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Potential Impacts of Climate Change on Waste Management in Ilorin City Nigeria

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Abstract - Ilorin is one of the major cities in Nigeria today and its growing capacity in both socio-economic affiliations is commendable. However, the city is potently polluted with heaps of refuse that are occasionally caused traffic hold-up in places in the urban centre. A lot of health incidence resulting from water, air and pest borne diseases are not uncommon within areas where prevalence of effluents prevailed. Current problems of poor waste management upon the government efforts is as a result of the potential impacts of climate change on the natural world, and with wide effects resulting from these changes has its implications in Ilorin city. This work examines the management of waste in city of Ilorin which has been the sole responsibility of the Kwara State Environmental Protection Agency (KWEPA) and other health management sectors. Worldly wise, there are evidences that climate change and its due,at least in part to human activities , gives rise to emissions of Green house gases (GHG,s) which invariably is disturbing the world (Wilby,2003). Over the last 100 years, the average temperature of the air near the Earth´s surface has risen a little less than 1° Celsius (0.74 ± 0.18°C, or 1.3 ± 0.32° Fahrenheit).

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Abstract - Ilorin is one of the major cities in Nigeria today and its growing capacity in both socio-economic affiliations is commendable. However, the city is potently polluted with heaps of refuse that are occasionally caused traffic hold-up in places in the urban centre. A lot of health incidence resulting from water, air and pest borne diseases are not uncommon within areas where prevalence of effluents prevailed. Current problems of poor waste management upon the government efforts is as a result of the potential impacts of climate change on the natural world, and with wide effects resulting from these changes has its implications in Ilorin city. This work examines the management of waste in city of Ilorin which has been the sole responsibility of the Kwara State Environmental Protection Agency (KWEPA) and other health management sectors. Worldly wise, there are evidences that climate change and its due,at least in part to human activities , gives rise to emissions of Green house gases (GHG,s) which invariably is disturbing the world (Wilby,2003). Over the last 100 years, the average temperature of the air near the Earth´s surface has risen a little less than 1° Celsius (0.74 ± 0.18°C, or 1.3 ± 0.32° Fahrenheit). Does not seem all that much? These changes could have significant impacts on a range of social, economic and environmental processes as well as waste management in the areas selected for this study. Two hundred (200) questionnaires were randomly distributed to member of households on wards basis in Ilorin. An addition of Fifty (50) questionnaires was also distributed to agencies that control and manage waste, while their contributions to waste control in the state were assessed. Suggestions were put forward for all to remain alert, and that in the future we may experience higher temperatures,extreme decay and more environmental problems except if proper precautions are taken.

Keywords : Climate Change, Potential impacts, Green house gases, Effluents, Waste management.

I. Introduction

Climate change results from the increase in the average temperature on Earth. As the earth is getting hotter, disasters like hurricanes, droughts, floods, land degradation, accumulation of wastes and wastes decomposition are getting more frequent. Human activities have led to large increases in heat-trapping gases over the past century. The climate change in the past 50 years or more is due primarily to human-induced increase. Global average temperature and sea level have increased, and precipitation patterns have changed. All these not alone, human "fingerprints" also have been identified in many other aspects of the climate system, including changes in ocean heat content, precipitation, atmospheric moisture, plant and animal health and location, and de-forestation syndrome have contributed to the phenomenon of our time.

In the U.S., the amount of rain falling in the heaviest downpours has increased approximately 20 percent on average in the past century. Many types of extreme weather events, such as heat waves and regional droughts, have become more frequent and intense during the past 40 to 50 years. The destructive energy of Atlantic hurricanes has increased. In the eastern Pacific, the strongest hurricanes have become stronger since the 1980s, even while the total number of storms has decreased. Sea level has risen along most of the U.S. coast over the last 50 years, and will rise more in the future. Arctic sea ice is declining rapidly and this is very likely to continue (Lynne Cherry and Gary Braasch, 2008). This work focuses on a study of Environmental Impacts of Climate Change on Waste Control Procedures in Ilorin city of Nigeria . The aim of this study is centered on how to improve on climate impacts to reduce perils of waste accumulation in the area of study. The attending objectives used are: Assessment of changes in temperature and other weather parameters, which in turn activate waste generation in the study area. Examination of disposal methods, if in conformity with modern method of waste control and management or not, and, what are the assessment impacts resulting from climate change on waste product on livability of people of Ilorin.

