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**ENHANCING THE ROLE OF LOCAL GOVERNMENT IN PROMOTING SUSTAINABLE
ENERGY TRANSITIONS IN GHANA. A CASE STUDY OF WA MUNICIPALITY**

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MUNICIPALITY

A thesis submitted to the Pan African University Institute of Water and Energy Sciences
(including Climate Change) in partial fulfillment of the requirements for the degree of
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By

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DEDICATION

This thesis is dedicated to my family and to the memory of my late father (James Kwaku Akrofi).

STATEMENT OF THE AUTHOR

I, Mark McCarthy AKROFI hereby declare that this thesis represents my original work and has not been submitted to another institution for the award of a degree, diploma, or certificate. I also declare that all words and ideas from other works presented in this thesis have been duly cited and referenced in accordance with the academic rules and regulations.

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BIOGRAPHICAL SKETCH

Mark is from Ghana and holds a BSc. Degree in Planning from the University for Development Studies (UDS). He also worked as a Teaching Assistant in the Department of Planning of UDS. Mark is passionate about researching sustainable energy, planning and environmental issues such as climate change and, he has authored some peer-reviewed journal articles to this effect. During his studies at PAUWES, Mark was a member of the University of Tlemcen and the University of East Carolina Global Virtual Classroom project. He co-founded the PAUWES Climate Change and Gender Club, represented the Club at the Clinton Global Initiative University (CGIU) conference in Chicago (USA) and the Global Youth Advancement Summit in East Lansing, Michigan (USA). Mark is a self-driven individual seeking to work in an organization that has a strong research culture, offers significant opportunities for knowledge enhancement, and extensive use of ingenuity.

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ABBREVIATIONS

CDD	Community Development Department
DCE	District Chief Executive
DMTDP	District Medium Term Development Plan
DPCU	District Planning and Coordinating Unit
EC	Energy Commission
EPA	Environmental Protection Agency
FGD	Focus Group Discussion
GSGDA	Ghana Shared Growth and Development Agenda
GSS	Ghana Statistical Service
ILGS	Institute of Local Government Studies
LDCs	Least Developed Countries
MDAs	Ministries, Departments and Agencies
MLP	Multi-Level Perspective
MMDAs	Metropolitan, Municipal and District Assemblies
MoE	Ministry of Energy
MPCU	Municipal Planning and Coordinating Unit
MTP	Medium Term Development Plan
NDPC	National Development Planning Commission
NGO	Non-Governmental Organization
NMTDPF	National Medium-Term Development Planning Framework
RCC	Regional Coordinating Council
RE	Renewable Energy
RPCU	Regional Planning and Coordinating Unit
SET	Sustainable Energy Transition
SNA	Social Network Analysis
SNV	Netherlands Development Organization
SSA	sub-Saharan Africa
STT	Socio-Technical Transition
UNDP	United Nations Development Program
VRA	Volta River Authority

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ABSTRACT

African local governments have an important role to play in Sustainable Energy Transitions (SET), yet their involvement in sustainable energy planning is severely inadequate. The main aim of this study was to examine how the role of local governments can be enhanced in promoting SET in Ghana. Using a mixed-methods design, the research was conducted in the Wa municipality of Ghana. Key-informant interviews, Focus Group Discussions (FGDs) and document reviews were the main methods of inquiry. A total of thirteen institutions, two local communities and seven policy documents were purposively sampled. Data were analyzed using ATLAS.ti and NetDraw Software. Results show that local government agencies, NGOs, central government agencies (ministries/departments), and private sector organisations were the main categories of actors in the municipality. Central government agencies and NGOs undertake most of the sustainable energy initiatives with local government agencies playing a facilitative rather than a direct role. Despite being the most popular in the actor-network, local government agencies' involvement in sustainable energy planning was low. The inadequacy of local government involvement in sustainable energy planning was highlighted in policy frameworks, yet the policy documents fail to explicitly outline strategies for integrating sustainable energies into local government plans. Consequently, little attention is given to energy issues in the local government plans. Energy-related projects constituted only 1.3 percent of all the projects found in the plans, and they were all focused on expanding electricity access through grid extension. The results also showed that all local government units are faced with significant logistical deficiencies. The study recommends the integration of sustainable energy planning into the district medium-term development planning process and proposes an integrated framework to this effect.

Résumé

Les gouvernements locaux africains ont un rôle important à jouer dans les transitions énergétiques durables (SET), mais leur participation dans la planification de l'énergie durable est gravement inadéquate. Le but principal de cette étude était d'examiner comment le rôle des gouvernements locaux peut être renforcé dans la promotion de la SET au Ghana. En utilisant une conception à méthodes mixtes, la recherche a été menée dans la municipalité de Wa au Ghana. Les entretiens avec des informateurs clés, les discussions de groupe (FGD) et les examens de documents ont été les principales méthodes d'enquête. Treize institutions, deux communautés locales et sept documents de politique ont été échantillonnés à dessein. Les données ont été analysées à l'aide d'ATLAS.ti et de NetDraw Software. Les résultats montrent que les agences gouvernementales locales, les ONG, les agences gouvernementales centrales (ministères / départements) et les organisations du secteur privé étaient les principales catégories d'acteurs de la municipalité. Les agences du gouvernement central et les ONG entreprennent la plupart des initiatives d'énergie durable, les agences du gouvernement local jouant un rôle de facilitateur plutôt que direct. Bien qu'ils soient les plus populaires du réseau d'acteurs, la participation des agences gouvernementales locales à la planification de l'énergie durable a été faible. L'inadéquation de la participation des collectivités locales à la planification de l'énergie durable a été mise en évidence dans les cadres de politique générale, mais les documents de politique générale n'énoncent pas explicitement les stratégies d'intégration des énergies durables dans les plans des collectivités locales. Par conséquent, peu d'attention est accordée aux problèmes d'énergie dans les plans des gouvernements locaux. Les projets liés à l'énergie ne représentaient que 1.3% de l'ensemble des projets figurant dans les plans, et ils étaient tous axés sur l'extension de l'accès à l'électricité via l'extension du réseau. Les résultats ont également montré que toutes les unités du gouvernement local sont confrontées à des déficiences logistiques importantes. L'étude recommande l'intégration de la planification de l'énergie durable dans le processus de planification du développement à terme moyen du district et propose un cadre intégré à cet effet.

1. INTRODUCTION

1.0. Introduction

This chapter presents a general introduction to the research. Specifically, it discusses the background of the study, the research problem, the research questions, objectives of the research, significance of the study, the scope of the study and an outline of the tentative chapters that the study entails.

1.1. Background of the Study

Globally, the costs of renewable energy technologies have been falling rapidly (IRENA, 2018), a situation which provides significant opportunities for advancing energy access in the developing world especially in Africa. Despite this fall in prices, 70% of people with access to electricity still rely on power generated from fossil fuels while about 1.1 billion and 2.8 billion people of the global population still lack access to electricity and clean cooking fuels respectively (International Energy Agency, 2017). In sub-Saharan Africa (SSA), 588 million and 846 million people lack access to electricity and clean cooking fuels respectively with fossil fuels and biomass still dominating current electricity supply and energy for cooking while the principal source of electricity access comes from the main grid (IEA, 2017).

Despite the vast availability of renewable energy resources, renewable energies still constitute less than 2% of sub-Saharan Africa's energy mix (Ouedraogo, 2017). Among the critical factors identified for this are; centralized energy planning (Hiremath, Shikha, & Ravindranath, 2007; Rawn & Louie, 2017; Tenenbaum, Greacen, Siyambalapitiya, & Knuckles, 2014) and lack of systematic planning (Avila, Carvallo, Shaw, & Kammen, 2017). The absence of this systematic planning has resulted in high transmission and distribution losses and a high dependence on hydro dams and diesel plants (International Energy Agency, 2014). According to Hiremath et al. (2007), centralized energy planning fails to incorporate variations in socio-economic and ecological factors in a region which influence the success of any intervention. This has created the need for more decentralized approaches and hence, the need to involve local governments. According to the IEA (2014), decentralized systems comprising off-grid and mini-grid solar PVs, deployment of Liquefied Petroleum Gas (LPG) and natural gas will be the most cost-effective solutions

to enhancing energy access in SSA. However, the traditional approaches to renewable energy planning and supply in SSA are centralized/top-down (Rawn & Louie, 2017; Tenenbaum et al., 2014) usually undertaken by few government bodies such as the ministry of energy or a state utility often acting alone or together. The role of local governments in Sustainable Energy Transitions (SET) and climate action has gained increased recognition in the literature (Hoppe, Graf, Warbroek, Lammers, & Lepping, 2015; Johnson, Nyambane, Cyoy, & Oito, 2016; Melica et al., 2018; Mey, Diesendorf, & MacGill, 2016). Sgouridis and Csala (2014) define SET as a process by which society replaces all major fossil fuel primary energy inputs with sustainably renewable resources.

Local governments act as key mediums for coordinating and implementing effective local energy and environmental policies (Muntwyler, 2015). They understand where challenges with regards to sustainable energy come from, they can assess local renewable energy resources and how these resources can be optimized, and they can also identify the strengths, weaknesses, opportunities and threats with regards to renewable energy development in their respective jurisdictions (van Staden, 2017). Despite these crucial roles that local governments can play in sustainable energy development, planning for sustainable energies remain centralized in Ghana often carried out by state agencies such as the Energy Commission (EC). As a result, very little is known about the holistic state of energy at the local/districts level; hence, making effective planning for sustainable energy issues highly impossible (Bawakyillenuo & Agbelie, 2014). To facilitate the deployment of renewables and a transition to cleaner and modern energy sources, the participation of local governments is highly essential. It is, therefore, paramount to give local governments a greater role in planning and promoting their energy needs. To enhance this role, an understanding of how local governments participate in renewable energy initiatives, their level of involvement in renewable energy policy and planning, the roles of key stakeholders at the local level, and how renewable energy planning can be made an integral part of the district planning process needs to be explored. This research aims at addressing (i) how actors at the local level engage in sustainable energy initiatives, (ii) how sustainable energies can be mainstreamed into the local government planning process and (iii) the institutional capacity of local government agencies to undertake sustainable energy planning.

1.2. Problem Statement

Since the launch of Ghana's decentralization policy in 1988, several local governments have been established and were given the mandate to plan for the development of their districts. Through their District Medium Term Development Plans (DMTDPs), local governments prepare and implement plans for various infrastructure and social services. These usually include health services; education; transport, water and sanitation. However, planning for sustainable energies which are crucial for energy security, livelihood enhancement and climate change mitigation, has not received much attention in the district planning system and consequently the DMTDPs. Why this is so, has not yet been established in the literature. In response to local and international demands for sustainable energies and climate change mitigation, the government of Ghana has made efforts to mainstream REs into national policies. Notable among these policies is the Sustainable Energy for All (SEforALL) action plan, the Renewable Energy Master Plan and the ECOWAS Renewable Energy Policy (EREP) to which the Ghana government is a party. While these and other efforts at the national level have been widely acknowledged; it remains unclear the extent to which local governments participate and mainstream REs into their local development plans. The Energy Commission, established by an Act of Parliament (Energy Commission Act, 541) is mainly responsible for energy planning in Ghana with a core mandate to "prepare, review and update indicative national plans to ensure that all reasonable energy demands are met, and to secure a comprehensive database for national decision making" (Energy Commission, 2018 p.1). As seen clearly in the mandate of the EC, it prepares only national energy plans. Hence, RE planning is centralized with no clear links to local development plans. Borchers, Euston-Brown, and Ndlovu (2015) acknowledged the fact that local governments in Africa have a crucial role to play in sustainable energy transitions but, they emphasized that these local governments are "...poorly understood by those trying to be agents of change, and research often remains at a superficial level" (p. 1). Bale, Foxon, Hannon and Gale (2012), also noted that local governments play a significant role in distributed generation and energy efficiency improvements but their willingness and capacity to play this role remains questionable.

In the broader literature, many studies have tried to explore the role of local governments in sustainable energy planning and development (Bawakyillenuo, Olweny, Anderson, & Borchers, 2018; Borchers, 2015; Hoppe et al., 2015; Johnson et al., 2016; Lammers &

Hoppe, 2018; Melica et al., 2018; Mey et al., 2016; van Staden, 2017). However, very scanty literature exists on the role of local governments in RE planning and sustainable energy transitions in Ghana. Bawakyillenu and Agbelie (2014) developed energy profiles and modeled various transition pathways and future scenarios for two municipalities in Ghana under the ‘Supporting ‘Sub Saharan African Municipalities with Sustainable Energy Transitions (SAMSET) project, which was carried out in some sub-Saharan African countries including Ghana. Even though the study aimed to support municipalities to plan for the effective and sustainable energy transition, how to mainstream this sustainable energy planning into the local government plans was not addressed. Also, the capacity of municipalities to undertake such energy planning was not assessed. Acquah (2014) studied decentralized rural electrification in Ghana but, his study focused on a technical and socio-economic evaluation of an ongoing solar PV project. The planning and governance aspects of the project in relation to the role of local governments were not addressed. In exception of these two studies (Acquah, 2014; Bawakyillenuo & Agbelie, 2014), there are hardly any studies on this subject in Ghana. The absence of sustainable energy planning in the local government planning process and the limited studies on the role of local governments in advancing sustainable energy transitions in Ghana, therefore, creates both a policy and literature gap which this study will attempt to address. In doing so, the study will seek to answer the following research questions.

1.3. Research Questions

1.3.1. Main research question

How can the role of local governments be enhanced to promote sustainable energy transitions in Ghana?

1.3.2 Specific research questions

1. How do key actors at the local government level engage in sustainable energy initiatives in Wa municipality?
2. How can sustainable energy planning be integrated into local government plans in Ghana?
3. What is the institutional capacity of local government agencies to undertake sustainable energy planning and implementation in Wa municipality?

1.4 Research Objectives

1.4.1 Main research objective

The overall objective of the research is; to examine how the role of local governments can be enhanced to promote sustainable energy transitions in Ghana.

1.4.2 Specific research objectives

1. To ascertain how key actors at the local level engage in sustainable energy initiatives in Wa municipality.
2. To examine how sustainable energy planning can be integrated into local government plans in Ghana.
3. To assess the institutional capacity of local government agencies to undertake sustainable energy planning and implementation at in Wa municipality.

1.5. Significance of the Study

Findings of this study are expected to provide a new holistic approach to sustainable energy planning in Ghana. This approach will be very useful for policy by providing useful insights for policymakers with regards to how various stakeholders at the subnational level can be effectively involved policy and planning for renewables and the mechanisms through which this can be done sustainably. The study seeks to integrate renewable energy planning into the traditional decentralized planning system in Ghana hence, shifting focus from a centralized energy planning to a more decentralized one in which local governments will have greater responsibility for identifying their own energy needs. Thus, the holistic state of energy issues at the local level will be known, and it will help to address the problem identified by Bawakyillenou and Agblie (2014) where the lack of such information makes effective planning for sustainable energy a major challenge. With similar decentralized planning systems in other sub-Saharan African countries, the study will also offer insights for policymakers and planners of these countries as to how to streamline renewable energy planning into their decentralized/local government systems in order to improve sustainable energy access.

Also, through engagement with various actors and stakeholders in the entire research process, the study will help strengthen institutional collaborations for effective service

delivery by bringing to light how the roles and responsibilities of the various stakeholders can be integrated and how the local levels can be more involved in energy policy and planning. From the problem statement above, this study will also make a significant contribution to filling knowledge gaps in the literature with regards to the role of local governments in sustainable energy transitions. It will thus provide insights and serve as an important source of reference for students and other researchers who may undertake related studies in the future.

1.6 Scope of the Study

The study focuses on assessing the role of local governments in sustainable energy transitions in Ghana and how these roles can be enhanced to facilitate the energy transition process. This assessment entails how local governments participate in RE planning, their level of involvement, how RE planning can be mainstreamed into their planning systems and the human, logistical and financial resources required for undertaking such activities. The content of the study is organized into five main chapters. The first chapter presents an introduction to the study, and the second chapter deals with a review of relevant literature while the third chapter presents the methods used in conducting the study. The fourth focuses on results and discussion while the fifth chapter presents a summary of the major findings as well as the recommendations and conclusions. The geographical context of the research is the Wa Municipality in the Upper West Region of Ghana. Wa is both the regional and municipal which makes it an ideal place to gain access to all local government agencies and stakeholders in the energy sector at the local level. The entire study was conducted within a period of six months from March to August 2019.

2. LITERATURE REVIEW

2.0. Introduction

This chapter presents a theoretical and empirical review of the literature on sustainable energy transitions and the role of local governments. The review is crucial because it provides a baseline on similar researches and reveals lessons and literature gaps from other studies that could be incorporated and addressed in this study. Key topics covered include theoretical perspectives of the sustainable energy transition, local governance and sustainable energy transitions, decentralization and sustainable energy policy in Africa, sustainable/renewable energy policy and planning in Ghana, local government system in Ghana and overview of sustainable energy development in Ghana.

2.1. Defining Sustainable Energy Transitions (SET)

According to Sgouridis and Csala (2014 p. 2609), sustainable energy transitions refer to “a controlled process that leads an advanced, technical society to replace all major fossil fuel primary energy inputs with sustainably renewable resources while maintaining a sufficient final energy service level per capita.” Similarly, The European Association of Local Authorities (2014) defined energy transition as a shift from a fossil fuel dominated system towards a renewable energy-based system. Steg, Perlaviciute and van der Werff (2015), explains that a sustainable energy transition is characterized by a dominance of renewable energy sources in future energy systems. An energy system refers to all components related to the production, conversion, delivery, and usage of energy (Allwood, Bosetti, Dubash, Gómez-Echeverri, & von Stechow, 2014). In other words, it is the techno-economic system that provides energy in the form of electricity, heat and fuels for end-users (Groscurth, Bruckner, & Kümmel, 1995). Lockwood, Kuzemko, Mitchell and Hoggett (2013), identified energy providers, policymakers and users of energy as the three main actors in the energy system. The EU’s Urban Innovative Actions (UIA, 2015, p. 1) defines energy transition as “a shift from a system dominated by finite (chiefly fossil-based) energy towards a system using a majority of renewable energy sources, also maximising the opportunities available from increased energy efficiency and better management of energy demand”. An energy transition encapsulates socio-cultural, economic, technological and environmental dimensions and hence calls for an active role of individuals and their communities (UIA, 2015).

