes, building designs are not regulated to ensure efficient energy performance of the building.
- A significant proportion of households in all three settlement classes use modern forms of energy (electricity and LPG). However, biomass will remain a major cooking and water heating energy source for most non-electrified households and third-class electrified households in the municipality in the near future mainly due to the perceived high cost of electricity and LPG. This has the potential of further depleting the forest cover of the nation and undermining climate change initiatives and programmes.
- The commercial, industrial and agricultural sectors in GEM depend largely on petroleum fuels (diesel, petrol and LPG) and electricity for their commercial and industrial activities. Besides the increasing carbon emission implications, there is a huge build-up of cost comprising installation of generators, maintenance costs as well as the operational costs of these activities.
- Although certain RETs – especially solar lamps and torches, solar PVs and wind PVs – are appreciably known across all sectors of the municipality, there is over-reliance of commercial and industrial activities on the national grid for electricity without initiatives to generate their own electricity through RETs. This is due to the absence of comprehensive regulations and policies regarding zero net energy businesses.
- Waste management is a challenge for GEMA. Meanwhile, there is renewable energy potential in the enormous waste generated monthly in the municipality.
- Although the use of private cars in the municipality is growing rapidly – by an average 20 percent annually – lots of people also depend on the commercial mini-buses (*trotro*), taxis and the public transport system in the municipality. Effective regulation of the transport systems in the municipality including provision of sufficient bus terminals, ensuring regular maintenance of public vehicles, regulating taxis and *trotro* unions will discourage private ownership of cars.
- From the survey results, there is high awareness level of energy-efficiency programmes in the municipality and also high willingness on the part of households to take advantage of the energy-efficiency programmes. Clearly, there is a disconnect between awareness of the energy-efficiency programmes in the municipality and accessibility.
- Individual behaviour has consequences on the total energy consumed by GEMA and other state or private institutions. The use of energy-inefficient electrical gadgets coupled with the lack of

retrofitting technologies such as human sensors which can automatically turn off office lights and equipment when occupants are out of the office all help to increase energy consumption in offices.

- Energy data at the local level are woefully insufficient as a basis for sustainable energy strategies in GEM. While national energy statistics provide an energy picture of the entire country, efficient local level energy strategies for a fast urbanizing municipality like GEM cannot be formulated on the basis of the national data.

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