Climate change discourse has been a serious international environmental concern and the subject of much research. Moreover, in international scientific circles, a consensus is growing that the buildup of C02 and other Green House Gases(GHGs) in the atmosphere will lead to major environmental changes such as (1) rising sea levels that may flood coastal and river delta communities; (2) shrinking mountain glaciers and reduced snow cover that may diminish fresh water resources; (3) the spread of infectious diseases and increased heat-related mortality;(4) possible loss in biological diversity and other impacts on ecosystems; (5) agricultural shifts such as impacts on crop yields and productivity; and (6) increase in waste generation impediment (McCarthy, 2001).

Climate change could result in changes in temperatures, cloud cover, rainfall patterns, wind speeds, and storms: all factors that could impact future

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waste management facilities' development and operation. The time scales for climate change and waste management are similar. For instance, landfill sites can be operational for decades and still remain active for decades following their closure (Houghton, 2001). There is, therefore, a need to consider potential changes in waste management over significant timescales and respond appropriately.

In most developed and developing countries with increasing population, prosperity and urbanization, it remains a major challenge for municipalities to collect, recycle, treat and dispose of increasing quantities of solid waste, especially in a changing climate. A cornerstone of sustainable development is the establishment of affordable, effective and truly sustainable waste management practices in developing countries. It must be further emphasized that multiple public health, safety and environmental co-benefits accrue from effective waste management practices which concurrently reduce GHG emissions and improve the quality of life, promote public health, prevent water and soil contamination, conserve natural resources and provide renewable energy benefits. The major problems facing Ilorin city today are incessant migration of people from rural areas and from other urban centers, most especially from Northern parts of the country where many people fled from religious or political persecutions. This new settlers added to the urbanization problems already prevailed in the city. This also added to some challenges facing by urban planners and developers on ways to ensure that the city adopt cleanliness pattern in conformity with modern cities of the world (Adedibu, 1983; Ahmed, 2008).

Ilorin metropolis lacks proper land use zoning arrangement, and has no precinct layouts of both new and old area demarcation. The city has little proper provisions for open spaces, greenbelts and recreational activities. The results of these have led to pollution of all types which are collectively referred as "brown agenda". This set of problems disproportionately has impacts on human, urban health and productivity (Bartone et al, 1994).For any city to be well developed, it must be properly planned because planning tends to concentrate on physical environment through; orderliness of layouts, provision of needed and necessary infrastructure and facilities, efficiency as well as ultimate aesthetic quality for the area. In other words, the planning process, from drawing board to implementation is nothing but environmental control as a means of ensuring functional and harmonious relationship between components of the urban areas and the ability to guarantee good health for urban residents through a sanitary control and management (Anozie, 1994).

In Ilorin, the capital of Kwara state, the problem of wastes is turning into alarming rate because the more these wastes are evacuated the more they are generated on a daily or weekly basis(see table 1). Huge of refuse are found dumped on unauthorized places, gutters and roads are filled up with sand and sediments which at times obstructed both free movement of pedestrians and vehicles alike. Thus, the issue of solid waste situation in Ilorin areas, to say the least, is quite distressing (Oyegun, 1987; Ahmed, 2000).

In Africa and Nigeria in general, cities and urban areas are the engines of economic growth and development, but implications of such growth need a thorough environmental management and adequate control. All over the world, urban centers/cities need environment that is free of health hazard, an environment where water, land, river and forest, public health, sewage and garbage disposal in factories among others, are of great important to all and sundry. Where these measures are not properly maintained, the consequences are numerous and hazardous. The gathering and disposal of solid wastes become a major public health issue of our time and this needs some urgent attention if our environment is to be protected. Therefore, this work sets up to achieve the following objectives: Examination of disposal methods that conform to the modern time techniques in removing effluent, bad odour, vermin, dust and other urban waste products in Ilorin township resulting from climate change in the recent time. Also assessment of changes in temperature and other weather parameters, which in turn could affect waste management and control processes among others in the study area.