By highlighting energy efficiency, socio-cultural and environmental dimensions, the UIA's definition provides a more comprehensive approach to SET. In defining SET, it is important to first consider the meaning of sustainability itself. As put forward by the office of sustainability of the University of Alberta, sustainability implies "meeting our own needs without compromising the ability of future generations to meet their own needs" (University of Alberta, n.d., p. 1). These viewpoints imply that a sustainable energy transition should not only be characterized by a switch from fossil-based energy systems to renewable energy sources but also, there is the need for efficient utilization of energy. Hence energy efficiency and conservation are very important in SET. Also, the sustainable use of biomass resources is paramount because if they are not well- utilized; they can be severely depleted and cause adverse impacts for future generations. Wood, for instance, is a vital source of bioenergy and hence, the creation of woodlots can be seen as an important strategy for SET (Energy Commission, 2012; FAO, 2010). Therefore, a comprehensive definition of SET must encapsulate all the dimensions mentioned above. In this regard, the sustainable energy transition is defined for the purpose of this research as a process by which society gradually increases the share of renewable energy in its energy generation mix with the ultimate aim of phasing out all fossil fuel energy sources while ensuring energy efficiency and the sustainable use of biomass resources. This process can be driven through technological innovation, sound social and economic policies, and the adoption of sustainable lifestyle patterns by individuals.

2.2. Theoretical Perspectives on Sustainable Energy Transitions

Kerlinger (1979) defines theory as a set of interrelated constructs, definitions and propositions, or hypothesis, that specify the relationship among variables. Simply put, a theory is a set of ideas that seek to explain or predict a real-world phenomenon by establishing relationships among the variables that make up the phenomenon. The importance of theoretical perspectives for a study like this cannot be overlooked. Theories are important because they provide a framework for analysis and are needed for applicability to practical real-world problems (Gay & Weaver, 2011). In addition, theories also provide a road map for studying problems and developing appropriate interventions. The following theoretical perspectives attempt to conceptualize and explain how sustainable energy transitions may occur in society.

2.1.1. The socio-technical transitions theory.

This theoretical perspective recognizes society as a socio-technical system. Socio-technical systems comprise of natural and built elements (energy infrastructure or resources) as well as social and institutional elements such as organizations and individuals (Foxon, Hammond, & Pearson, 2010; Verbong & Geels, 2010). In terms of structure, Geels (2004) identifies three main interrelated elements of a socio-technical system; a network of actors and social groups, formal, cognitive and standardized rules that guide their activities and, physical and technical features such as infrastructure. According to Shove & Walker (2007), the Socio-Technical Transitions approach (STT) is the leading body of theory on sustainable energy transitions. This socio-technical transition denotes a change of the socio-technical system from one relatively stable state to another (Geels, 2002) and the systems are made up of several different areas across industry, technology and politics (Turnheim & Geels, 2012).

Sustainable energy transitions, therefore, reflect new technologies, changes in user practices as well as policies. In this regard, Foxon (2011) posits that a low carbon transition, for instance, is characterized by changes in how we use energy, development and deployment of cleaner energy technologies as well as a change in the industrial mix within national or global economies. These elements are inter-linked within a socio-technical system hence making transitions uneasy (Geels, 2002) with lock-in “that relate to sunk investments, behavioral patterns, vested interests, infrastructure, favorable subsidies and regulations” (Geels, 2010 p. 495). Hence, it becomes challenging for new technologies to succeed because they are associated with regulations, user practices and infrastructure (Lockwood et al., 2013). The fundamental tenet of this theory is that sustainable energy transition is a function of social, technological and political factors in any given society.

In developing the STT theory further, the Multi-Level Perspective (MLP) was introduced (Geels, 2002; Rip & Kemp, 1998). According to Geels and Schot (2007), in the MLP, transitions are understood as results of a configuration between developments at multiple levels within the socio-technical system. Transition to a new socio-technical system thus comes as a result of interactions between three levels: regimes, niches and landscapes (Geels, 2002; Geels & Schot, 2007; Papachristos, Sofianos, & Adamides, 2013; Rip & Kemp, 1998). According to Smith, Voß, and Grin (2010), socio-technical regimes are the

mainstream and highly institutionalized way of realizing societal functions. Geels (2002) refers to the socio-technical regime as the semi-coherent set of rules carried by different social groups which direct and coordinates the activities of different actors and by so doing ensures the stability of socio-technical configurations. Simply put, “regimes refer to rules that enable and constrain activities within communities” (Geels, 2002 p. 1260). Niches relate to technical innovations that drive socio-technical transitions. According to Kemp, Schot, and Hoogma (1998), and Geels and Schot (2007), niches are where technical innovations that drive novel ways of satisfying societal demands originate. Research and Development (R&D) is thus, an essential component of niches. However, Geels (2002) adds that supportive social networks and processes such as learning by doing are vital. Niches and regimes are both situated within a landscape.

The landscape level is the peripheral structural setting (Lockwood et al., 2013) or context for the interaction of actors (Geels, 2002) within which regimes and niches operate. They are external factors that affect both regimes and niches. Examples include fuel prices, economic factors such as inflation, conflicts, emigration, broad political alliances, and environmental pressures (Geels & Schot, 2007; Smith et al., 2010). Interactions within and between these three different levels (regime, niche and landscape) are what brings about transition (Geels, 2010). Papachristos et al. (2013) explain that the stability of a regime can be disturbed by pressures from the external environment (landscape), innovations developed in niches or internal tensions within a regime. Social groups within a regime, for instance, can mount an internal pressure in response to technical innovations within niches or events from the external environment (landscape). Lockwood et al. (2013) cite an example that, the acknowledgement of climate change, for instance, can be one of such responses.

Foxon (2011) attempted to expand further, the socio-technical transitions approach. He adopted a ‘co-evolutionary’ approach (Lockwood et al., 2013) to develop a framework for the analysis of low carbon energy transitions. Foxon (2011) posited that transition is the result of interactions between five main elements (eco-systems, technology, institutions, business strategies and user practices). He argued that these elements influence each other through evolution and co-evolution between them in a manner similar to the multi-level perspective. Through the co-evolutionary framework, Foxon (2011) attempts to provide a single framework for analyzing transition at the micro, meso and macro levels while

giving considerations to the interactions or dynamics within and between each level. The framework emphasizes the influence of institutions in change within and between different systems and recognizes regimes as the result of interactions between specific groups of actors. Thus, it goes a little further than the multi-level perspective (Lockwood et al., 2013). However, Foxon's (2011) framework has been critiqued on the grounds that “it does not provide much detail on what is contained within each system, and importantly, what is happening and who is involved in the interactions between them” (Lockwood et al., 2013, p. 12).

In sum, the STT recognizes society as a socio-technical system comprising of regimes, niches and landscapes which interact to bring about sustainable energy transitions. A transition is thus, more likely to happen where these elements are in conformity with each other. In this regard, Lockwood et al. (2013) argued that transitions could be purposively driven where actors such as governments seek to facilitate the process by adequately nurturing and managing niches and where there is more pressure from landscape factors on regimes. A vital strength of the STT lies in the fact that it points out the high complexity and dynamic character of transitions as well as the need for actively using policy to manage transitions (Lockwood et al., 2013).

The theory is however critiqued that, despite its recognition of policy playing a central role in transitions, it has failed to discuss into details, the political dimensions of decision making (Fouquet, 2010; Kern, 2011; Meadowcroft, 2011). A second critique of the STT is that; it fails to provide precisely the nature of interactions between actors and institutions within the various levels (niches, landscapes and regimes) hence, its explanatory power is limited (Lockwood et al., 2013). In an attempt to address some of these critiques, Lockwood et al. (2013) applied an institutionalist approach to the energy sector and energy transitions. They proposed a provisional framework for analyzing energy transition and the reasons for different outcomes. Their approach is discussed in the ensuing section.

2.1.2. An institutionalist approach to the energy sector and energy transitions

Applying an institutionalist approach to energy transitions, Lockwood et al. (2013) argued that energy transitions are characterized by outcomes resulting from changes in actor practices in the energy system. They explain that incentives and rules put in place by governing institutions shape these changes in actor practices. Consequently, policy

paradigms become institutionally entrenched through rules put in place, designing of institutions for governing policy and set of policy objectives (Kuzemko, 2013). Interactions, therefore, occur between the governance system, policy objectives, energy institutions and public concerns at different levels. Central to these interactions are various political and economic actors who shape and are shaped by institutions and ideas in the energy system (Lockwood et al., 2013). Energy providers, policymakers and users of energy are the three principal actors vital for understanding the energy sector and hence, for explaining an induced energy transition (Lockwood et al., 2013). Lockwood et al. (2013) argued that it is the interactions between these actors that create the institutions that govern the energy system in any country and consequently, a change in these interactions results in changes in governance. The nature and outcomes of the interactions between these different actors are conceptualized in the figure below.

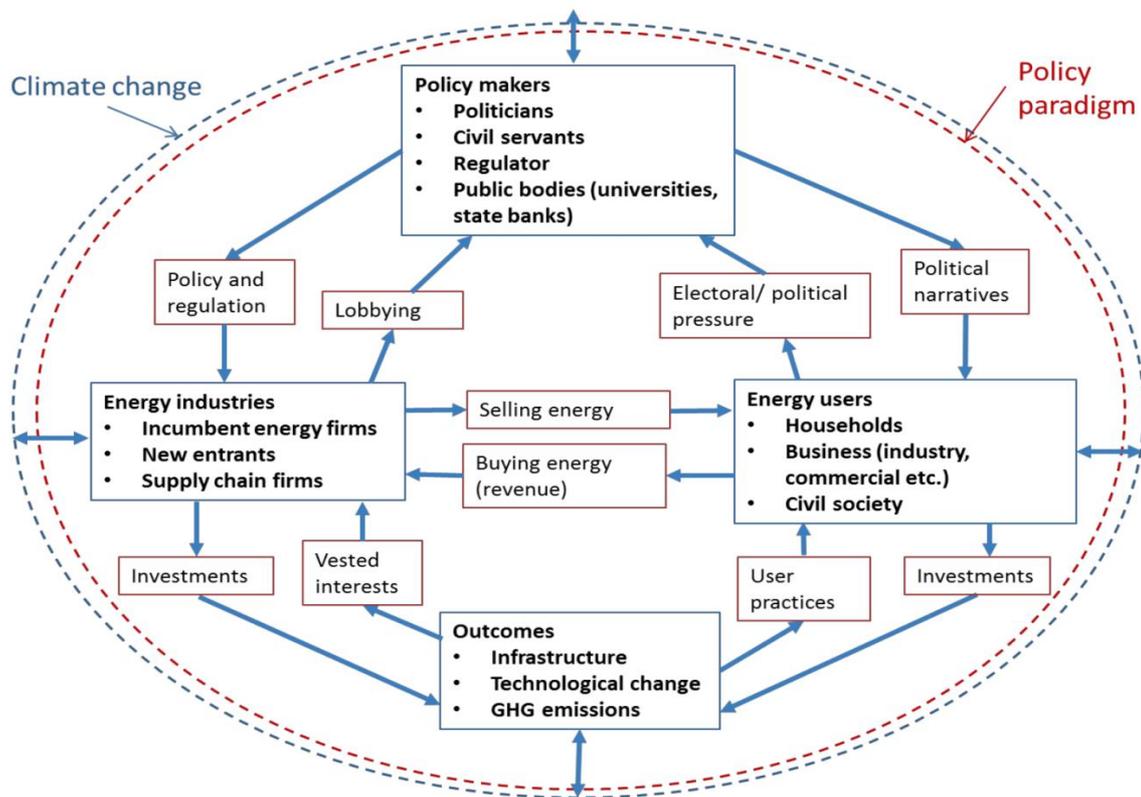


Figure 2.1: Actors and agencies in the energy system (Lockwood et al., 2013).

From figure 2.1, Lockwood et al. (2013) argued that, practices such as investments, technological change and outcomes are determined by institutions and that all of these will have feedback effects on the actors. They (Lockwood et al., 2013) posit that at the beginning of energy transition in any given country, incumbent energy firms will dominate energy investments (production and supply). The investments of these firms

will, however, be significantly influenced by the institutions put in place by policymakers. Even so, incumbents can also shape policy decisions through lobbying especially if the policies are unfavorable to their corporate goals (Stenzel & Frenzel, 2008). These firms also have considerable political power in that; they are central to providing energy goods and services to end-users. In the event where they fail to deliver these services, reprisals may arise from the public and can have negative consequences for politicians. As a result, large energy firms have secured a considerable amount of influence (Meadowcroft, 2005). While large firms are vital actors in the energy sector, Lockwood et al. (2013) also acknowledge the fact that the relationship between politicians and energy users is a significant factor in policy setting. For example, in countries where energy users are much concerned about climate change, policymakers will more likely pay attention to cutting Green House Gas (GHG) emissions by choosing cleaner and sustainable energy sources. Hence, climate change awareness and the enthusiasm of the populace to take climate action is vital for sustainable energy transitions. Studies have, however, shown that energy security and costs of energy services are relatively more important to energy users than environmental issues and as such, they are unwilling to pay for clean energy (Harrison & Sundstrom, 2010).

Lockwood et al. (2013) proposed four main conditions that are pertinent to the energy transition. The first condition is that new practices and investments leading to sustainable energy transitions must be less costly, more profitable and less risky than conventional practices and investments. The second condition is that institutional arrangements must be more inclusive to create sufficient grounds for new players/entrants in the energy system. Such inclusiveness is conducive for innovation in practices and outcomes (Mitchell, 2000). A third condition is that there must be a balance between sufficient returns to attract investors and energy costs to end-users. Hence, there must be opportunities to ensure that investors maximize profits while and at the same time not impose high costs on end-users. The last condition is the existence of reinforcing policies that drive the energy system towards sustainability. Policies must be reinforcing in that; they must yield not only economic benefits but also social and political benefits (Lockwood et al., 2013).

Both the STT and institutional perspectives are of the view that energy transition results from the interaction between different actors in the energy system. However, while the STT deals with social and technical elements, the institutionalist perspective places more

emphasis on the politics and economics of energy transition with the view that changes in user practices often occur where there is sufficient political will to transform the nature of energy demand (Lockwood et al., 2013). Both perspectives are essential and provide an important context for this research. Local governments in Ghana are administrative units with defined geographical boundaries and with the autonomy to develop their jurisdictions. They can thus be classified as socio-technical systems on their own. Niches, landscapes and regimes also characterize each district. The ensuing section discusses how districts in Ghana can be classified as socio-technical systems.

2.1.3. The ‘district’ as a socio-technical system

Districts are the lowest level within Ghana’s three-tier public sector system which comprises of central, regional and local/district levels (Friedrich-Ebert-Stiftung and ILGS, 2016). Districts in Ghana are usually defined in terms of population. Ghana’s local Government system was established by an Act of Parliament (Local Government Act 462). The Act sets out the mandate and regulations that govern the creation of districts. It stipulates that an ordinary district should typically be an area with a population of at least 75000 while municipal and metropolitan districts should usually have a minimum population of 95000 and 250000 respectively. Collectively, they are known as Metropolitan, Municipal and District Assemblies (MMDAs). The nation is divided into regions, and each region is sub-divided into districts. As local government bodies, “districts are corporate bodies, perform public functions within their jurisdictions, have their political leadership (often elected) and, prepare and approve their budgets” (Friedrich-Ebert-Stiftung and ILGS, 2016, p. 11).

The ‘regime’ element of a socio-technical system is therefore evident in the district. Each district has a general assembly (hereafter known as the Assembly) which is the highest decision-making body of the district and performs deliberative, legislative and executive functions. As stipulated in the Local Government Act 462, two-thirds (70%) of the assembly members must be elected and they are the primary liaisons between the district and their communities (Friedrich-Ebert-Stiftung and ILGS, 2016). Each district also has a District Chief Executive (DCE) who represents the central government and is responsible for the daily performance of the supervisory and managerial functions of the Assembly. Article 243 of Ghana’s constitution stipulates that the DCE shall be appointed by the

president and this appointment will be approved by not less than two-thirds of the Assembly members. The DCE holds office for not more than two terms with each term spanning four years and shall be removed from office by not less than two-thirds of the Assembly members (Friedrich-Ebert-Stiftung and ILGS, 2016). Each district also has a Member of Parliament (MP) who represents electoral constituencies within the district and serves as the liaison between the District Assembly and the parliament. They advocate for the needs of their electorates in parliament, brief the Assembly on proceedings in parliament and also guide the Assembly on legislations enacted by Parliament in order to ensure that by-laws enacted by the Assembly do not conflict with national legislations. All these elected officials are accountable to their subjects within the district hence, where their regime fails to meet the expectations of the populace, they risk losing their power and positions because the electorates will vote them out. The risk of losing power implies that, with regards to sustainable energy transitions, the Assembly must ensure that favorable rules and regulations, by-laws and other essential conditions exist for incumbent energy firms, new entrants as well as the energy users in order to facilitate the development, deployment and usage of sustainable energies.

In terms of 'landscape', the district as a socio-technical system has defined geographical boundaries and is situated with a broader environment comprising of other districts, regions and the nation as a whole. Even though it can enact and enforce its bylaws, the Assembly is also surrounded by national laws, policies and regulations which it must abide by and which significantly influence its activities. With regards to the physical environment, environmental conditions vary among various regions and, thus, among the districts of Ghana. Climate change effects, for instance, manifest differently in different parts of the country. The northern part which is characterized by the guinea savannah vegetation type, for example, suffers from droughts, and strong winds; hence, climate change effects are more severe in the agricultural sector. In the southern part of the country, coastal towns and cities are under increasing threat from rising sea levels resulting from climate change (Boateng, Wiafe, & Jayson-Quashigah, 2017). Each district thus has the task of responding to these environmental pressures because they are the first point of call when their inhabitants are affected by these hazards. The level of threat posed and the extent of impact felt by the inhabitants can also result in internal tensions within the regime as postulated by Papachristos et al. (2013) especially when different groups or the indigenes begin to mount internal pressure for solutions in response to the threats

posed by the hazards. This pressure can eventually lead to regime change where the elected officials are voted out for failing to meet the expectations or needs of the people.