II. Evidences of Climate Change in Developed and Developing Country

The global temperature has risen by about 0.60c. over the last 100 years and 1998 was discovered to be the single warmest year in the last 142 global instrumental record (Jonathan and Kerey(2003). There is also evidence in Nigeria today that climate change is already happening and it is due, to human activities that give rise to emissions of greenhouse gases (GHG) get proper checks. Climate models suggest that in the future in this country we are likely to experience higher temperatures, changes in seasonal precipitation and a shift to more extreme rainfall events, rising sea levels and more frequent storms. These changes could have significant impacts on a range of socio-economic and environmental processes that are affected by the weather (NIMET, 2009)

The timescale for climate change and some of the consequences on how we manage our waste in urban centers are similar. For example; landfill sites can be operational for decades and still be active for decades following their closure. Residual wastes will remain in the landfill site for many years after degradation processes have ceased, while capital

assets like energy from waste plants and materials will remain to be operational for decades and so could be affected by climate change. Climate change is happening now and so could already be affecting waste management processes and operations that are subject to weather related impacts. There is therefore a need to consider potential changes over significant timescale and respond appropriately. Different other types of waste are daily piled up in streets of Ilorin, though a contracted company-, 'Clean and Jerk' (Ola Kleen) is responsible for streets cleaning, but our disposal sites are affected by some undisputable items which need some additional and modern means of waste disposal if we must abate the peril of impacts ahead of time in the state in general. This study therefore, call for establishing a lasting solution to the socio-economic menace attached to the impacts that change climate exerts on; individual, agricultural products and on human health conditions in the study area. It suggests that some improvements on the methods of waste collection, transportation and disposal need additional and overhauling operations.

Accordingly, the United Nations Programmes on 'Global Environmental Outlook 2000' has warned that an impending worldwide environmental damage is imminent as a result of irreversible harm done to ecosystems (Owolabi, 2000). The Earth Summit in Rio in 1992 has also clearly alerts the world on the evils of environment mistreatment (FEPA, 1993). Though many nations are giving priorities to other environmental issues, while many nations are facing other worldly hazards. For example, the United States of America had the highest awareness on environmental issues followed by the European countries. While some Asian, Mid-East and African nations are facing political upheaval and instability.

III. Climate Impacts

The world view of global warming project is documenting this change through science photography from the Arctic to Antarctica, from glaciers to the oceans, across all climate zones. Rapid climate change and its effects is fast becoming one of the prime events of the 21st century. It is real and it is accelerating across the globe. As the effects of this change combine with overpopulation and weather crises, climate disruptions will affect more people than does war (Oyedele, 2009).

The status of waste management sector in Nigeria indicates that the availability and quality of annual data are major problems for the waste sector. Solid waste data is lacking for many countries, data quality is variable, definitions are not uniform and inter-annual variability is often not well quantified. However, there are three major approaches that have been used to estimate global waste generation and this is adopted for this work:

i. data from national waste statistics or surveys including IPCC methodologies (IPCC, 2006);
ii. estimates based on population (NBSC, 2006)
iii. the use of a proxy variable linked to demographic or economic indicators for which national data are annually collected (US EPA, 2008). Global solid waste generation rates range from <0.1 t/cap/yr (tons per capita per year) in low income countries to >0.8 t/cap/yr (table 1). Overall, the waste sector contributes <5% of global GHG emissions (US EPA, 2003).

In Nigeria, accurate data on the quantities of municipal solid waste generated in Nigeria are not easy to come by. Nevertheless, Rushbrook and Pugh (1999) outlined the range of per capita waste generation as well as waste densities (on net weight basis) from low and middle income neighborhood of Nigerian cities (see table 1).

Table 1 : Range of Management Solid Waste (MSW) per capita Generation and Density in Nigeria.

Waste Generation Capacity(WGC)	Middle Income Earner	Low Income Earner
Waste generation (Kg/cap/day)	0.5- 0.9	0.4- 0.6
Waste densities (net weight basis-Kg/m^3)	170-330	250-500

Source : Rushbrook and Pugh (1999) and as modified by the Author (2011).

IV. Waste Management Activities in Nigeria

In Nigeria, recycling activities are not popular and non-existent. However, the recovery of materials from wastes (scavenging) is practiced on a large scale. This type of recovery takes place at both legal and illegal dump sites where scavengers search continually for valuable metals, plastics, and bottles to be reused or for sale to buyers of different type of scraps. In general, treatment of solid wastes is not often carried out in Nigeria. Incineration of wastes or use of approved sanitary landfill is non-existent. The most common practice is open dumping and burning of waste within residential areas and at illegal and legal dumps. Other strategies employed in disposing waste in the country include:

a) Composting :

Composting is a biological process that uses micro-organisms to degrade organic matter using atmospheric oxygen. The stabilized end product occupies a reduced volume compared with the starting materials. The principal emissions are C02 and water

vapor, bio-aerosols and odor. It is estimated that nearly a quarter of all household waste is organic and can be composted. In Nigeria, compositing is undertaken in the open. The end product is used in farms.

b) Collection and Transfer :

Waste transfer points are used by waste management companies as a means of increasing the efficiency of their waste collection service through the bulking up of waste into larger consignments prior to transfer to dump and disposal sites. At the transfer points, waste is loaded directly into large bulk container vehicles and transferred by road to the dump site. The environmental impacts commonly cited are: odor, dust, bio-aerosols, attraction of bird, noise and surface water pollution and surface water runoff management. Waste transfer stations are often located along the streets, while the dump sites are usually away from the city centers.

c) Combustion :

Combustion of MSW results in emissions of $C0_2$ (because nearly all of the carbon in MSW is converted to $C0_2$ under optimal conditions) and N_20. $C0_2$ from burning biomass sources (such as paper products and yard trimmings) is not courted as a GHG because it is biogenic.

V. Waste Management Policies and Regulations in Nigeria

The discovery of a major toxic waste dumped by a foreign company at Koko Town near Warri in Delta State, Nigeria in 1987 led to the establishment of Federal Environmental Protection Agency (FEPA) by Decree No. 58 of 1988. In June, 1999, the Federal Government of Nigeria created the Ministry of Environment and as a result, FEPA's function was absorbed by the new ministry.

The Federal Ministry of Environment has the following instruments of intervention in place to tackle the problem of environmental degradation including waste management:

- The revised policy on environment, 1999.
- The National Agenda 21 (published in 1999), which touches on the various cross-sectoral areas of environmental concern and map out strategies on how to address them.

These instruments complement what existed in the form of guidelines and standards for environmental pollution control in Nigeria and other regulations that deal with effluents, industrial pollution, waste management and environmental impact assessments (FME, 2003).Among FEPA's instructions in combating environmental degradation are the waste management Regulation S.1.9 of 1991 and Environmental Impact Assessment (EIA) Decree No. 86 of 1992. FEPA policies regulate the collection, treatment and disposal of solid and hazardous waste for municipal and industrial sources and makes EIA mandatory for any major development project likely to have adverse impact on the environment (see table 2).There is also in existence an environmental sanitation edict of 1997 that declared the last Saturday of every month to be used for cleaning the environment for three (3) hours (7am – 10am). This edict is still in force and still being observed all over Nigeria. Every last Saturday of the month, between the hours of 7am and 10am, people are required by law to clean their surroundings and offenders are apprehended and punished as stipulated by the act. The post-1988 environmental laws and regulations continue to prevail without any change.

Table 2 : Impacts of Waste Management on the Environment.

Climate Variable	Potential Climate Change	Examples of Impacts on Waste Management on the environment
Temperature	Annual warming of between 1^0 and 5^0 by the 2080s	Increased water for both workers and site operations.
	More hot days increases especially in dry seasons	Decline in air quality and subsequent negative impacts of heat on vulnerable groups.
	Number of cold days decreases, especially in rainy seasons	Impacts on biological processes e.g. composting anaerobic digestion etc.
	More frequent stagnant summer anticyclones.	Increased risk of changes in distribution of vermin and pests.
Precipitation	Generally wetter days for Nigeria, mostly In the Southern part.	Increased risk of flooding from groundwater, Surface water, tidal and sea surfaces..

	Precipitation intensity increases in rainy seasons	Disruption to infrastructure e.g. road and Rail
		Increased precipitation intensity could affect slope stability on waste management sites (Jones,1993)
		Impacts on biological processes e.g. composting, anaerobic digestion etc.
Cloud Cover	Reduction in cloud cover	Risk to workers of skin condition associated with increased exposure to sunshine during outdoor workings.
Humidity	Specific humidity increases especially during rainy seasons	Impacts on outdoors biological processes.
Sea level	Mean sea level may be up to 86cm Above its current level due to thermal Expansion and natural land movements by the 2080s.	Inundation of waste management facilities. Increased erosion of coastal areas.

Source: Adopted from Enete I. C.(1996) and modified by the Author (2011).