As socio-technical systems, districts also have niches. Niches relate to technological innovation and, hence, research forms an essential part of the niches. Geels (2002) adds that supportive social networks are equally vital. A major function of the MMDAs as defined in section 10 (3) of the Local Government Act, 1993 (Act 462) is to; “initiate, sponsor or carry out such studies as may be necessary for the discharge of any of the functions conferred by Act 462 or any other enactment” (Republic of Ghana, 1993, p. 3462). Each MMDA also has decentralized departments which are responsible for providing the needed technical expertise for the development of the district. Section 10 (4) of the Act also provides for District Assemblies to “promote or encourage other persons or bodies to undertake projects under approved development plans” (Republic of Ghana, 1993, p. 3462). Hence, the MMDAs can liaise with or encourage higher education institutions, private sector companies and incumbent energy firms to undertake innovative research that will speed up sustainable energy access within their jurisdictions.

Having classified districts as socio-technical systems, this study is situated in analyzing the interactions among various actors at the local level with regards to promoting the development and utilization of sustainable energies. Specific emphasis is placed on local government agencies/departments responsible for planning and implementing local development plans and how national policy frameworks and guidelines for district-level planning affects their engagement in SET initiatives. The nature of sustainable energy projects and the engagement of NGOs and private sector actors at the local level is also examined in the study. In so doing, the study contributes to the above theoretical perspectives by helping to understand how actors interact in a socio-technical system (the lack of which has been cited as a limitation of Lockwood et al. (2013) framework). Also, the analysis of how policy frameworks influence planning for sustainable energies at the local government level and how NGOs and private sector actors engage in sustainable energy development in the municipality will help to understand further, the linkages between regimes, niches and their landscapes. The ensuing sections deal with some empirical literature on the subject of local governance and sustainable energy transitions.

2.2. Local Governments and Sustainable Energy Transitions

By managing a wide range of public services, local governments play a crucial responsibility which keeps them in constant contact with local communities (Kelly & Pollitt, 2012). Typical roles usually carried out by local governments include urban land-use planning, transport planning, water supply, street and traffic lighting, municipal waste management and environmental protection (Tait & Euston-Brown, 2017). These roles place them in a strategic position, and through their activities, they can influence national energy policies and the benefits accruing from that (Lemon, Pollitt, & Steer, 2015). According to Bale, Foxon, Hannon and Gale (2012), local governments play a significant role in distributed generation and energy efficiency improvements but their readiness and competence to perform this role remain questionable. Since the Rio Earth summit in 1992, influencing change from the local level has gained increased momentum, with the Local Agenda 21 becoming the first substantive political initiative to encourage the full incorporation of grassroots level actions into national and local level policies on sustainability (Fudge & Peters, 2009). According to Fudge and Peters (2009), the growing concerns around sustainable energy now includes a wide acknowledgment of the effectiveness of projects that are embedded within a bottom-up approach incorporating social, cultural and economic concerns.

Local governments have been identified as critical mediums through which to coordinate and influence local initiatives towards developing more effective energy and environmental policies. The United Kingdom (UK) Committee on Climate Change (CCC, 2012) for instance makes reference to how local governments can provide an interface for technological innovation and deployment, institutional change and behavioural change at the community or individual level. However, the role of local governments in sustainable energy transitions has often received little attention or seen as a part of the ruling regime (Bolton & Foxon, 2013). According to Bawakyillenuo, Olweny, Anderson, and Borchers, (2018), local governments can play both direct and facilitative roles in promoting sustainable energy. Where local governments have direct mandates, their direct roles, for instance, may include regulating energy efficiency standards in buildings while where such direct mandates do not exist, they may play a facilitative role such as awareness creation.

Fudge, Peters and Woodman (2016) identified three main reasons why local governments are a necessity in sustainable energy transitions: political influence from the local level, public engagement and, technology and infrastructure. Politically, local governments provide new opportunities for active citizen involvement and also influence important discussions with regards to energy (Mulugetta, Jackson, & van der Horst, 2010). Similarly, Fudge and Peters (2009) argued that through local service provision and their formal political status, local governments could stimulate a community-driven approach to the energy policy agenda of the UK. With regards to public engagement, local governments act as key actors in designing and implementing policies and programs to promote sustainable energy transitions. They have a better understanding of their communities, can monitor project implementation closely and, hence, identify project success and failures more quickly than central governments (Bawakyillenuo et al., 2018b).

Wade (2008) argued that linking individual-level actions and global problems such as climate change is vital if efforts to promote low carbon development are to be achieved and this is where the participation of local governments is crucial. Wade (2008) stresses further that local governments have the capability and should lead their communities towards addressing issues such as climate change. Local governments can also play a significant role in technological diffusion and the provision of sustainable energy infrastructure (Fudge et al., 2016). Programs to facilitate decentralized sustainable energies such as rooftop solar, grid-connected solar, efficient cookstoves, off-grid wind energy amongst others are most likely to be effective when local governments are involved in their planning and implementation (Bawakyillenuo et al., 2018b). In the UK for example, many local governments are playing the lead role in making renewable energy a pre-requisite for any significant development (Fudge et al., 2016). The roles and competencies of local governments in sustainable transitions, however, vary across different countries.

2.2.1. Energy-related local government competencies in sub-Saharan Africa

Bawakyillenuo et al. (2018) identified the competencies of local governments across some SSA countries and municipalities with regards to the extent to which they control and regulate various energy-related services and facilities. Overall, the assessment showed that the involvement of local governments in facilitating, regulating and setting policies

concerning sustainable energy is low and limited. In Ghana, Uganda and South Africa, local governments have limited power in decentralized renewable energy generation, and the central government does almost everything. Electricity distribution, managing street and traffic lighting systems and public transport services are all centralized in Ghana (see table 2.1). However, local governments in countries like South Africa and Kenya are highly engaged in electricity distribution or connection while in Uganda, Zimbabwe and Ethiopia, local government competencies are high in managing street and traffic lighting systems.

Table 2.1: Energy-related competencies of local government across sub-Saharan Africa

Energy-related mandate	Local Government Competency Level		
	Low—Limited Powers, Central Government Does "Lions share."	Medium—Ability to create a long-term vision, set policies, influence user behavior; often congruent with the central government	High—Own and Operate Asset, Budgetary Control, Regulatory Powers
Electricity production (generation)	South Africa		
Electricity distribution or connection	Ghana		South Africa, Nairobi
Decentralized renewable energy (generation)	South Africa, Uganda, Ghana		
Gas supply services			Nairobi
Street and traffic lighting	Ghana, Nairobi		South Africa, Uganda, Addis Ababa, Zimbabwe (Harare)

Building control		Uganda, Addis Ababa, Zimbabwe (Harare), Nairobi	Ghana, South Africa
Public transport services	Ghana, Uganda, Zimbabwe (Harare), Nairobi	South Africa, Senegal	
Private vehicles (licensing, monitoring)	Nairobi, Addis Ababa	Ghana, South Africa	
Environmental protection		South Africa, Uganda, Ghana, Addis Ababa, Zimbabwe (Harare)	

Source: Bawakyillenuo et al. (2018)

In response to the low level of engagement of local governments in energy-related services and facilities as presented in table 2.1, Bawakyillenuo et al. (2018) suggested that energy-related mandates need to be devolved and accompanied by budgets as well as funding for research programs and staff capacity development. Devolution, which is a form of decentralization involves the transfer of specific governance responsibilities and functions to subnational or local levels that are usually not under the direct control of the central government (Ferguson & Chandrasekharan, 2012). According to Rodríguez-Pose and Gill (2003), devolutions entail some level of subnational legitimacy, decentralization of authority and resources. Johnson, Nyambane, Cyoy and Oito (2016) emphasize that devolution helps to address past discrepancies created by centralized energy planning noting that, centralized approaches to energy planning have tended to give more credence to large-scale energy systems with less attention to the household sector in Kenya. While devolution brings the government closer to the grassroots and allows for a better understanding of local needs and helps to develop appropriate interventions, such understanding and interventions may remain limited if, in practice, there is inadequate participation at the grassroots level, and planning remains firmly controlled by the central government (Haque, 2008).

2.2.2. Decentralization and energy policy in LDCs and SSA countries

Access to sustainable energy especially in rural areas can be greatly enhanced if national policies promote decentralized development planning and service delivery especially when local governments are given the mandate and capacity to address community energy needs (Havet, Chowdhury, Takada, & Cantano, 2009). Havet et al. (2009) stress the fact that the involvement of local people and institutions in the planning and implementation of sustainable energy projects can enhance government accountability in delivering modern energy services. However, their (Havet et al., 2009) review of energy in decentralization policies of some Least Developed Countries (LDCs) and SSA countries showed that the connections between energy and decentralization were hardly addressed in policy documents, hence, creating a lacuna in the decentralization approaches of many developing countries. The linkage between energy and decentralization was better discussed in sector-specific policies even though the discussions vary widely across different energy issues. Three main themes related to energy and decentralization dominate in the national policy documents of the countries studied: participation, local planning and service delivery (Havet et al., 2009). In all 96% of countries in SSA had decentralization policies; however, only 4% of those policies explicitly mention 'energy.' Overall, 92% of LDCs had decentralization policies yet; only 6% of the policies explicitly mention 'energy.' These statistics imply that the provision of sustainable energies through decentralized approaches is still a gap in many developing countries' national policies, a situation that could significantly impede sustainable energy transitions. The countries whose decentralization policies explicitly mentioned energy were: Nepal, Madagascar, South Africa and Sudan (Havet et al., 2009).

In Nepal, the establishment of national decentralization legislation in 1990 has given districts substantial control over the development of mini and micro-hydropower. According to Havet et al. (2009), this gave way for the government to integrate energy issues into local government discussions. The Local Self-Governance Act of 1999 is the legal document that made provision for decentralization and districts/local governments the responsibility for planning, implementing, operating and maintaining mini and micro-grids in the country (Government of Nepal, 1999). Before this Act, approaches to rural energy supply were highly centralized, resulting in coordination problems which hampered the delivery process (UNDP, 2011a). The decentralization legislation resulted in a transfer of the authority to plan local energy programs from centralized institutions to

local governments which significantly enhanced the delivery of energy services to rural areas (UNDP, 2011a). The government also established a local energy fund at the district level to ensure the financial sustainability of energy systems. Funds from the central government are deposited in the district energy funds which are then allocated to community-level energy funds (UNDP, 2007a). Households own the community-level energy fund and they use it for the development of rural energy systems. Revenue generated from such systems is deposited back into the fund, and where they make profits, they share it among stakeholders. This approach not only helped to create a sense of ownership but also, an avenue to generate funds locally and the development of a financially sustainable energy system (UNDP, 2007a).

Decentralized energy provision in Madagascar is limited; however, a decentralization policy established in 2006 is expected to pave the way for locally managed electricity supply and energy services (Havet et al., 2009). The strategy sets out plans for rural electricity projects to be locally financed and staffed. Havet et al. (2009) found out that full policy documents for South Africa and Sudan did not provide much detail in the context of energy and decentralization, even though, both countries' constitutions provide for local governments to be involved in electricity generation. Very detailed sector-specific policies, however, exist for both countries and many other countries in SSA. Generally, in LDCs, 48% of sector-specific policies explicitly mention energy in the context of decentralization while in SSA countries, 58% of sectoral policies explicitly address energy in the context of decentralization (Havet et al., 2009). Energy decentralization in the sector-specific policies of both LDCs and SSA countries mostly focused on electricity and traditional biomass with little emphasis on renewables and biofuels while virtually nothing exists on modern energies for cooking and mechanical power which are essential especially for the poor. Also, most of the policies did not address fossil fuels in the context of decentralization.

Traditional biomass is common in many of the policies, with local governments or districts given the responsibility to manage biomass resources. In Guinea, for instance, districts are responsible for managing forests in their jurisdiction in collaboration with non-governmental organizations, government departments and village-based organizations (IMF, 2008). However, Havet et al. (2009) noted that more emphasis was placed on forest management than fuelwood management in many of the policies. Decentralized electricity

generation was found in 12 LDCs and 11 SSA countries, however, the focus was mainly on supply factors such as electricity generation, the establishment of regulatory agencies and grid extension. Where local governments were given the responsibility for electricity generation or distribution, inadequate financial and human resources often constrained their ability to effectively deliver such services (Havet et al., 2009).

Renewable energies including biofuels have also not been adequately addressed in national policies of many LDCs and SSA countries. The study by Havet et al. (2009) revealed that only 18% of LDCs and 11% of SSA countries have policies that explicitly address renewable energies in the context of decentralization respectively. Many of the policies emphasized close collaboration between central governments and local governments. With regards to cooking and heating, policies and programs existed in countries; however, only Lao PDR had policies that link more efficient appliances and the management of natural resources in the context of decentralization. Even though little attention was given to improved cooked stoves as they were not explicitly stated in the policy documents (Havet et al., 2009). Despite the existence of policies and programs for improved cookstoves, fuels and devices for heating; no linkages exist between such programs and local level participation and planning. Policies put in place to reduce the costs of cleaner fuels for cooking such as LPG were also not linked with decentralization in many countries (UNDP, 2007b).

In sum, the review by Havet et al. (2009) shows that approaches to energy provision are highly centralized in most LDCs and SSA countries as national policies hardly discuss the linkages between energy and decentralization. Many countries have specific programs and strategies for meeting the energy needs especially for the poor; however, only a few of them have decentralization policies that mirror such initiatives. Synergies between decentralization and energy initiatives are weak and, hence there is the need for further exploration on how to strengthen these linkages to facilitate effective and efficient delivery of energy services towards a sustainable energy transition.

2.2.3. Promoting energy decentralization through national policy: the German Energiewende

Intending to completely phase out nuclear energy by 2022 and increase the electricity generated from renewable sources to 80% by 2050 (Quitow et al., 2016), the German

Energiewende is one of the most widely acknowledged national energy transition initiatives worldwide. The Energiewende aims to achieve a 50% and 80% reduction in primary energy use and GHG emissions respectively by 2050 and seeks to rely principally on hydropower, biomass, geothermal, solar and wind energy (Quitow et al., 2016). The primary reasons behind this ambitious policy initiative are not only climate protection and environmental sustainability but also the need for Germany to reduce energy imports and secure a large share in the renewable energy market. According to Kemfert and Thornton (2013), achieving these targets would require significant changes and improvement in technologies, energy networks and energy management practices. The development of energy storage technologies (Ausfelder et al., 2015), restructuring of energy distribution systems (Zeng, Yang, Zhao, & Cheng, 2013) and their integration into existing grids (Appelrath, Kagermann, & Mayer, 2012) are some of the key challenges identified.

The Ethics Commission for a Safe Energy Supply (2011) notes that a purely technological approach to implementing the Energiewende cannot yield the desired results because institutional set-ups, governance arrangements and spatial planning practices amongst others are equally essential. The implementation of the Energiewende is, therefore, transforming traditional social and economic structures and by so doing, it is replacing the 'centralized and monopolistic' structure that dominated Germany's energy sector with a more decentralized and diversified RE system (Quitow et al., 2016). Becker, Blanchet, & Kunze (2016) for instance argued that Germany's energy sector is being diversified if not democratized by the rise of local-level energy initiatives. Through this decentralization, new alliances are being formed between well-informed actors and stakeholders in Germany's energy sector, and as a result, creating changes in regional and local governance regimes. (Becker et al., 2016; Gailing & Röhring, 2016). Morris (2014) for instance argued that community-based and ecologically motivated political activism are the primary reasons behind the growth of RE technologies in Germany.

The success of the Energiewende was primarily augmented by the enactment of Germany's Renewable Energy Act (REA) in the year 2000. According to Quitow et al. (2016), the REA provided a stable policy framework and provided a strong incentive for the growth of many renewable energy technologies because it provided more realistic feed-in tariffs (over 20 years) which were based on the actual generation costs of the technologies rather than the electricity cost. In terms of achievements, the Energiewende

resulted in an increase in the share of renewable energy in gross electricity consumption to about 33% in 2015, and a decline in CO₂ emissions (Quitow et al., 2016). It has also created numerous employment opportunities with the formation of green businesses and small-scale energy entrepreneurs. There has been a rise in gross employment from 160000 in 2004 to about 370000 in 2013 through renewable energy development (Lehr et al., 2015). Despite these achievements, the Energiewende is not without challenges. Quitow et al. (2016), recount that the Energiewende has resulted in an abrupt rise in the price of electricity for end-users such as private households who do not benefit from special tax allowances. Local energy-related conflicts have also been reported in relation to increased public participation in the energy sector. These conflicts are primarily driven by trade-offs between allocating land for wind power plants, loss of agricultural land for food production, the emergence of factory farms and grid extension from the northern to the southern part of the country (Appel, Ostermeyer-Wiethaup, & Balmann, 2016; Leibenath, Wirth, & Lintz, 2016).

Overall, Germany's Energiewende is widely acknowledged as one of the most comprehensive energy transition policies in the world. It demonstrates from both policy and practice perspectives; how national governments can promote sustainable energy transitions through decentralized processes which encourage local level and community-driven initiatives. Such initiatives promote broader public participation in renewable energy development. Gailing & Röhring (2016) for instance, noted that the Energiewende had increased the relevance of regional and local planning mechanisms for spatially allocating RE plants. Key challenges and lessons learned from the implementation of the Energiewende also serve as useful guidelines for other nations which want to follow the same path. The Energiewende demonstrates that sustainable energy transitions can be achieved through national policies that encourage local-level energy initiatives, especially through local governments.

2.3. Local Governance and Decentralized Service Provision in Ghana

Historically, Ghana's local government system transitioned between three main periods; the colonial/pre-independence era, after independence (1957-1987) and the current local government system (1988 till date) (Friedrich-Ebert-Stiftung and ILGS, 2016). The ensuing section discusses how local governance in Ghana evolved since the colonial era to the current system that the country is using.