VI. Methodology

This work employs in addition to secondary data, a survey aimed at generating primary data on the potential impacts of climate change on waste management standard in Ilorin. The work embarks on the random distribution of questionnaire to 200 households in ten selected wards from Ilorin. This allows for generation of needed and necessary information on; respondents perception about the causes of climate change, the estimated volume of water in which households use during dry season periods, quantity of fuel used when there is no supply of electricity from the Power Holding Company of Nigeria (PHCN) and impacts of combustion carbonized items and other domestic wastes generated by households from homes, selling points (stalls) and farmlands (see tables 3, 4, 5 and 6). In all, three hundred structured questionnaires were used to assess the households' response to impact of climate change as affecting domestic waste in their areas and their coping mechanism. In addition to this, on the spot assessment and oral discussions were carried out among the agencies that control and manage waste in the selected study area. The agencies include; the Kwara State Environmental Protection Agency (KWEPA), the Kwara State Ministry of Health and the Kwara State Waste Management Company (KWMC).The reason for this is to assess their contributions and attendance challenges on climate change as affecting waste management activities in the state.

Table 3 : Households Response to Method of Domestic Waste Control/Disposal in Ilorin Metropolis.

Location By Wards	Dump on Available Space	Drum/Dustbin	Bury in Ground	Burn in Incinerator	Others	Total & %
Adewole	3 (15.0)	9(45.0)	2 (10.0)	3 (15.0)	3(15.0)	20(100)
Balogun Alanamu	10(50.0)	4(20.0)	2(10.0)	2(10.0)	2(10.0)	20(100)
Balogun Gambari	9(45.0)	7(35.0)	3 (15.0)	1(5.0)	0(0.0)	20(100)
Balogun Ajikobi	5(25.0)	5(25.0)	2(10.0)	3(15.0)	5(25.0)	20(100)
Balogun Fulani	4(20.0)	6(30.0)	3(15.0)	3(15.0)	4(20.0)	20(100)
Baboko	7(35.0)	4(20.0)	4(20.0)	4(20.0)	1(5.0)	20(100)
Magaji Aare	2(10.0)	9(45.0)	4(20.0)	2(10.0)	3(15.0)	20(100)
Magaji Badari	6(30.0)	7(35.0)	4(20.0)	2(10.0)	1(5.0)	20(100)
Magaji Ibagun	4(20.0)	5(25.0)	5(25.0)	2(10.0)	4(20.0)	20(100)
Magaji Ngari	6(30.0)	2(10.0)	6(30.0)	3(15.0)	3(15.0)	20(100)
Total	**280	**570	**175	**125	**130	200(100)

Source : Author's Computation.
*1.Figures in parentheses are row percentages. 2. ** are total row percentages.*

Table 4 : Estimated Figures of Waste Generated in Ilorin Metropolis by Wards (2006) .

	Location/Area	Garbage		Ashes		Paper		Rags		Polythene/Rubber bag		Unclassified Items		Total	
		Kg	%	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
1.	Maraba	0.782	0.10	0.512	0.06	2.63	0.32	0.24	0.03	2.61	0.32	1.43	0.17	8.204	9.84
2.	Adewole	0.736	0.30	0.004	0.00	0.154	0.06	0.004	0.00	0.73	0.29	0.883	0.35	2.494	2.99
3.	Ita-Amodu	0.920	0.23	0.663	0.18	0.222	0.06	0.831	0.21	0.600	0.15	0.731	0.18	2.967	3.56
4.	Oloje	0.600	0.12	2.72	0.56	0.009	0.00	0.281	0.006	0.413	0.09	0.814	0.17	4.547	5.45
5.	Oja-Oba	0.243	0.07	2.23	0.61	0.131	0.04	0.113	0.03	0.225	0.06	0.732	0.20	3.672	4.41
6.	Idi-Ape	0.51	0.06	0.79	0.14	0.99	0.18	0.361	0.07	1.73	0.31	1.14	0.21	5.543	6.65
7.	Oju-Ekun	0.633	0.12	0.77	0.14	0.71	0.01	0.93	0.17	1.55	0.28	1.53	0.28	5.484	6.58
8.	Alore	0.534	0.11	0.66	0.14	0.21	0.04	0 .88	0.18	1.46	0.30	1.09	0.23	4.834	5.79
9.	Tipper Garage/Tank	1.222	0.24	0.72	0.14	0.232	0.05	0.73	0.14	1.02	0.02	1.17	0.23	5.094	6.11
10.	Ajikobi	0.259	0.08	0.34	0.10	0.02	0.01	0.55	0.17	0.93	0.12	0.98	0.30	3.309	3.97
11.	Alanamu	0.851	0.16	1.72	0.33	0.77	0.15	0.30	0.06	0.85	0.16	0.76	0.14	5.251	6.29
12.	Baboko	0.943	0.21	0.90	0.20	0.63	0.14	0.27	0.20	0.97	0.21	0.84	0.18	4.553	5.46
13.	Oke Aluko	0.77	0.19	0.39	0.10	0.79	0.20	0.31	0.08	1.20	0.29	0.62	0.15	4.08	4.89
14.	Surulere	0.931	0.15	0.66	0.11	0.89	0.14	0.65	0.10	1.41	0.23	1.70	0.27	6.241	7.49
15.	Ita-Ajia	0.98	0.23	0.05	0.01	0.71	0.17	0.07	0.02	1.55	0.36	0.89	0.21	4.25	5.09
16.	Zango/Kulende	1.66	0.45	0.14	0.04	0.11	0.03	0.06	0.02	0.65	0.17	1.10	0.3	3.72	4.46
17.	Balagun Fulani	0.881	0.25	0.61	0.17	0.14	0.04	0.09	0.03	0.85	0.24	0.93	0.27	3.501	4.19
18.	Taiwo-Isale	0.94	0.03	0.04	0.01	0.92	0.30	0.43	0.14	0.99	0.32	0.58	0.19	3.054	3.66
19.	Taiwo-Oke	0.12	0.01	0.001	0.00	0.65	0.45	0.01	0.01	0.63	0.43	0.15	0.10	1.453	1.74
20.	Sabon-Ngari	0.052	0.05	0.003	0.00	0.51	0.46	0.11	0.10	0.14	0.13	0.33	0.30	1.105	1.33
	Total	**14.57**	**3.16**	**13.92**	**3.04**	**11.43**	**2.85**	**6.34**	**1.77**	**20.51**	**4.48**	**18.4**	**4.43**	**83.36**	**99.95**

Source : Author's fieldwork.

Table 5 : Estimated Figures of Waste Generated in Ilorin Metropolis by Wards (2010).

	Location/Area	Garbage		Ashes		Paper		Rags / Polythene&Rubber bag		Unclassified Items		Total			
		Kg	%	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%	Kg	%
1.	Maraba	1.8768	4.46	1.2288	3.68	6.312	22.85	0.576	3.32	6.264	12.73	3.432	7.52	19.6896	9.84
2.	Adewole	1.7664	4.19	0.096	0.29	0.369	1.34	0.009	0.05	1.752	3.56	2.119	4.65	5.9856	2.99
3.	Ita-Amodu	2.208	5.25	1.5912	4.75	0.533	1.93	1.994	11.51	1.44	2.93	1.754	3.85	7.1208	3.56
4.	Oloje	1.44	3.42	6.528	19.49	0.0216	0.08	0.674	3.89	0.991	2.01	1.954	4.28	10.9128	5.46
5.	Oja-Oba	5.5832	13.27	5.352	15.98	0.314	1.14	0.271	1.56	0.54	1.09	1.757	3.85	8.8128	4.41
6.	Idi-Ape	1.224	2.91	1.896	5.66	2.376	8.59	0.866	4.99	4.152	8.44	2.736	5.99	13.3032	6.65
7.	Oju-Ekun	1.5192	3.61	1.848	5.52	0.71	2.57	2.232	12.88	3.72	7.56	3.672	8.05	13.1616	6.58
8.	Alore	1.2816	3.05	1.584	4.73	1.704	6.17	2.112	12.19	3.504	7.12	2.616	5.73	11.6016	5.79
9.	Tipper Garage/Tanke	2.7332	6.49	1.728	5.16	0.557	2.02	1.752	10.11	2.448	4.98	2.808	6.16	12.2256	6.11
10.	Ajikobi	0.6216	1.48	0.816	2.44	0.048	0.17	1.32	7.62	2.232	4.54	2.352	5.16	7.9416	3.97
11.	Alanamu	2.0424	4.85	4.128	12.32	1.848	6.69	0.72	4.15	2.04	4.15	1.824	4.00	12.6024	6.29
12.	Baboko	2.2632	5.38	2.16	6.45	1.512	5.47	0.648	3.74	2.328	4.74	2.016	4.42	10.9272	5.46
13.	Oke Aluko	1.848	4.39	0.936	2.79	1.896	6.86	0.744	4.29	2.88	8.85	1.488	3.26	9.792	4.89
14.	Surulere	2.2344	5.31	1.584	4.73	2.136	7.73	1.56	9.00	3.384	6.88	4.08	8.94	14.9784	7.49
15.	Ita-Ajia	2.352	5.59	0.12	0.36	1.704	6.17	0.168	0.97	3.72	7.56	2.136	4.68	10.20	5.10
16.	Zango/Kulende	3.984	9.47	0.336	1.00	0.264	0.96	0.144	0.83	1.56	3.17	2.64	5.79	8.928	4.46
17.	Balagun Fulani	2.1144	5.03	1.464	4.37	0.336	1.22	0.216	1.25	2.04	4.15	2.232	4.89	8.4024	4.20
18.	Taiwo-Isale	4.564	10.85	0.096	0.29	2.208	7.99	1.032	5.95	2.376	4.83	2.32	5.09	7.3296	3.66
19.	Taiwo-Oke	0.288	0.68	0.0024	0.01	1.56	5.65	0.024	0.14	1.512	3.07	0.36	0.79	3.4872	1.74
20.	Sabo-Ngari	0.1248	0.29	0.007	0.02	1.224	4.48	0.264	1.52	0.336	0.68	1.32	2.89	2.652	1.33
	Total	**42.07**		**33.50**		**27.63**		**17.33**		**49.21**		**45.62**		**200.05**	**99.98**