2.3.1. The pre-independence era (Before 1957)

The system of local governance during the pre-independence (Ghana was referred to as the 'Gold Coast' in this era) era was termed as 'the indirect rule system' where traditional chiefs with the support of their elders were the focal point of local governance (Friedrich-Ebert-Stiftung and ILGS, 2016). According to Laryea-Adjei (2007), municipalities were first created in 1859 in the Gold Coast (now Ghana) through the passing of a municipal ordinance which gave chiefs the legal basis to carry out some limited judicial and legislative functions. These functions, including rating activities were done under the supervision of Provincial Commissioners and agents of the British government. This system of local governance was later modified to allow for the local councils to be constituted of two-thirds elected members and one-third of appointed chiefs. Some technical and professional persons were also appointed from the local areas to be part of the councils (Laryea-Adjei, 2007). The colonial or pre-independence era of local governance saw the creation of the first town councils for the cities of Accra, Kumasi, Sekondi Takoradi and Cape Coast in the year 1943 (Laryea-Adjei, 2007). According to Friedrich-Ebert-Stiftung and ILGS (2016), the first Local Government Ordinance was passed in 1951. This ordinance saw the creation of 252 urban, local and district councils (Ahwoi, 2010). Friedrich-Ebert-Stiftung and ILGS (2016) recount that the new system of local governance was tied with the old system and it further deepened the undemocratic power of chiefs who were now being appointed as presidents of the new councils. Following the shortfalls of the new system, a commission was formed in 1956 to propose new reforms to the Local Government System with a specific focus on measures controlling revenue, expenditure, taxation and other fiscal issues. However, these reforms hardly materialised before Ghana's independence in 1957.

2.3.2. The post-independence era (1957-1987)

In 1957, Ghana developed its constitution which eventually led to the declaration of independence on March 6, 1957. The adoption of the constitution came along with new amendments in the Local Government System. The country was divided into Eastern, Western, Ashanti, Northern and the Trans-Volta Togoland Regions (Friedrich-Ebert-Stiftung and ILGS, 2016). Regional Assemblies were created for each of the five administrative regions, and responsibility of the development of the regions was given to the Assemblies. The local, urban, district and municipal councils were, however, retained

and this attracted opposition from the Regional Assemblies because their importance in carrying out local government functions was undermined. According to Friedrich-Ebert-Stiftung and ILGS (2016), this situation thrived until 1960 when the Republican Constitution was promulgated, and it remarkably strengthened the Local Government system. Ghana was reorganized into eight regions.

In 1961, there was another reform through the enactment of the Local Government Act (Act 54) which further created city, municipal and local area councils (Ahwoi, 2010). This Act paved the way for grassroots participation by incorporating Village, Town and Area committees into the Local Government process proscribed. However, the Act barred the authoritative roles of traditional authorities and called for the election of members of the various committees with District Councils under the chairmanship of a paramount chief who is appointed by the minister for justice (Friedrich-Ebert-Stiftung and ILGS, 2016). The role of the paramount chief was to oversee the processes leading to the election of a substantive chair of the District Council. Hence, the position of the paramount chiefs was provisional. The mandate of the District councils lasted three and the councils with principal responsibility for managing the environment, security, infrastructure and social services provision.

A Local Administration Act (Act 359) was passed in 1971, and it conferred power on Regional Chief Executives to oversee the Regional Councils. This Act was, however, amended through the decree in 1974 (Friedrich-Ebert-Stiftung and ILGS, 2016). The Amendment Decree of 1974 established a four-tier local government structure which consisted of Regional Councils, District Councils, Area, Municipal, Urban and Local Councils, and Town/Village Development Committees (Ahwoi, 2010). This new system provided for the creation of 273 municipal, area, urban and local councils of which only six were created as of 1977 (Ahwoi, 2010). The creation of District Councils, Village, Town and Area Development Committees was passed into law through parliament in 1979, and this law stipulated that two-thirds of the members of the various councils be elected while one-third of them were to be appointed by the local authorities. However, in 1980 this appointment power was conferred on the President of the Republic and called for two representatives from the Regional Councils (Friedrich-Ebert-Stiftung and ILGS, 2016). This reform eventually paved the way for Ghana's current local government and decentralization system.

2.3.4. Ghana's current local government system (1988 till date)

Ghana's current District Assembly system of local governance was introduced in 1988 through the promulgation of the PNDC Law 207. This system resulted in the creation of new districts which increased the number of districts from 65 to 110 which the overall objective of ensuring citizen participation and ownership of government system (Friedrich-Ebert-Stiftung and ILGS, 2016). Decentralization and local government were a central pillar of the fourth Republican Constitution of Ghana in 1992 which dedicated the entire chapter (chapter 20) to decentralization and local governance. Article 240 (1) states that the country shall have a local government system which shall be decentralized as far as practicable. Clause two of the same article provides for parliament to enact laws to ensure the transfer of power, responsibilities and resources from the central government to the grassroots levels. In 1993, the Local Government Act (Act 462) was enacted. This Act is the legal framework that established Ghana's local government structure and spelled out the conditions for the creation of districts, functions of District Assemblies, their composition and administrative structure among others. The District Assemblies were given deliberative, legislative and executive powers and they are tasked with the responsibility to integrate administrative, political and required development support to ensure equitable allocation of power and resource for balanced regional development in Ghana (Akrofi, Akanbang, & Abdallah, 2018). Twenty-eight more districts were created in 2003 bringing the total number of districts to 138. Thirty-two more were added in 2007, and the number of districts rose to 216 by 2012 (Friedrich-Ebert-Stiftung and ILGS, 2016). In 2017, the government created 38 districts hence, bringing the total number of districts to 254. These districts are made up of Metropolitan, Municipal and District Assemblies (MMDAs)

2.3.4.1. The local government structures

The current local government structure of Ghana consists of Regional Coordinating Councils (RCCs) and MMDAs. There are a four-tier Metropolitan Assembly structure and a three-tier District Assembly structure. Below the MMDAs are the sub-district structures which show the difference between the four-tier structure of Metropolitan Assemblies and the three-tier structure of District Assemblies (see fig. 2.2). These sub-district structures are Sub-metropolitan District Councils, Urban/ Zonal/ Town/ Area Councils and Unit Committees (Friedrich-Ebert-Stiftung and ILGS, 2016). The conditions taken into account

in the creation of districts are the population, geographic contiguity, and economic viability of the area (Republic of Ghana, 1993).

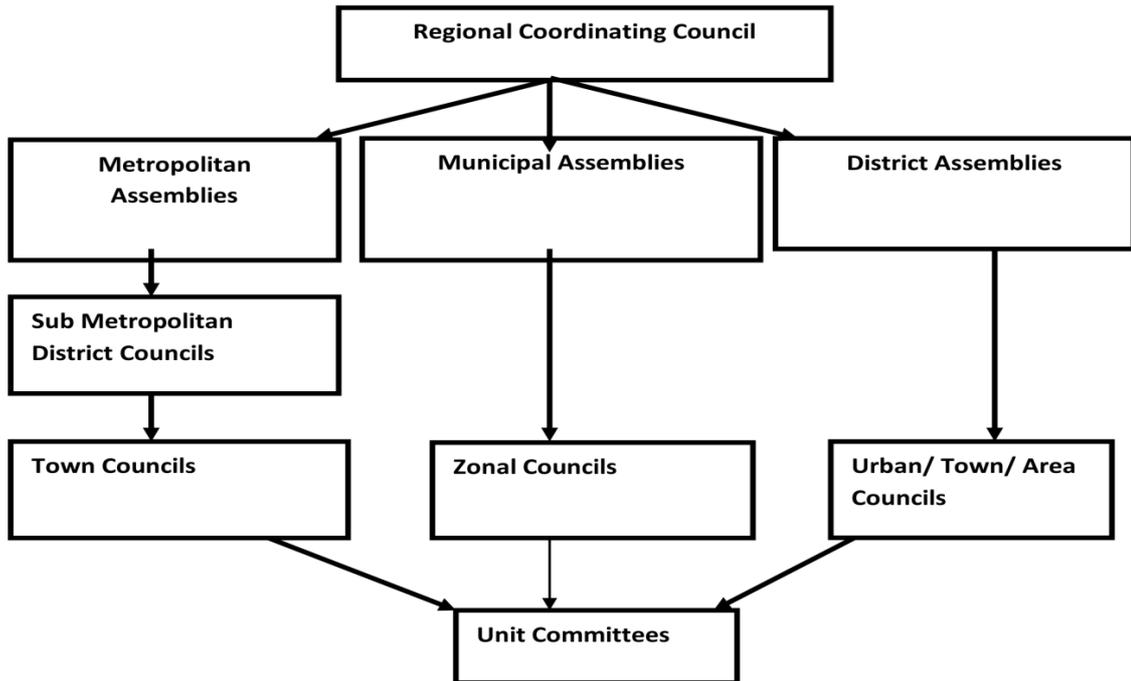


Figure 2.2: Ghana's local government structure (Friedrich-Ebert-Stiftung and ILGS, 2016).

At the apex of the local government structure is the RCC which is the highest administrative and political body in a region. It is made up of a regional minister, deputy regional minister, presiding members of District Assemblies within the region, District Chief Executive (DCE) of various districts within the region, two chiefs from the Regional House of Chiefs and regional heads of decentralized departments within the region (Friedrich-Ebert-Stiftung and ILGS, 2016). The Local Government Act (Act 462) spells out the functions of the RCCs into two broad categories; coordinating and planning functions. The coordinating functions include amongst others: to monitor, coordinate and evaluate the performance of districts in the region, monitor use of all funds allocated to the districts and manage public services within the region. With regards to planning functions, the RCCs are required to among others, provide the District Planning Authorities with the requisite data and information for planning, coordinate and harmonize plans of the districts with the developmental policies and priorities of the central government (Republic of Ghana, 1994).

MMDAs are the next level after the RCCs in Ghana's local government structure. This is depicted in figure 2.2. Metropolis, municipalities and districts are differentiated by the population size and the settlement patterns of an area. The Local Government Act 462 stipulates that: a local government unit with a minimum population of 250000 people is a metropolis, a municipality is a single compact settlement of at least 95000 people while a district is an area or unit of local government with at least 75000 people. MMDAs are composed of a Chief Executives, one representative from each electoral area within the district, member of parliament from the constituency in the district. They also have appointed persons who by constitutional provision shall not be more than thirty percent of the membership of the assembly and are appointed by the president in consultation with local authorities (Republic of Ghana, 1993). The district coordinating director is the secretary of the Assembly. MMDAs perform executive, legislative and deliberative functions. These functions include: the preparation and implementation of plans, programs and strategies for the overall development of the district, submit through the RCCs, development plans and budgets of the districts for approval by the Ministry of Finance, initiate programs for infrastructural development and promote social development and productive activities in the district (Republic of Ghana, 1993). Below the MMDAs are the sub-district structures. These sub-district structures are made up of Sub-Metropolitan District Councils, Urban/Zonal Councils, Town/Area Councils, and Unit Committees. Table 2.2 provides a brief description of each of these local government structures.

Table 2.2: Description and composition of district sub-structures

Sub-structure	Description	Composition
Sub-Metropolitan District Councils	Found in Metropolitan Assemblies and established for cosmopolitan areas, with identical urbanization and management problems.	Minimum of fifteen but not more than twenty members of elected members of the Assembly. Maximum of five Unit Committee members and five adult residents (with women being the majority) within the sub-

		metropolitan district.
Urban Council	Peculiar to settlements of "ordinary" District Assemblies with populations above 15,000 and which are cosmopolitan	Maximum of five elected persons from the District Assembly and ten representatives from the Unit Committees.
Town Council	Established for settlements with a population exceeding 50,000 people (Metropolis) Established for settlements with populations between 5,000 and 15,000 people (Districts)	Maximum of five elected persons from the District Assembly and ten representatives from the Unit Committees.
Area Council Zonal	Exists for a number of settlements and villages which are grouped but whose individual settlements have populations of less than 5,000 people.	Maximum of five elected persons from the District Assembly and ten representatives from the Unit Committees.
Zonal Council	Are found in the "one-town" Municipal Assemblies with population of 3,000	Maximum of five elected persons from the District Assembly and ten representatives from the Unit Committees.
Unit Committees	Rural Areas: A cluster of settlements with a population between 500 and 1,000 people Urban Areas: Settlements with a Population of at least 1,500	Not more than five elected persons through elections conducted by the electoral commission.

Source: Adapted from Friedrich-Ebert-Stiftung and ILGS (2016).

With regards to the functions they play, Sub-Metropolitan District Councils are responsible for among other functions: keep records of all rateable properties within their areas, collect fees, waste management, assist the Assembly in street naming exercises, administer self-help projects, maintain market infrastructure and implement bye-laws of the Assembly (Friedrich-Ebert-Stiftung and ILGS, 2016). Urban, Town, Area and Zonal councils perform similar functions like the Sub-Metropolitan District Councils. They assist the District Assemblies in revenue collection, keeping records of all rateable and datable properties, street naming exercises, disaster prevention and preparation of short, medium and long-term development plans for their respective areas (subject to approval by the District Assembly). Unit Committees are the lowest levels in the local government structure. They are the closest to the local communities and people and hence, play an essential role in enforcing bye-laws and mobilizing resources for development. They are the primary conduits for the representation, community participation and accountability from the grassroots level. They provide supervision of the staff of the Assembly who work in their communities, organize communal labor and voluntary work, initiate and implement community-driven and self-help projects and, they prepare community action plans which serve as inputs into the District Medium Term Development Plan (DMTDP).

2.3.4.2. The administrative structure of the District Assembly

Administratively, the District Assembly (DA) is made up of the General Assembly, the Executive Committee (and its sub-committees), the Public Relations and Complaints Committee, the Coordinating Directorate and the Decentralized Departments. The General Assembly is the highest decision-making body of the district and is led by the Presiding Member. It performs executive, legislative and deliberative functions. The executive committee operates through its subordinate units such as the development planning, finance and administration, works, social services and, justice and security sub-committees (see fig. 2.3). The Executive Committee is headed by the Metropolitan/Municipal/District Chief Executive, and it is responsible for coordinating and implementing decisions by the General Assembly. It also oversees the day-to-day administration of the district (Friedrich-Ebert-Stiftung and ILGS, 2016). The Public Relations and Complaints Committee is more or less the moral compass of the district. It is the conduit through which the public file complaints about the conduct of the Assembly and local authorities' staff members. The committee ensures transparency, public

accountability, efficiency and the rule of law by receiving complaints from the general public, investigating them and making recommendations to the District Assembly (Friedrich-Ebert-Stiftung and ILGS, 2016). It enables citizens to express their views and seek justice when aggrieved by the conduct of the staff of the District Assembly.

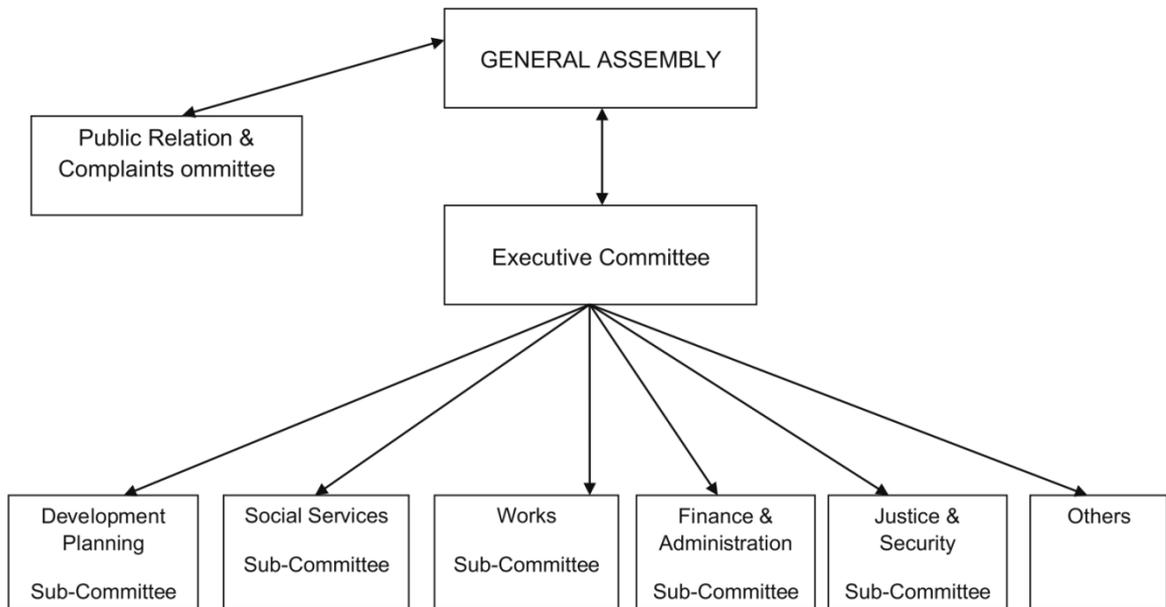


Figure 2.3: The administrative system of the district (Institute of Local Government Studies, 2018)

The sub-committees play deliberative functions and report to the Executive Committee for action. The Development Planning sub-committee is responsible for undertaking a resource analysis for the district. This analysis is done to develop an information base on the resources of the district to enable effective planning. The Development Planning sub-committee also conducts risk analysis on the exploitation of such resources and prepares short/medium/long-term development plans for the district. The Social Services sub-committee is responsible for areas of social development such as education, health, welfare, culture amongst others in the district. It develops an information base on these social issues, prepares social development plans and analyzes their implications on the development of other sectors in the district (Friedrich-Ebert-Stiftung and ILGS, 2016). Delivering and maintaining infrastructure in the district is the primary responsibility of the Works sub-committee. It undertakes an infrastructure needs assessment for the district, develops an information base and initiate programs for the development infrastructure like roads, market areas, schools, water and sanitation. The Finance and Administration sub-committee has the primary responsibility of ensuring accountability and financial

transparency in the district. It analyzes the revenue and expenditure patterns of the district, develops strategies to improve upon them, prepares financial plans and maps out strategies to improve resource utilization (Friedrich-Ebert-Stiftung and ILGS, 2016). Enforcement of bye-laws and, resolution of inter and intra-district conflicts are the primary functions of the Justice and Security sub-committee. This committee ensures that there are adequate logistics for the police to function effectively and make the necessary provisions for the effective functioning of community tribunals, magistrate and courts. All these sub-committees submit their plans and report to the Executive Committee.

2.3.4.3. Decentralized development planning system in Ghana

To strengthen decentralization and citizen participation in development planning and decision making, the Development Planning (System) Act (Act 480) was enacted in 1994. This Act established the mechanism for a bottom-up approach to development planning in Ghana. It is the legal framework which spells out the processes and procedures for citizen participation in the development planning process of the district (Friedrich-Ebert-Stiftung and ILGS, 2016). Clause 3(1) of the Act states that “A District Planning Authority shall conduct a public hearing on any proposed district development plan and shall consider the views expressed at the hearing before adoption of the proposed district development plan”(the Republic of Ghana, 1994, p. 3). This decentralized development planning is done under the guidance of the National Development Planning Commission (NDPC) which was created by the NDPC Act, 1994 (Act 479). The commission is responsible for coordinating all development planning efforts in Ghana. It develops guidelines for the preparation of district and sectoral plans in the country. The commission is also responsible for approving district and sectoral plans.

The decentralized planning system ensures that development planning in Ghana follows a bottom-up approach which begins with the preparation of community action plans by unit committees. This action planning is done with guidance from the District Planning and Coordinating Unit (DPCU). These plans are a valuable source of data for planning and decision making and, where such plans are unavailable, each district is required to gather data on the real needs of at least 50% of their communities (NDPC, 2013). The DPCU coordinates the planning activities of sectoral departments in the district and synthesize these activities and formulate a comprehensive district development plan (Republic of

Ghana, 1993). Upon completion DMTDP through various participatory approaches and public hearings, the plan is submitted to the RCC whereas stipulated by the Local Government Act, 1993 (Act 462), the Regional Planning and Coordinating Unit (RPCU) harmonizes the DMTDP in accordance with national objectives and priorities. After harmonization, the DMTDP is sent to the NDPC which validates and approve the plan by the guidelines issued to the districts. Figure 2.4 presents the decentralized planning system in Ghana.

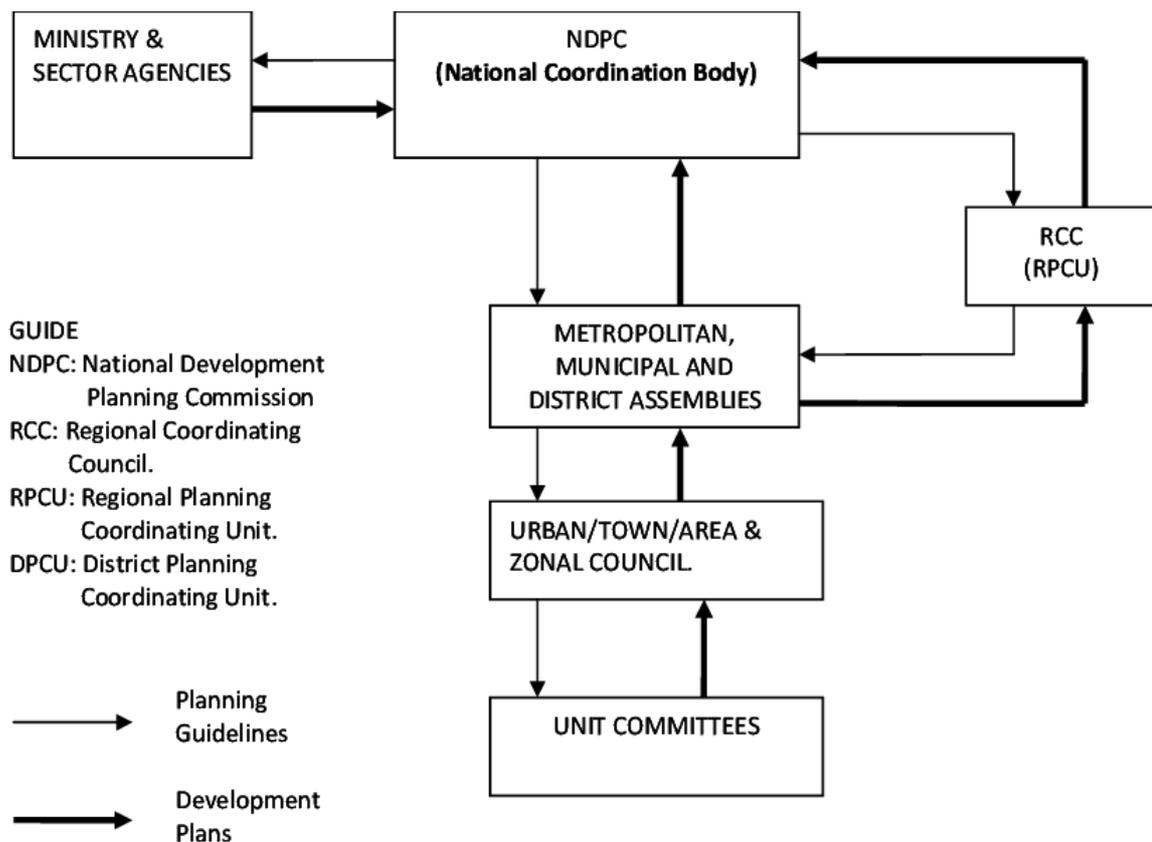


Figure 2.4: Decentralized planning system in Ghana (Inkoom, 2009).

2.4. Overview of Sustainable Energy Development in Ghana

Significant progress has been made in expanding electricity access in Ghana with about 82% of the population having access in 2016 (Kumi, 2017). However, renewable energy growth remains a major issue with renewables contributing only 0.2% to the energy mix (Kumi, 2017). In 2010, Ghana formulated a national energy policy/Energy Sector Strategy and Development Plan (ESSDP) which placed much emphasis on increasing the share of renewables such as wind, solar, mini-hydro and waste to energy (Ministry of Energy, 2010). The ESSDP had a target of increasing the share of renewables to 10%. To achieve

this target, the Renewable Energy Act, 2011 (Act 832) was passed by parliament to provide the required legal and regulatory framework for the development of RE in Ghana. The Act provides for the efficient development and utilization of renewable energy resources through creating a favorable fiscal and regulatory environment that will attract pricing incentives (Government of Ghana, 2011). Ghana was one of the early adopters of the United Nations Sustainable Energy for All (SE4ALL) initiative. Subsequently, the country prepared its first country action plan for the SE4ALL in 2012 with the principal objectives to ensure universal access to modern energy services, double the share of renewables in the energy mix and double the rate of energy efficiency (Hagan, 2015). In connection with this SE4ALL action plan, a Sustainable Energy for All Acceleration Framework (SEAAF) was adopted to assess challenges and identify measures to help achieve the objectives of the SE4ALL. The main aim of the SEAAF is to

...address commonly observed challenges in energy policy planning and programming, such as advancing demand-driven prioritization of energy services based on development needs; coordinating multi-sectoral responses to scale up equitable energy access; and establishing inclusive and participatory multi-stakeholder partnerships to deliver universal access to sustainable energy” (Energy Commission, 2012, p. 4).

This initiative was led by the Energy Commission with support from the UNDP and it resulted in three main outputs: situational analysis report, prioritized commitments and a country action plan, and draft partnership agreements for the implementation of the action plan (Energy Commission, 2012). Emphasis on increasing the share of renewables was also a principal component in the Ghana Shared Growth and Development Agenda (GSGDA II) which was Ghana’s national policy framework from 2014 to 2017. It had the objectives to amongst others, accelerate the implementation of the Renewable Energy Act (Act 832) of 2011, provide access to waste-to-energy technologies and facilitate the development of grid-connected standalone power plants (Hagan, 2015). Much of these national efforts are augmented by the support of numerous development partners who are working towards improving sustainable energy access in Ghana. Current development partners in Ghana’s RE sector include the African Development Bank (AfDB), the UNDP, the EU, Agence Française de Développement (AFD), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Switzerland State Secretariat for Economic

Affairs (SECO) amongst others (Hagan, 2015). The World Bank, AfDB and SECO are currently the main partners supporting the Ghana Energy Development and Access Project (GEDAP) which seeks to connect about ten thousand people in deprived communities to renewable energy. According to Hagan (2015), the Kreditanstalt für Wiederaufbau (KfW) is supporting the Volta River Authority (VRA) in developing a twelve megawatts solar PV project while the GIZ focuses on providing technical assistance to the implementation of the Renewable Energy Act (Act 832). The GIZ is also supporting a number of sustainable energy projects including the Energizing Development Project which seeks to ensure productive use of renewable energy in agriculture, and improved cookstoves for gari processing (Hagan, 2015).

Some international and local NGO's are also actively engaged in Ghana's renewable energy sector. The Netherlands Development Organization (SNV) is collaborating with the GIZ on the EnDev project. A Ghanaian-based NGO (The Kumasi Institute of Technology, Energy and Environment-KITE) is also involved in sustainable energy initiatives in Ghana. It assisted Ghana in developing an Energy for Poverty Reduction Action Plan and the business development services package for African Rural Energy Enterprise Development (AREED). Ghana's sustainable energy sector is thus, comprised of several national and international institutions as well as local NGOs and private sector actors. The structure of the sector is presented in figure 2.5.

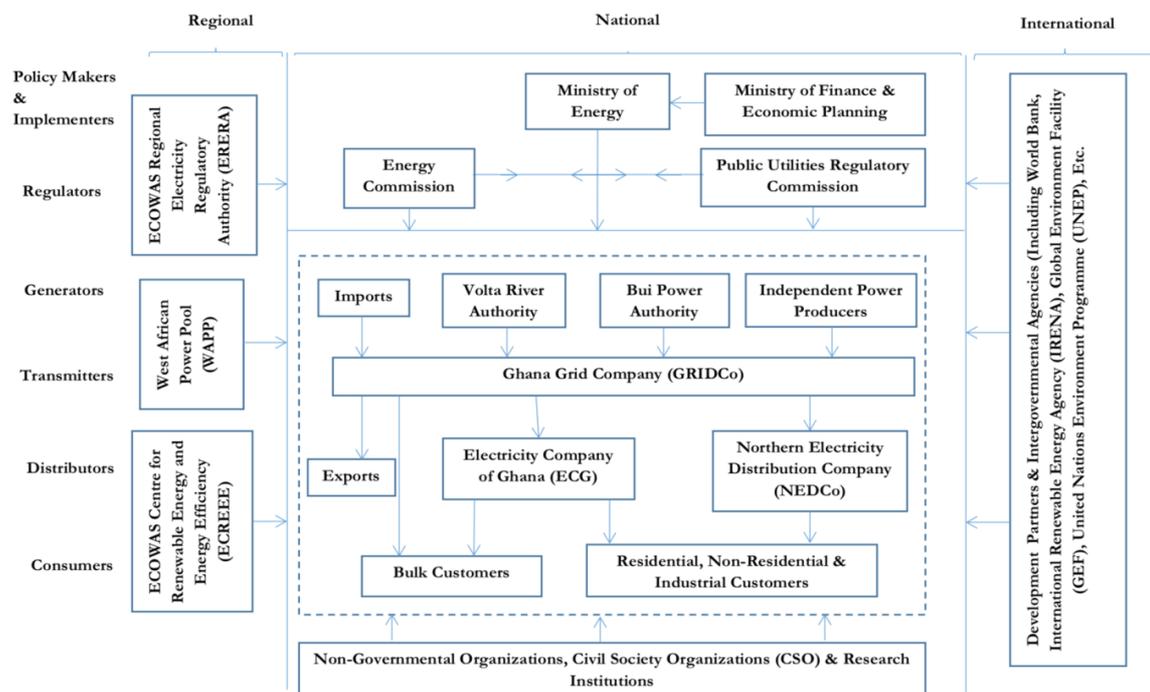


Figure 2.5: Stakeholders in Ghana's power sector (Kumi, 2017)

2.5. Conceptual Framework

Figure 2.6 depicts a conceptual framework for the study. The framework posits that national-level sustainable energy initiatives are influenced by international efforts to accelerate the development of sustainable energies. Section 2.4 above clearly shows how such external factors are influencing sustainable energy initiatives in Ghana. External pressures especially environmental factors such as climate change also influence national-level energy initiatives. In response, legal and regulatory frameworks are developed, policies and programs are formulated at the national level and institutional arrangements are made for the implementation of such policies. The legal and regulatory frameworks, policies and programs put in place significantly influence the involvement of NGOs and private sector operatives who invest in sustainable energies in a country. However, the success of both government, NGOs and private sector initiatives is hinged on the involvement of local governments. While national policies and programs can determine how local governments participate in sustainable energy development; local governments contribute significantly to the formulation of effective policies and effective programs hence, the two-way relationship between them.

By virtue of being closest to the communities, local government provide realistic information with regards to energy needs, they can mobilize resources for the implementation of RE projects, monitor closely and provide feedback for policy and program design purposes, encourage active citizen participation and local initiatives in sustainable energy development and utilization as well as invest in sustainable energy initiatives. These roles are very vital for the operation of both NGOs and private sector operatives. Local government can help them to quickly identify where needs exist and provide them with reliable information to help them set up their projects. All these efforts culminate in an acceleration of sustainable energy development which includes the development and utilization of mini-grids, off-grid systems, clean cooking technologies, amongst others which ultimately translates into a sustainable energy transition. This study thus, examines the role of local government as posited in the conceptual framework with the aim of suggesting measures to facilitate a sustainable energy transition through the active involvement of local governments in Ghana.

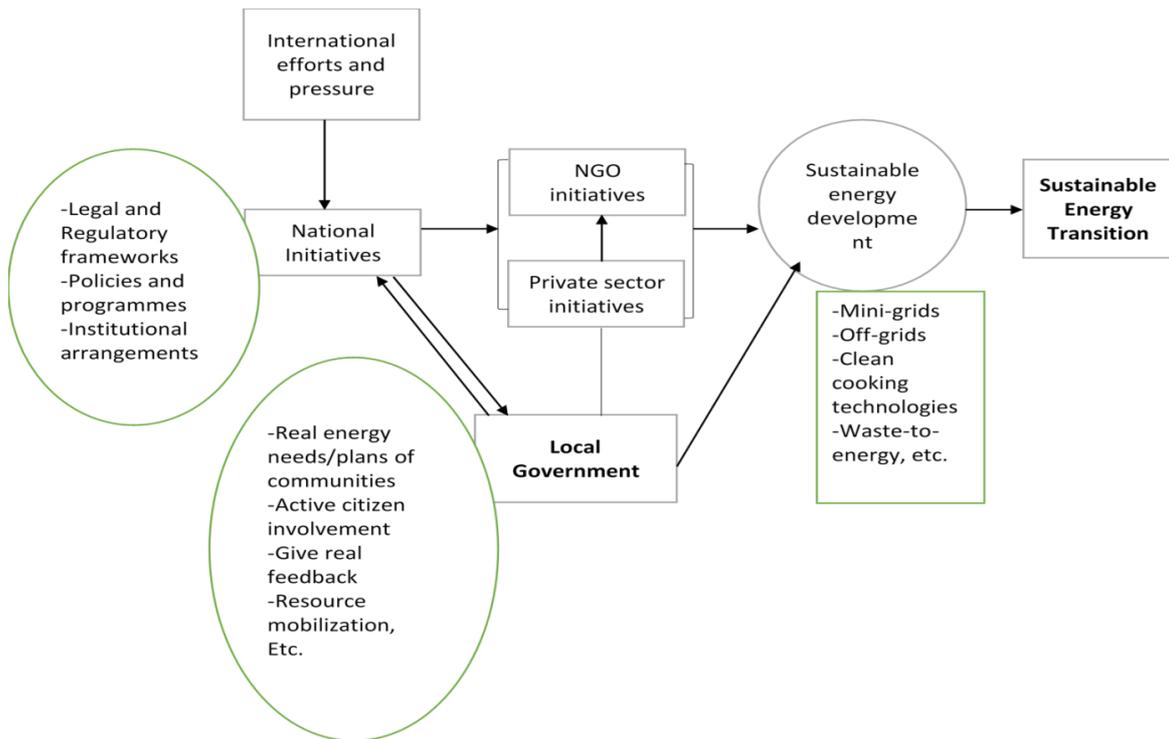


Figure 2.6: Conceptual Framework

2.6 Summary

The review has shown that the role of local government in sustainable energy transitions is widely acknowledged amongst scholars. Despite the acknowledgment of this important role, many local governments, especially in sub-Saharan Africa, still have limited functions with regards to sustainable energy development and utilization. Bawakyillenuo et al. (2018) showed that central governments still play the dominant role in sustainable energy development with minimal roles of local government in many SSA countries. Havet et al's. (2009) the review also showed that national energy policies rarely addressed the linkages between energy and decentralization, hence, creating a gap in the decentralization approaches of many developing countries. Linkages between energy and decentralization are better addressed in sector-specific policies than national policies. Thus, no clearly linkages exist between national-level plans and local plans. In Ghana, despite a long history and well-established local government structure and decentralized planning system, local government involvement in sustainable energy initiatives remains extremely limited with planning for such initiatives virtually missing in the local government planning system. From a theoretical viewpoint, the structure of local government units (districts) in Ghana qualifies them as socio-technical systems with

regimes, niches and landscapes. Hence, local governments are very vital agents through which national energy transition can be achieved. However, their participation and in sustainable energy initiatives, how sustainable energy planning can be integrated into the district planning process and their capacity to undertake sustainable energy planning and implementation have not been fully explored in the literature.

3. RESEARCH METHODOLOGY

3.0. Introduction

The previous chapter presented a review of relevant literature which highlighted vital variables that are of prime concern to this research. The literature review also provided information on the theoretical perspectives of Sustainable Energy Transitions (SET), the role of local government in SET, the current stance of the involvement of local government in SET in sub-Saharan Africa and other developing countries and, an overview of sustainable energy development in Ghana. The review provided insights as to what data needs to be collected in order to answer the research question: how can the role of local government be enhanced in promoting SET in Ghana? This chapter proceeds with a description of the study setting and then focuses on the methodology that is adopted for the research. Primarily, it discusses the research strategy, selection of study participants, sampling techniques, methods of data collection and data analysis.

3.1. Study Setting (Wa Municipality in Context)

Upgraded from an ordinary district to a municipality in 2004, the Wa Municipal Assembly (WMA) is one of the eleven districts in the Upper West Region of Ghana. The capital of the municipality is Wa, which also doubles as the capital of the Upper West Region. The municipality lies within latitudes 1°40'N to 2°45'N and longitudes 9°32' to 10°20'W and shares administrative boundaries with Nadowli District to the North, Wa East District to the East and South and the Wa West District to the West and South. Figure 3.1 depicts the map of the Wa municipality.