Source : Author's Computation.

VII. Findings and Discussions

It was found out that from this study that most households need some orientation as regards how, when and where to dump waste they generated daily in their community and homes. Because most households in both Ilorin dump refuse at all available area in their homes or send their wards to dump refuse in the rivers closed to their residential areas. Even where bins are available for waste disposal from homes and community, after bins are filled up, many people still dump waste products in the bare floor. In Ilorin, it was discovered that 56 (28%) households dumped refuse generated in their homes on any available spaces, while 58 (29%) households dropped waste generated from their homes in drums/dustbins in selected wards in Ilorin. Similarly, only 23(11.5%) households drop their waste in barrel or dustbins. However, most households at selected wards in Ilorin claimed that Government did not provide them with any waste-bins but they make provisions for this on their own.

In general, when households from the study area were asked if they filled any changes in the weather within their locations, more than half of the total households retorted sharply that, they experienced such sudden changes in climate conditions, such as, hotness throughout the day even in the wet seasons. The likely solutions as they suggested, is that, they want Government to ease the problems of incessant power output so that every home could afford either air conditioners of fans to wade-off heat. Also, Government to take more responsibility on issue of waste management in all cities and towns in the states in order to avoid epidemic diseases.

VIII. Suggestions and Recommendations

Nigeria with a population of about 130million people and a few urban areas where the population is concentrated provides fertile grounds for LFGE / MSWE projects. The waste disposal sites in these concentrated urban areas provide a vast supply of renewable energy sources. Methane gas which is created naturally through anaerobic waste decomposition is a readily available renewable energy source that can be collected and used directly as medium or high Btu gas for industrial use or to fuel turbine driven generators of electricity. The inability of the existing power infrastructure to consistently meet the power demand needs in the urban and rural areas provides an opportunity for the public and private sector to explore alternative energy sources using existing sustainable resources. The existing alternative energy solutions (residential and industrial

generators) are prohibitively expensive to acquire and maintain and are not environmentally sound.

In order to ensure success and sustainability of LFGE / MSWE projects in the study area and Nigeria in general, Greennovative Chain recommends the following keys:

1. Recognizing generated waste as a reusable resource for generating electricity supply rather than an unfortunate urban and rural menace. Through energy recovery processes, collected and disposed waste serves as a reusable resource for generating electricity supply.
2. Designing robust and sustainable municipal waste management plans that are based on strategic goals.
3. Identifying and recommending appropriate disposal infrastructures that reduce environmental pollution caused by combustion of waste in regulated and non-regulated waste disposal sites.
4. Identifying sustainable energy solutions using Landfill Gas to Energy (LFGE) / Municipal Solid Waste to Energy (MSWE) technologies to address the endemic power supply shortage in Nigeria while mitigating greenhouse gas emissions.
5. Providing lower cost alternative LFGE / MSWE energy solutions as compared to the current prohibitive acquisition costs for private fossil fueled electricity generating sets.
6. Financing LFGE / MSWE projects through the Clean Development Mechanism (CDM). Benefits of LFGE / MSWE