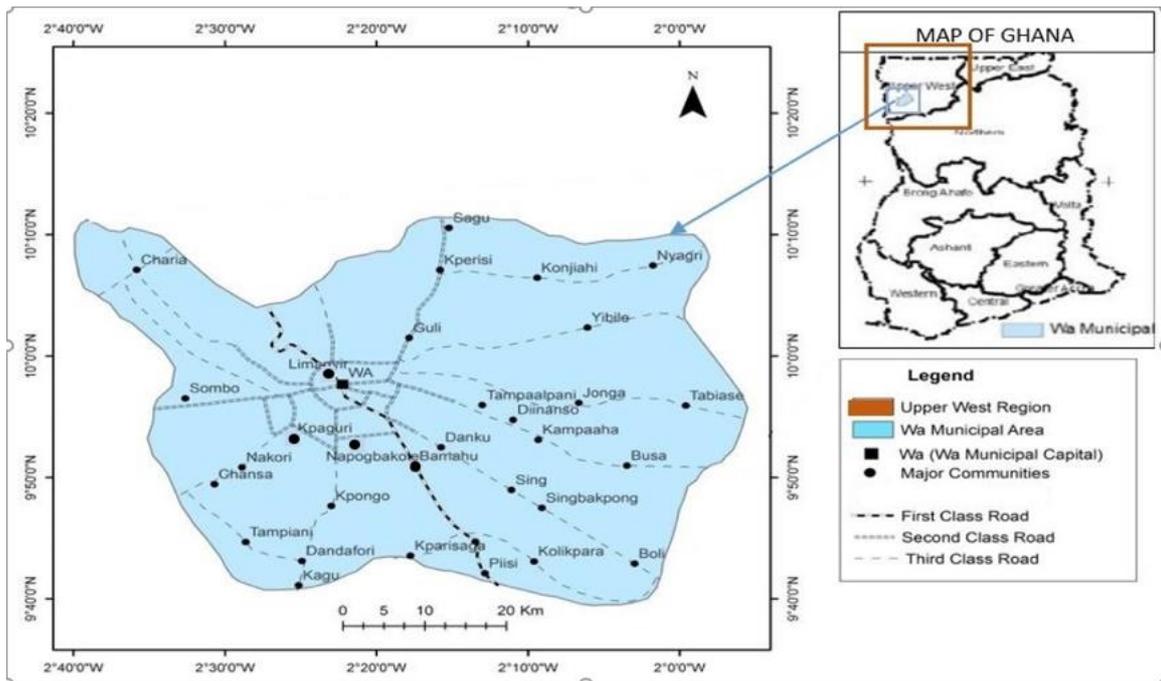


Figure 3. 1: Map of Wa Municipality(Wa Municipal Assembly, 2014)

By the Local Government Act (Act 462), the Assembly is the highest administrative and political body in the municipality with core responsibility to implement government policies and projects for the overall development of the municipality. The municipality lies within the savannah high plains zone with an average height of between 160meters and 300meters above sea level (Wa Municipal Assembly, 2014). The climate of the area is generally hot and dry. South-West monsoon winds from the Atlantic Ocean brings rains between April and October while North-Eastern trade winds from the Sahara Desert brings a long dry season from November to March. The mean annual temperature ranges from 27 to 28 Degree Celsius (UNDP, 2011b). The average annual rainfall differs between 840mm and 1400mm (Wa Municipal Assembly, 2014). The strong winds and all-year-round sunshine in the municipality provide good opportunities for solar and wind energy development.

The total population of the municipality is 107,214 persons with growth rates of 2.7% and 4% for rural and urban areas, respectively (Ghana Statistical Service, 2014). Most of the population who are aged 15 years and above are employed in the agricultural sector (29.3%) followed by the service and sales sector (25.7%). With regards to energy, the principal source of energy for lighting in the entire municipality is electricity from the national grid. 72.1% of dwelling units derive their source of lighting from the national grid, 15.1% use flashlights/torch, 10.9% use kerosene lamps while 0.1% use crop residue

and firewood (Ghana Statistical Service, 2014). The proportions of dwelling units using electricity for lighting from the national grid is 81.5% in urban areas and 48.4% in rural areas. Many of the rural population still rely on flashlights/torch (31.5%) and kerosene lamps (18.4%) for lighting (Ghana Statistical Service, 2014). Only 0.2% of dwelling units in the entire municipality use solar energy and gas lamps. Hence, sustainable/renewable energy usage for lighting in the municipality is extremely low. Given the unreliable nature of power supply from the main grid and the good potential for solar energy (Wa Municipal Assembly, 2014) in the municipality, the current low level of sustainable energy utilization provides an opportunity and a potential market for investment into renewable energy sources such as solar.

With regards to cooking, the dominant source of fuel for cooking in the municipality is charcoal and wood with 55.2% and 22.9% of households relying on these sources respectively while only 16.3% of them use LPG (Ghana Statistical Service, 2014). The proportion of households using charcoal for cooking is higher for urban areas (65.7%) than rural areas (28.9%) while wood is predominantly used by rural households (56.2%) than urban households (9.8%). Only 18.4% and 11.0% of urban and rural households use gas, respectively (Ghana Statistical Service, 2014). Energy for cooking thus comes principally from biomass as both charcoal and wood are derived from it. There is the need for much to be done in promoting the development and utilization of modern energy for cooking in the municipality because the usage of biomass has environmental consequences especially in a municipality that lies within the savannah zone with fewer trees and under a rising threat of encroachment by the Sahara Desert.

Since the Municipal Assembly (which is the local government body) is responsible for formulating and implementing developmental projects, it is better positioned to spearhead the development and utilization of sustainable energy by the households. All NGOs and private sector actors working on the issues mentioned above also collaborate and must first go through the Assembly before carrying out any such initiatives. This study is thus, rooted in examining how the decentralized departments of the Assembly which are concerned with development planning and implementation regarding energy issues are working towards SET. NGOs and private sector actors working on sustainable energy issues in the municipality also form part of the study. This assessment will help to understand how the role of the local government, in general, can be enhanced to facilitate

the development and utilization of sustainable energies. Given that all MMDAs have the same administrative structure as stipulated by the Local Government Act (Act 462) of 1994, findings from this study can be generalized for other districts and provide useful insights for improving upon the local government planning process to give a greater role to municipalities and districts to plan and implement sustainable energy initiatives.

3.2. Methods

The study begins with a broader look at the current outlook of sustainable energy issues with specific reference to some challenges that constrain the transition process in Africa. It subsequently narrows down to discuss how local governments can play a more significant role in facilitating this process, and finally, puts forward a conceptual framework which attempts to link the various variables in the study. This section presents the methods and techniques used for data collection, data analysis and presentation of results.

3.2.1. Research approach

The research employed a mixed-method approach where both quantitative and qualitative methods are used in gathering and analyzing data. The study thus draws on the pragmatic philosophical worldview, where the researcher draws liberally from both qualitative and quantitative assumptions during the conduct of the research (Creswell, 2009). The mixed-method approach is suitable for the study because the research questions are made of both ‘what’ and ‘how’ and hence, demand both descriptive (quantitative) and explanatory (qualitative) application. Yin (1984) explains that one condition that can determine which type of research strategy to adopt is the research questions. According to Schell (1992) questions of ‘who’, ‘what’, ‘where’, ‘how many’ and ‘how much’ are much more quantitative while questions of ‘why’ and ‘how’ are more qualitative. Specifically, the concurrent strategy under the mixed-method approach was used. According to Creswell (2009), this strategy involves the collection and analysis of both qualitative and quantitative data at the same time. The quantitative component of the study focuses on social network analysis for the interactions and involvement of local stakeholders in sustainable energy planning and implementation. Quantitative techniques are also used in assessing the institutional capacity of various local government units/departments in the municipality. The qualitative aspect deals with obtaining in-depth information from

participants with regards to their involvement in SET initiatives. It also entails a content analysis of relevant documents on sustainable/renewable energy policy and planning in the study area.

3.2.2. Study population

The study population refers to all the entities that the researcher wants to study (Blaxter, Hughes, & Tight, 2006). It involves the objects, places, a defined class of people or events that are selected because they are relevant to addressing the research objectives. In this research, the population of interest includes all institutions/agencies/actors concerned with sustainable energy development in the Wa municipality. The study is centered on assessing the participation and involvement of local government in sustainable energy transition initiatives in the municipality and subsequently address how the role of local government can be enhanced in promoting sustainable energy development. These stakeholders (central government agencies, local government units/departments, NGOs, private sector actors and local communities) are, therefore, essential for obtaining the information needed to address the research questions since they are primarily concerned with sustainable/renewable energy issues.

3.2.3. Units of inquiry

The units of inquiry/analysis for this study are mainly institutions and agencies that deal with sustainable/renewable energy issues in the Wa municipality. Two local communities (Busa and Guropisi) that benefitted from renewable energy projects were also involved. Information was solicited from various heads of departments and focal persons from the agencies and institutions that are of prime concern to this research. Local government agents and representatives at the community level were also involved. Institutions such as the Energy Commission, the Municipal Planning and Coordinating Unit (MPCU), the Community Development Department (CDD), the Ministry of Energy (MoE), the Volta River Authority (VRA), the Environmental Protection Agency (EPA) as well as NGOs and private sector organizations dealing with sustainable energy issues in the municipality were the units of analysis for the study.

3.2.4. Selection of study participants

Participants of the study were selected using purposive sampling. This non-probability sampling technique is ideal for the study because the information is required from only participants who are engaged in local governance and sustainable energy issues in the municipality and thus, possess in-depth knowledge that is needed to answer the research questions. The selection of participants was done through preliminary literature search initial data collection and snowballing. The researcher first conducted a literature search on the actors involved in renewable/sustainable energy initiatives in the municipality. This search focused on institutional arrangements in key policy documents as well as a review of NGOs that are currently working on sustainable energy issues in the municipality. Next, a visit was made to the Municipal Planning and Coordinating Unit (MPCU), which coordinates all developmental projects and programs at the local government/municipal level. A list of all actors and agencies working on sustainable energy issues was requested from the Municipal Development Planning Office. This list was reconciled with the list obtained from the literature search to obtain the list of participants for the research. In the course of data collection, the respondents were asked to mention other actors that they work with on sustainable energy issues in the municipality. This process led to the emergence of some new actors who were not captured in the initial list generated. The RCC, MPCU, Community Development Department (CDD), Statistical Service, Volta River Authority (VRA), Netherlands Development Organization (SNV), amongst others were identified as the main actors with regards to sustainable energy development in the municipality. These stakeholders play important roles in the proper functioning of the local government in the municipality. Hence, to enhance the role of local government in SET, an assessment of their involvement is essential.

3.2.4. Sources and types of data

Data for the study were obtained from both primary and secondary sources. Primary data were obtained through interviews. The data were collected from all the actors mentioned above. Actors were interviewed to obtain primary data on their engagement in sustainable energy initiatives, their participation and nature of involvement in sustainable energy initiatives. Secondary data, on the other hand, were obtained from both published and unpublished sources. These sources include institutional reports (Statistical Service

Report, District Development Plans, NDPC guidelines) and other studies related to the subject matter and the study area. Documents such as the National Development Planning Commission's (NDPC) guidelines for district-level planning and the MTDPs of the Wa municipality were sources for relevant secondary data and information on the procedures and processes involved in development planning and implementation at the local level. The MTPDs were analyzed to establish the current state of sustainable energy planning and implementation at the district level while the NDPC guidelines were reviewed to identify possible gaps that resulted in sustainable energy planning not being given much attention in the district planning process.

3.2.5. Methods and instruments of data collection

Different methods with their corresponding instruments were used in gathering data for the research. The methods and instruments used are primarily based on the mixed methods nature of the research. Interview was the main method used in gathering data from all the actors involved in the study. Various heads of departments and focal persons from the institutions were the points of contact, and face-to-face interviews were conducted with them to obtain the needed data and information. Key informants such as Assembly members and unit committees of selected communities were also interviewed. The corresponding instrument for data collection was the interview guide. The guide entailed a series of open-ended questions which served as the basis for discussion between the researcher and the respondents. However, to assess the capacity of the local government agencies in planning and implementing sustainable energy programs, a structured questionnaire was administered in the MCPU, RCC, Statistical Service Department, CDD and the VRA to obtain data on their current human resource base as well as logistics.

Focus Group Discussion (FGD) was another method used for collecting primary data in this study. It was used for collecting qualitative data from two beneficiary communities (Busa and Guropisi) of sustainable energy projects. Two FGDs were conducted with each comprising of between six and eight people. The two FGDs were constituted of members of the community-level committees that were formed to oversee the implementation and management of the projects. The instrument used for the FGDs was the FGD guide. The guide entailed a list of open-ended questions which the researcher used in facilitating the

discussions. Each of the participants was given turns to speak their opinions to ensure that the discussion was not hijacked by only a few individuals who are very active and vocal.

The third method of data collection used is document review. The review is an iterative process which entails skimming, reading and interpretation, and it combines elements of both content and thematic analysis (Bowen, 2009). This method was used to extract relevant data from documents such as the MTDPs, NDPC guidelines and National Medium-Term Development Planning Frameworks (NMTDPF). A data extraction sheet was the instrument used in gathering data from the documents that were reviewed. Table 3.1 summarises the various methods used in collecting the needed data for the research.

Table 3. 1: Methods of data collection

Methods Applied	Instrument	Key Features	Outcomes
Interviews	Interview guide	Face-to-face interviews were conducted with focal persons at the various institutions selected for the study.	-Data on actors' engagement in sustainable energy initiatives -Data on human resources and logistics in local government units/departments
FGD	FGD guide	Discussions with community-level committees in charge of RE projects	-Data on the nature of RE projects in the municipality
Document review	Data extraction sheet	Documentary analysis	-Archival data -Data on sustainable energy projects in the MTDPs

3.2.6. Methods of data analysis

Due to the mixed methods nature of the research, a variety of methods were used to analyze the data. These methods are discussed in details in the ensuing sub-sections.

3.2.6.1. Social network analysis (SNA)

Cronin (2015, p. 4) defined SNA as “a set of techniques for identifying and representing patterns of interaction among social entities, be it individuals, groups, organizations or social artifacts.” SNA is based on graph theory, and it employs graphical techniques to analyze the nature and pattern of relationships among different entities. These entities (in this case, the actors under study) are represented as points which are known as nodes, or vertices whiles the relationships between them are represented by lines which are referred to as ties, edges or arcs (Cronin, 2015). Cronin (2015) explains further that directionality and value differentiate relationships in a network. The directional relationship involves a transfer of information or advice from one entity (node) to another. Non-directional relationships, on the other hand, are represented as edges and may comprise of information sharing between members of the same organization (Cronin, 2015). The relationship between the entities is measured in terms of frequency of contact or by criteria set by the researcher.

In this study, the main aim of utilizing the SNA method is to analyze actor involvement in sustainable energy policy and planning at the local government level. Hence, the research employed two main criteria: magnitude and directionality. Magnitude refers to the frequency and strength of social interaction (Xu et al., 2018). In this study, magnitude is measured in terms of the exchange of information among actors with regards to sustainable energy development in the municipality. Actors were asked to indicate which other actors, both government and NGOs they engage with frequently (in terms of communication or exchange of information) in SET initiatives in the municipality. They were first asked to provide a brief description of the nature of their engagement in sustainable energy initiatives in the municipality. Based on this data and the criteria mentioned above, a data matrix was created where '1' and '0' were used to indicate whether or not there is a relationship between two actors or not with '1' denoting the presence of a relationship and '0' denoting the absence of one. The data gathered from this assessment formed the basis of network visualization, which was done using the NetDraw

(Borgatti, Everett, & Freeman, 2002) component of UCINET 6 software. The data gathered from this assessment formed the basis of the network visualization, which was done using the NetDraw component of UCINET 6 software.

Directionality refers to the flow or direction of the social interaction in terms of where or from whom the interaction originated and to whom it is directed. Directionality was measured in terms of where information usually originates from and to whom it is directed in the actor-network, and it was visualized with arrowheads in the diagram depicting the actor-network (see figure 4.2). Hence a line with arrow ends on both sides indicates a two-way exchange of information between actors while a line with an arrowhead on only one end shows a one-way flow of information between actors in the network. According to Putnam (2000), social resources such as information that is available to an individual is dependent on the extent to which that individual is at the center of a cohesive network. Hence the centrality measures inherent in the NetDraw software was used in ascertaining core actors and mediators within the actor-network in the municipality. Four main measures of centrality are used in this study;

- **Degree centrality:** refers to the number of other adjacent nodes (actors) that a particular node has direct connections with. The number of linkages is known as the degree of a node, and hence, the most central node (actor) in a network is the one with the highest degree (that is, the highest number of connections) (Cronin, 2015). Degree centrality is an indicator of popularity. According to Hansen et al. (2011), it is a crude measure that does not differentiate between quantity and quality. It is simply the number of connections that a node has hence, a node with ten connections will have a degree centrality of ten (Golbeck, 2015).
- **Eigenvector Centrality:** The eigenvector centrality considers not only the degree (number of connections) that an actor has but also the degree of the other actors that it is connected to (Cronin, 2015). Thus, an actor with few connections (low degree) could have a high eigenvector centrality if those connections have higher degrees. It provides a better measure for identifying core actors in the network than the degree centrality.

- **Closeness Centrality:** Closeness centrality takes into consideration the position of all other nodes in the network. It indicates how close a node is to all other nodes in the network and measures the mean distance between a node and every other node in the network. Hansen et al. (2011) explain that a low closeness centrality means that an actor is directly connected or just a step away from most others in the network. Actors at the periphery of the network may thus, have high closeness centrality scores implying that they need to go through a more extended channel or distance to connect with other actors in the network.
- **Betweenness centrality:** Betweenness centrality identifies nodes that bridge less connected parts of the network. It is the proportion of times a node appears on the shortest paths between each pair of nodes (Cronin, 2015) and it helps to identify mediators in the actor-network. It highlights an actor's role in passing information from one part of the network to another. An actor with a high betweenness centrality is more likely to know what is going on in multiple social cycles (Hansen et al., 2011) because most of the information that flows from one section of the network to the other goes through them.

3.2.6.2. Document analysis

Document analysis is a step-by-step technique for reviewing and evaluating both print and electronic documents (Bowen, 2009). It entails an examination and interpretation of data to provide meaning, to understand and to generate empirical knowledge (Corbin & Strauss, 2008). The main rationale for the use of this method is triangulation. Hence, the research seeks to draw on multiple sources of evidence in order to validate findings through the use of different data sources and methods. According to Patton (1990), triangulation enables the researcher to avoid accusations that the outcomes of the study are the product of a single source or method. Such an approach is ideal for mixed methods studies (Bowen, 2009) like this one. Yin (1994) explains that document analysis is predominantly applied to case studies which produce much detailed descriptions of a phenomenon, event or organization. It is less time-consuming, cost-effective, and many documents are readily available.

As noted earlier, document analysis involves content and thematic analysis. These two techniques are applied in this study with the aid of the ATLAS.ti software. Bowen (2009) defined content analysis as a process of organizing information into categories in accordance with the research questions. Four categories of documents were involved in this analysis; the MTDPs (for the periods 2010-2013 and 2014-2017) of the municipality, the NDPC guidelines for district/municipal level planning (2010-2013 and 2014-2017), the NMTDPF (2010-2013, 2014-2017) and the Ghana Renewable Energy Master Plan. In doing the content analysis, both documents were imported into the ATLAS.ti software. The researcher read the documents and organized the information into categories by assigning specific quotations and codes to sections that are related to sustainable energy issues. The word cloud feature of the ATLAS.ti software was used to generate word clouds with specific emphasis on energy-related keywords in the MTDPs. These word clouds enabled the researcher to examine the level of attention given to energy issues in the local government plans as well as to compare the emphasis placed on conventional and non-conventional energy development in the plans.

Thematic analysis, on the other hand, involves recognition of patterns within the data, with the resulting themes forming the categories for analysis (Fereday & Muir-Cochrane, 2006). This analysis entails a more careful and in-depth reading and review of the documents. Following the initial categories generated in the content analysis, the researcher did a careful review of the categories to identify specific patterns with regards to the study objectives. The difference between the first and second categorization is that the first stage only identifies categories based on general information relating to energy issues in the documents under review while the second stage entails a more detailed analysis of these categories to identify themes/patterns that relate to the subject matter; local governance and sustainable energy transitions. Results obtained here were presented and discussed alongside the interview data obtained from primary sources.

3.2.7. Presentation of results

Network visualization using the NetDraw software is used to present results of the quantitative network analysis of actor involvement in sustainable energy initiatives in the municipality. Word clouds generated from the ATLAS.ti software were also used to present the result of the content analysis focusing on energy-related keywords in the

MTDPs. Qualitative data obtained from FGDs and key informant interviews were transcribed and imported into the ATLAS.ti software where codes were assigned to specific themes in each interview data. Outputs of the codes with their corresponding quotations were generated, and the patterns were used for analysis. Results were discussed and where necessary quotations were presented verbatim to support the findings.

3.2.8. Ethical considerations

For ethical purposes, the researcher obtained an introduction letter from the PAUWES, which gave him the clearance to solicit information from the institutions and participants of this research. All data collection instruments were devoid of any personal information such as names or contact addresses. Each data collection instrument has a preamble which introduces the main aim of the research and indicates a statement of assurance that data gathered is purposely for academic work and that respondents were assured of confidentiality and anonymity. In instances where pictures and audio recordings were made, the researcher sought verbal consent from all respondents before proceeding with such recordings. Also, in presenting quotations made by respondents, no identifying information such as names, or position titles of the respondents was mentioned as the source.

4. RESULTS AND DISCUSSIONS

4.0. Introduction

This chapter presents the results from the analysis of field data. Results obtained are discussed in line with the research objectives. Hence, the chapter begins with an analysis and discussion of how local government agencies and other actors at the local level participate in sustainable initiatives and the nature of such initiatives. An examination of how sustainable energy planning and implementation can be mainstreamed in the local government planning system is presented next while the institutional capacity of various local government agencies is discussed in the last section. Both quantitative and qualitative results obtained from primary and secondary sources are mixed in the discussions to enable triangulation and a detailed explanation of the results. Inferences are also made to the existing literature for the purpose of comparing the results of this study to those of previous studies. This comparison helps to identify conformity or contrast with the findings made by other studies.

4.1. Local Actors' Involvement in Sustainable Energy Initiatives in Wa Municipality

Actors are formal or informal individuals or groups which influence the formulation and implementation of solutions to address public problems (Cahn, 2012). Shannon (2003) adds that these individuals or groups are directly or indirectly associated with or affected by the policy process and they can include governments, NGOs, business, communities and Civil Society Organizations (CSOs). The principal actors identified in the sustainable energy sector in Wa municipality include local government agencies, NGOs, Ministries, Departments and Agencies (MDAs), and private sector organizations. The ensuing subsection discusses the activities of the various actors in details.

4.1.1. Types of actors and the nature of their involvement in sustainable energy initiatives

The study revealed 13 main actors in sustainable energy initiatives in the Wa municipality (see figure 4.1). Two beneficiary communities of sustainable energy projects were also included. Hence a total of 15 actors were analyzed.

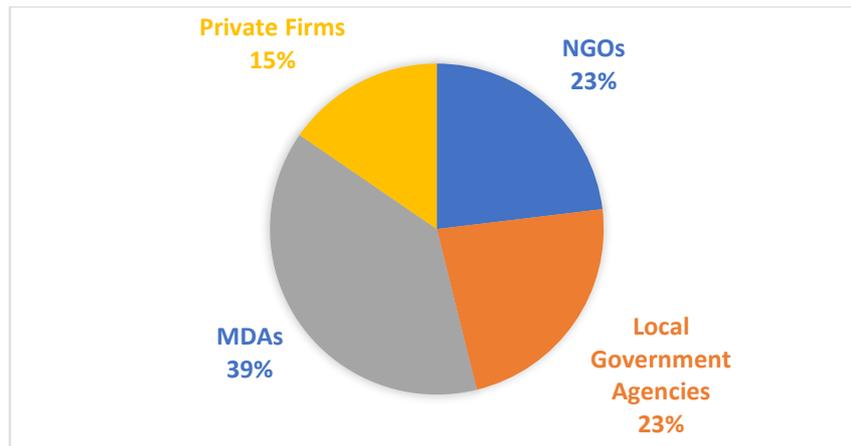


Figure 4. 1: Key actors in SET initiatives in Wa municipality

The roles and types of initiatives vary between the actors in the municipality. While some actors' activities are primarily concerned with sustainable/renewable energy development and utilization, other actors' activities are not directly focused on sustainable energies. An NGO such as WaterAid, for instance, is primarily into the provision of clean water and sanitation services to communities. However, it relies on solar-powered water pumping systems in providing water to the communities due to the unreliable nature of electricity supply from the national grid. The EPA is particularly concerned with environmental conservation, but in so doing, it organizes programs to sensitize rural communities (especially women) on sustainable use of fuelwood (mostly through the use of locally made improved cookstoves). It also undertakes woodlot projects across rural communities in the municipality.

Also, the Statistical Service Department is primarily responsible for the collection, analyzes and dissemination of data. Thus, its activities are not directly focused on sustainable energies, but it collects and analyze data on energy especially at the household level and makes these data available for planning and other purposes upon request by the Energy Commission, local government agencies and NGOs. An interviewee at the Statistical Service Department stated the department's key role with regards to energy as: *“By our mandate, we coordinate the production of all statistical activities in the country. So, we provide technical support to the Energy Commission in their statistical needs”*. The RPCU coordinates the activities of the local government agencies, especially development planning in the entire region. Hence, even though it is at the apex of the local government structure, it only coordinates and does not initiate any sustainable energy projects. WaterAid, the EPA and the Statistical Service Department and the RPCU can

thus, be considered as secondary actors in SET at the local level since their activities are not directly focused on the development and utilization of renewable/sustainable energies.

Table 4.1 presents a summary of all the actors and their activities.

Table 4. 1: Types of local actors and the nature of their involvement in SET activities

Name of Actor	Type	Description of the actor's role in planning and implementation of sustainable energy initiatives.
Regional Planning and Coordinating Unit (RCPU)	Local government	The RCPU is a unit of the RCC which is at the apex of the local government structure. It coordinates all development planning and implementation activities of the municipal Assembly and state agencies within the Upper West Region.
Municipal Planning and Coordinating Unit (MCPU)	Local government	The MCPU is responsible for planning and implementation of development projects for all sectors (including energy) at the municipal level. It also coordinates the activities of other decentralized departments, NGOs and private sector actors in the municipality.
Community Development Department (CDD)	Local government	The CDD is a member of the Municipal Planning and Implementation Committee. It engages communities to get their needs for incorporation into the municipal medium-term development plan. It also works with NGOs in sustainable energy initiatives at the community level.
Statistical Service	State agency	It is the government agency

Department		responsible for collecting and analyzing statistical data for, and on behalf of the government. It provides data for planning at the local government agencies. It usually collects household-level data, including data on various energy sources.
Volta River Authority	State agency	State agency responsible for generating, transmission and distribution of electricity (from both renewable and non-renewable sources).
Environmental Protection Agency	State agency	State agency responsible for environmentally sustainable development. It partners with NGOs to train local communities on sustainable use of fuelwood and also undertakes community-based woodlot projects in the municipality.
Ministry of Energy	State Agency	Responsible for energy policy formulation, implementation, monitoring and evaluation as well as supervision and coordination of activities of Ghana's Energy Sector Agencies. Initiated an ICT project which saw the installation of solar PV systems for 25 rural schools in the Municipality.
Energy Commission	State agency	State agency responsible for the regulation, management, development and usage of energy resources in Ghana. It regulates electricity, natural gas and RE industries in Ghana.

PronetNorth	NGO	An NGO focused on poverty reduction, gender equality, ecological balance and human dignity. It implements projects that enhance the adoption of sustainable/renewal energy at the community /local level in the municipality.
Netherlands Development Organization (SNV)	NGO	An international NGO focused on poverty alleviation and improving access to basic services such as energy, water, hygiene and sanitation. It has implemented sustainable cookstove projects across some rural communities in the municipality.
WaterAid	NGO	An international NGO primarily focused on improving access to clean water, toilets and hygiene. Implements solar water pumping projects for rural communities in the municipality.
PUMPTECH	Private firm	A private sector firm which is into the sale and installation of solar water pumping systems in the municipality.
Best Solar	Private firm	A private firm which is mainly into the sales and installation of solar PV systems and applications.

4.1.2. Sustainable energy actors' network in Wa municipality

The network of actors in the municipality is characterized by a wide range of interactions between NGOs, MDAs, private firms and local government agencies. Private firms are mainly contracted by either NGOs or state agencies to undertake installations of solar systems for them. Hence the nature of the interaction (defined in the context of this study as the exchange of information and communication with regards to the development and utilization of sustainable energies) is mostly one-way with the source of interaction often

emanating from the NGOs or state agencies such as the Energy Commission. However, an interviewee at PUMPTECH, a private sector firm indicated that their organization has presented its profile to the local government agencies particularly the MCPU and the CDD so that they can be contacted in case their services are needed. Both private sector firms (Best solar and PUMPTECH) are also constantly in touch with private individuals and households through advertisements. Hence to complete the network, a dummy variable for private individuals/households (PI) was introduced. These private individuals are therefore not considered as major actors even though they form a part of the network. Data gathered from private firms indicates that their clients are mostly institutions and NGOs due to the high cost of the solar systems. However, a few individuals who can afford the systems also form part of their clients. A respondent at PUMPTECH recounted that “... *our clients are mostly NGOs because of the expensive nature of the solar systems. They include World Vision, UNDP, Community Water and Sanitation Agency (CWSA), FAO and a few private individuals who can afford it*”. Figure 4.2 shows the sustainable energy actor-network in the Wa municipality.

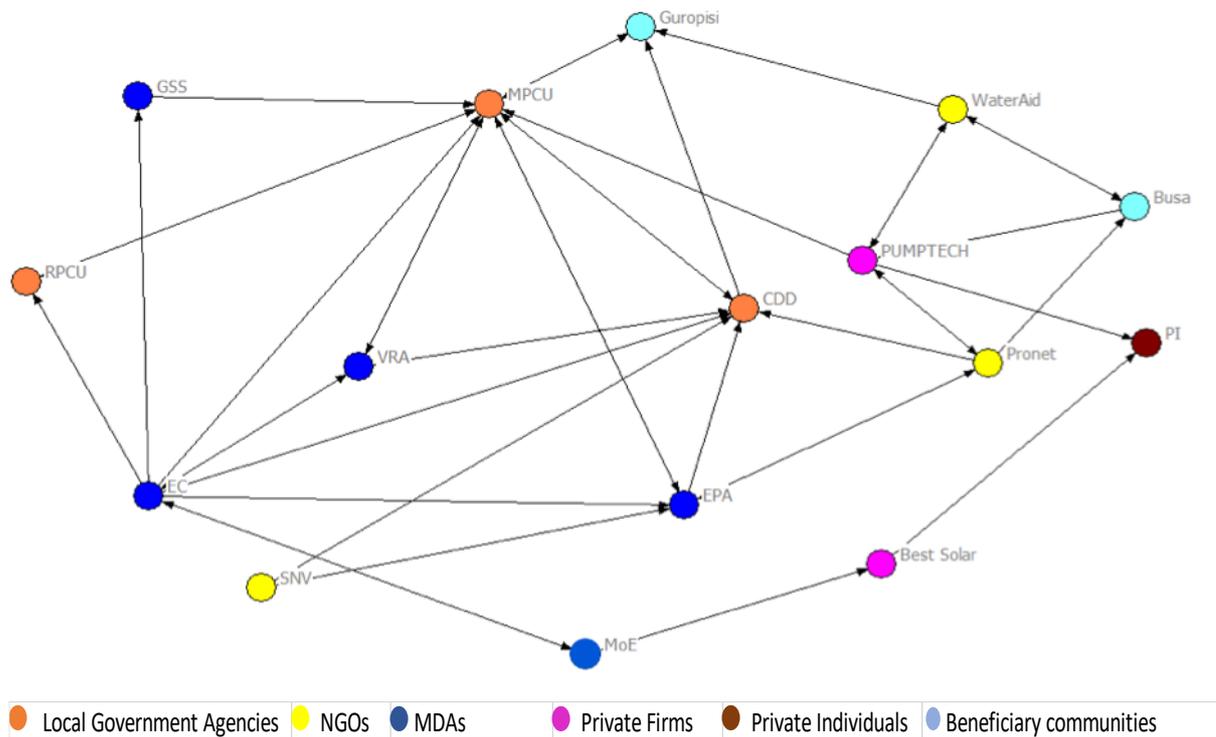


Figure 4. 2: The sustainable energy actor-network in Wa municipality.

Figure 4.2 portrays a series of directional relationships (in terms of exchange of information and communication) between the actors in the system. There are no non-directional relationships in the network because all actors are from different organizations;

thus, there is no exchange of information between members of the same organization. Cronin (2015) explains that non-directional relationships comprise of information sharing between members of the same organization. Observably, there are one-way and two-way interactions among the actors. The lines with only one arrowhead indicate a one-way interaction while those with arrowheads on both ends indicate a two-way exchange of information and interaction between actors. For example, there is a one-way interaction between the EC and the RCPU, the EC and the MPCU, and, the EC and CDD with the source of interaction being the EC. This relationship is based on the data gathered from the local government and state agencies and affirms the findings from the local government agencies which indicated that they only get involved in sustainable energy initiatives of the EC when they need to perform some functions for it. For instance, when asked whether they coordinate the activities of the EC, an interviewee at the RCPU stated that “...we only get involved if they are undertaking any projects that require our coordination or participation.” Similarly, an interviewee at the CDD recounted that “...unless the Energy Commission needs us to do something for them (like data collection), we usually don't do much on energy” while the MPCU indicated that the EC mostly engages it in policy briefing meetings.

On the other hand, there are two-way interactions between agencies such as the MPCU and CDD, RCPU and MPCU mainly resulting from the coordination of development planning and implementation at the local level. The MPCU, for instance, relies on the CDD for community needs and aspirations which it incorporates into the MTDP while the RCPU coordinates the activities of the MPCU hence, there is a constant interaction between these actors. Two-way interactions between state agencies such as the EPA and local government agencies such as the MPCU often result from collaborations on sustainable energy projects and also due to the fact the MPCU coordinates the developmental activities of all state agencies and decentralized departments at the local level. The MPCU also works hand-in-hand with the VRA in extending electricity supply to communities within the municipality. Data gathered from the VRA indicates that the MPCU with the aid of the CDD often selects communities to which the national grid is to be extended for electricity supply. The VRA carries out such extension projects. The findings above support Foxon's (2011) assertion that energy transition results from the interaction between elements such as institutions, business strategies, technology and user

practices. The actor-network shows that all actors in the municipality are in one way or the other connected and some of them do collaborate on sustainable energy projects.

4.1.2.1. Core actors within the actor-network

Degree and eigenvector centrality scores are used to identify the core actors in the actor-network. Table 4.2 summarises the scores of all centrality measures of the actors. The degree centrality scores from the actor-network show that local government agencies such as the MPCU, CDD and the EC (state agency) are the core actors in the sustainable energy sector in the municipality with degree scores of 8, 7 and 7 respectively. These scores imply that they have the highest number of connections in the actor-network. However, as noted by Hansen (2011), degree centrality is merely an indicator of popularity and does not really differentiate between quantity and quality. It simply measures the number of actors that a particular actor is connected to. Hence, the popularity of actors such as the MPCU and the CDD is primarily tied to the fact that most of the other actors in the network contact them before implementing their activities in the municipality. The MPCU, as mentioned earlier, coordinates all developmental activities at the local level while the CDD works with other state agencies and NGOs in meeting the needs and aspirations of local communities. Based on the degree centrality scores, the least popular actors in the network are the RCPU, GSS, MOE, SNV and Best Solar.