There are several environmental and social benefits from implementing LFGE / MSWE solutions. A few are listed below:

1. Improved Security: With improved power supply, it can be expected that night crimes will be reduced.
2. Increased Productivity: Countless hours are lost each day due to a) power outages and b) health related issues caused by hazardous air pollutants.
3. Increased Profitability for Businesses: Lower energy costs compared with the current alternate solution of private generating sets. This will lead to lower costs of doing business and subsequently increases in returns to shareholders.
4. Increased Ownership and Accountability: If consumers and businesses understand the correlation between appropriate waste disposal and power supply, it is anticipated that consumers will be motivated to ensure appropriate disposal of waste takes place within their communities.
5. Sustainable Electricity: Landfill Gas and Municipal Solid Waste is available for combustion to electricity 24hours in 7days..
6. Improved Air Quality in the urban areas: Methane is 21% more potent than CO_2. Therefore, channeling methane from landfills to generate electricity reduces environmental pollution and health hazards caused by natural combustion of waste. Generation of electricity from LFG / MSW will also reduce the usage of private generating sets thereby reducing the air pollution caused by emissions from fossil fuel generators which are the prevalent alternative energy source today in Nigeria.
7. Noise Reduction: Reducing the noise pollution caused by fossil fuel generators which are the current prevalent source of electricity.
8. Optimal Land Use: Reclaiming land from landfill and waste disposal occupation – both regulated and non-regulated sites. High generation levels of methane in landfills (50 – 60%) and leach generation makes dumpsites unsafe areas to develop on every street corner.
9. Sustainable Feedstock: Providing sustainable and affordable to electricity to our communities. The feedstock (waste) will always be generated in every household and commercial enterprise as a by-product of daily living.
10. Job creation: Creating public and private sector jobs in the area of waste collection and disposal, facilities operations and maintenance, recycling etc.
11. The Federal Government of Nigeria should incorporate Energy From Waste (EFW), biomass and biogas, as a key component of its energy production strategy. Currently, EFW is one of the key components of energy production. The focus has been more geared to conventional energy sources i.e. Fossil fuels, Hydro, Coal etc as evidenced in the Renewable Energy Action Program (REAP) document. The manifold benefits include avoiding waste to unregulated sites, reduction in environmental pollution, renewable and sustainable energy value chain solutions.
12. Eliminating regulatory barriers that could be key obstacles to potential LFG recovery projects. In Nigeria, alternative energy prices i.e. fossil fuel generating sets and the cost of maintenance are relatively high thus the LFG cost could be an attractive alternative.
13. Waste disposal acts and relevant Municipal regulations must be in place to support waste collection, recycling, transportation, disposal and operation.
14. Laws must be enforced to ensure that waste is transported to regulated waste disposal areas. This would result in a sanitary environment void of dispersed waste and a reduction in environmental pollution in the communities. No one is immune from keeping these laws.
15. Policies and regulations should be put in place to support energy production and sales from renewable resources. Examples of such policies based on best practices in the United States are the

IX. Conclusion

This study has begun the process of understanding what climate change could mean for waste management in urban areas of Nigeria. As it is a new area, it is recommended that more research is carried out into specific impacts. The selection of truly sustainable waste strategies is very important for both the mitigation of GHG emissions and for improved urban infrastructure. Most wastes could be turned into a new product that can benefits all a sundry, therefore some private companies and individuals could be encouraged to source for new wealth from refuse as it is being practiced in advanced world through wastes recycling efforts. Finally, the work has also demonstrated a research effort on upgrading waste management and control in Ilorin city of Nigeria. Though the bulk of this management was left to Government who also contacted the waste management to firm like-Ola-Clean Company to handle. The job being carried out by this company is commendable, but from all indications and information gathered for this investigation, only the main streets and low density area like Government Reservation Area (G.R.A) were adequately catered for. Whereby, the inner parts of the urban areas were almost untouched by this agent (Ahmed, 2008). Efficient and effective disposal of refuse and other effluent is dependent on the waste/refuse management technique adopted by the local or state government. Therefore all stakeholders- the governments, the present company that handle the sanitary development in the city, as well as private and public sectors should share the responsibility together. This no doubt will pave ways for an improved quality of environment free from deplorable sanitary condition or from any threat from change in weather or climate which is a new peril to the world.

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