Table 4. 2: Centrality scores for actors in the network

Actor	Centrality Measures			
	Degree	Betweenness	Closeness	Eigenvector
RPCU	2.00	0.00	34.00	0.18
MPCU	8.00	29.85	23.00	0.46
GSS	2.00	0.00	34.00	0.18
CDD	7.00	16.92	25.00	0.43
VRA	3.00	0.00	31.00	0.27
SNV	2.00	0.00	38.00	0.16
PUMPTECH	5.00	24.13	27.00	0.20
Pronet	4.00	8.07	30.00	0.22
EC	7.00	23.63	26.00	0.40
EPA	5.00	7.72	28.00	0.35

WaterAid	3.00	2.25	36.00	0.11
MoE	2.00	8.50	36.00	0.09
Best Solar	2.00	2.50	41.00	0.03

The Eigenvector centrality provides a better measure for identifying core actors in the network than the degree centrality. It provides a better measure because it does not only consider the degree (number of connections) that an actor has but also the degree of the other actors that it is connected to (Cronin, 2015). Thus, despite having a low degree centrality, an actor could have a high eigenvector centrality if the other actors that it is connected to, have higher degree centralities (more connections). From table 4.2, it could be seen that even though actors such as the RCPU, GSS, MOE, SNV and Best Solar all have degree centralities of 2, their eigenvector centralities differ with the RCPU and GSS having the highest score of 0.18. These scores imply that the RCPU and GSS are popular actors than the MOE, SNV and Best solar because many of the actors they connected to (such as the MPCU, CDD, EC and PUMPTECH), have higher degree centralities while the MOE, SNV and Best Solar are connected to actors with lower degree centralities. PUMPTECH is popular than its rival firm (Best Solar) and many of the NGOs because the firm does the installation of solar systems for several governmental and non-governmental organizations in the municipality. This in part is due to the fact that the firm has submitted its organizational profile to the local government agencies such as the MCPU and also has Pronet North (an NGO which undertakes sustainable energy initiatives in the municipality) as its key partner.

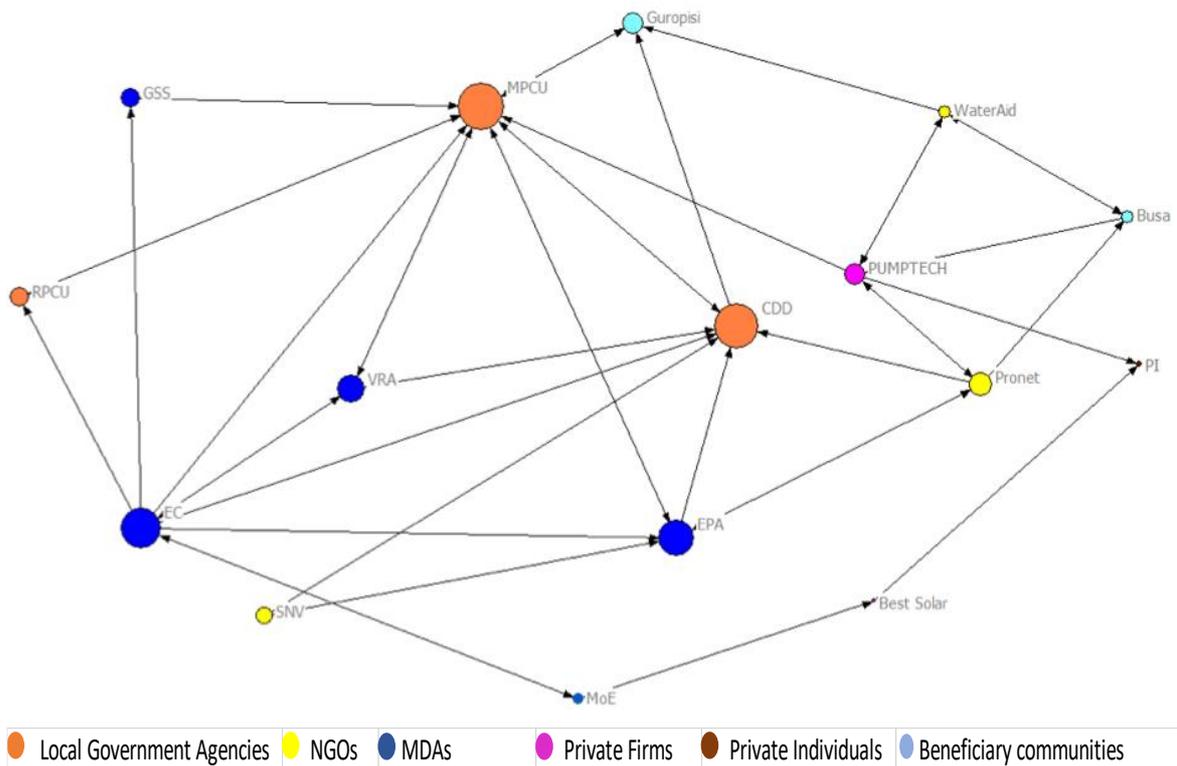


Figure 4. 3: Eigenvector centrality of actors in the network

4.1.2.2. Mediators within the actor-network

Betweenness centrality helps to identify mediators within the actor-network. It indicates an actor's role in sharing information from one part of the network to another. The MPCU has the highest betweenness centrality with a score of 29.85. Given its role of coordinating all developmental projects and activities of all other agencies in the municipality, the MPCU serves as an important connection between all the actors. PUMPTECH is the second popular mediator in the actor-network. The firm executes the projects of many of the actors, especially the NGOs and serves as the implementational link between the local government agencies, local communities and NGOs. For instance, after installation of solar systems in local communities, the firm trains a few individuals at the community level to operate and undertake basic maintenance of the project. In the event where there is a major problem, the community members inform the firm, and if there is the need for changing some major components, the firm, in turn, informs the authorities in charge of the project for funds to buy and install the component. An interviewee at firm stated that; *“we train some people in beneficiary communities to operate and maintain the systems. But if there is a problem that is beyond their capacity, we send our technical team to work on it”*. The EC is also a principal intermediary in the actor-network. However, as seen in

figure 4.4, the EC basically connects only the state agencies and local government agencies with a mostly one-way interaction often originating from it to the other agencies.

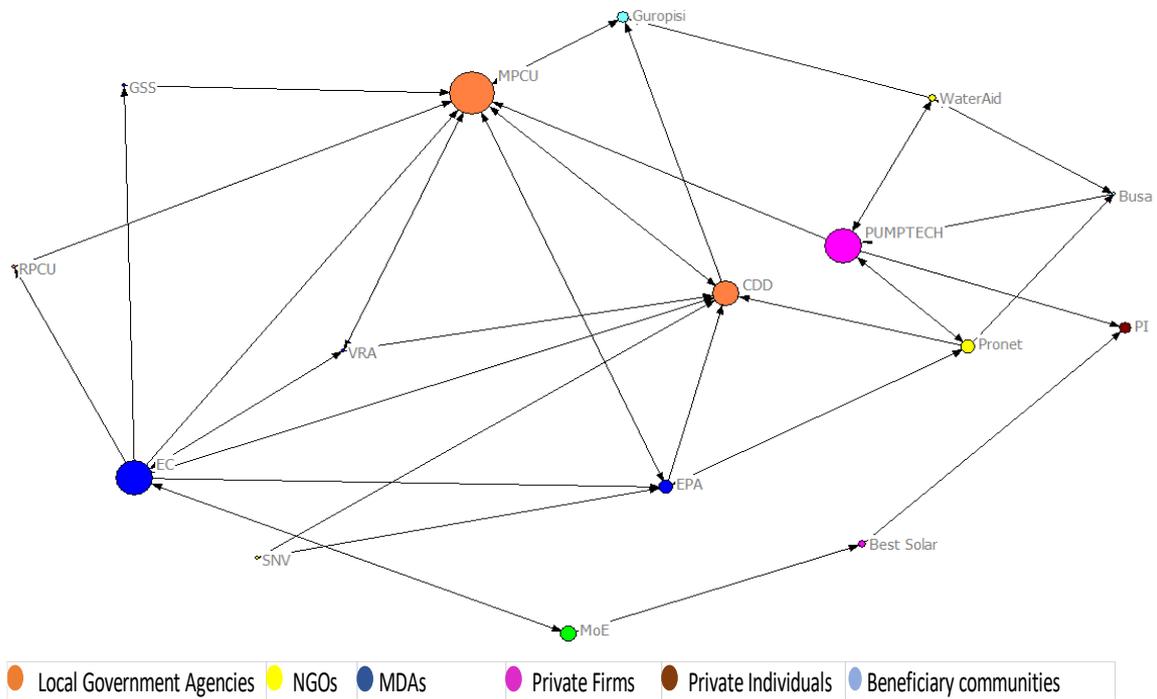


Figure 4. 4: Betweenness centrality of actors in the network.

Using the closeness centrality scores, it can be deduced from Figure 4.5 that the MPCU, CDD, EC and PUMPTECH are closer to all other actors in the network than the rest of the actors. According to Hansen et al. (2011), a low closeness centrality score means that an actor is directly connected or just a step away from most of the other actors in the network. The larger circles in figure 4.5 thus, represent actors who are farther away (with higher closeness centrality scores) from all other actors in the network whiles the small circles depict actors who are directly connected or close (with lower closeness centrality scores) to most of the other actors in the network.

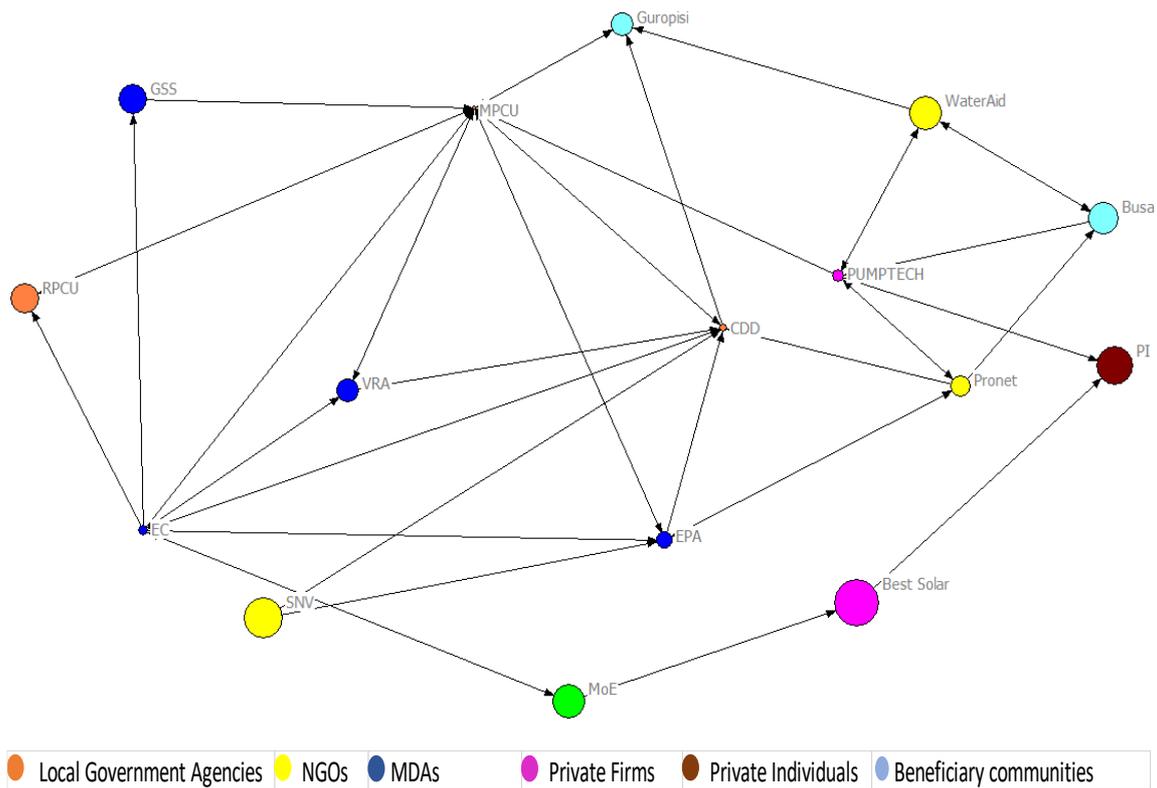


Figure 4. 5: Closeness centrality of actors in the network.

Despite being the most popular in the actor-network, results from the analysis of data gathered through interviews with the various local government agencies show that their involvement in sustainable energy planning and implementation is low. The only sustainable energy initiatives that they participated in were those initiated by the MDAs or NGOs. Hence, the local government agencies themselves have not initiated and implemented any sustainable energy initiatives of their own. Interviews with the RCPU, MCPU and CDD all revealed that they only get involved when the Energy Commission needs them to perform a specific function or when some NGO or state agency is carrying out a project that requires their participation. A respondent at the CDD, for instance, recounted that the department only participated in collecting community-level data on energy consumption for the Energy Commission. When queried as to whether the department has ever participated in any sustainable energy-related initiative, the respondent indicated that: *“Yes. We administered questionnaires to gather data on energy consumption in the municipality. This was done for the Energy Commission”*. The MPCU’s involvement in renewable/sustainable energy initiatives is also low as compared to its participation in other sectors such as health and education. A review of the 2010-2013 and 2014-2017 MTDPs of the municipality, for instance, found no projects on

sustainable/renewable energies even though projects on electricity supply through the extension of the national grid were found (see section 4.2). Data gathered from the MPCU shows that despite having carried out an awareness program on renewable energies, the unit's limited involvement in the planning and implementation of sustainable energy initiatives is not because it does not have the ability to do so but rather, it is because of the centralized nature of how such initiatives are carried out. An interviewee at the unit asserted that:

We participate more often in sectors such as education and health than renewable/sustainable energy. It is not because we cannot do these things; it is because everything is done at the top. Even though issues of renewable energy are incorporated under the Infrastructure and Human Development dimension of the new Medium-Term Development Framework, it does not mention local government agencies as implementing or collaborating agencies (Respondent, MPCU).

The respondent at the MCPU added that incorporating sustainable energy projects into the municipal medium-term plan *"is also a matter of priority and how the community see it as a felt need"*. This statement suggests that perhaps, sustainable energies are currently not a priority to the local government in the municipality. On the part of the communities, the non-recognition of sustainable energy as a felt need can be attributed to the low level of public awareness on renewable energy systems and their benefits in Ghana as a whole. Bensah, Kemausuor, Antwi, and Ahiekpor (2015), and Hagan (2015) identified inadequate public education and awareness on various types and benefits of renewable energy technologies as a key policy gap in Ghana's RE sector. The low level of involvement of local government agencies in sustainable energy planning is also reflected in their lack of awareness of the Ghana Renewable Energy Master Plan. The plan was prepared in recognition of the fact that most renewable energy initiatives in the country are either pilot projects or are being carried out on short-term planning cycles (Energy Commission, 2019). Therefore, the plan has a principal objective of addressing this shortfall by providing a framework for the long-term promotion and development of Ghana's renewable energy resources. However, both the MPCU and the CDD have not heard about this plan while an interviewee at the RCPU stated that *"I have heard about it.... but I don't really know much about it"*. Even though the master plan mentions NGOs and private sector actors as key collaborators in its implementation, all the NGOs and private

sector actors in the municipality are either not aware of it or have only heard about it but they do not know their specific roles in its implementation. In all, 70% of the actors are not aware of the plan while 30% have only 'heard about it'. Inferring from the above discussions and findings, it could be deduced that local government agencies play a facilitative rather than a direct role in promoting sustainable energy initiatives. Bawakyillenuo, Olweny, Anderson, and Borchers, (2018), explain that the role of local governments in promoting sustainable energy can be described as facilitative where they do not have direct mandates and they undertake activities such as awareness creation.

4.1.3. Nature of sustainable energy interventions in Wa municipality

The absence of sustainable energy projects in the MTDPs prompted the need to examine how such projects are delivered in the municipality. Two beneficiary communities (Busa and Guropisi) of some sustainable energy projects were used as case studies to understand the nature of sustainable energy initiatives in the municipality.

4.1.3.1. Case study 1: A solar lighting project in Guropisi

Guropisi is a small rural community in the Wa municipality. The community is located to the north-eastern part (geographic coordinates 9.976984, -2.321265) of Wa, the municipal and regional capital on the Wa-Sandema road. In 2013, the Ghana Cocoa Board (COCOBOD) launched an initiative to supply solar street lights to cocoa, coffee and shea nut growing communities across the country. Guropisi is one of the communities that benefitted from the project primarily because it was not connected to the national grid as at that time. The project was delivered through the Wa municipal assembly which installed seven solar street lights in the community. Participants of a Focus Group Discussion in the community indicated that the lights were strategically sited in the community based on clusters of houses. Plate 4.1 shows some of the street lights installed in the community.



Plate 4.1: Solar street lights in Guropisi

During its implementation, the community members provided manual labor, and after the installations were complete, a committee was set up at the community level to monitor and operate the lights. Apart from providing lighting at night, the project also yielded some benefits to the community members. A participant in the FGD is quoted saying; “...*the lamps stopped theft cases in the community and also helped to prevent bad adolescent behavior among our children because the lights made it easier for them to be monitored at night*”. The participants recounted that, prior to the solar street lights, theft cases were frequent in the community. A manifestation of these theft cases was evident in what remains of a solar water pumping system that was installed in the community. Plate 4.2 shows the platform on which a water storage tank was mounted and one of the metal poles on which a solar panel was mounted. The community’s only borehole was mechanized with a solar water pump and a storage tank to make access to clean water easier. However, the solar panel was stolen and the borehole had to be returned to its initial state with a fitted handpump from which drawing water is more laborious and time-consuming.



Plate 4.2: A community member manually pumping water from the borehole

Despite the benefits that the lights brought to the community, all of the seven street lights installed in the community are currently non-functional. One of the project committee's member explained during the FGD that, they were told during the installation of the project that the batteries of the solar street lights will last for five years hence, the current state of the lights is because the batteries have elapsed their life span. When asked whether they have reported the issues to the municipal assembly, the answer was 'no,' and when queried on why they have not reported the issue, one participant simply pointed to the transmission lines of the national grid that are currently running through the community. The community members never reported the non-functionality of the solar street lights to the authorities because they are now connected to the national grid and thus, have no need for the solar street lights. The municipal assembly has also not followed up on the project to monitor the functionality of the street lights. This situation is a clear indication of the shortfalls associated with the ad-hoc nature of sustainable energy projects in the country. Since the project was not planned and implemented through the MTDP process of the municipality, no records of it were found in the projects as well as the monitoring and evaluation sections of their 2010-2013 and 2014-2017 MTDPs.

The absence of the project in the MTDP perhaps explains why they have not followed up to monitor the project. Bawakyillenuo et al. (2018a) argued that local governments could monitor project implementation more closely and quickly identify successes and failures than the central government. However, the findings above suggest that monitoring of such projects becomes ineffective when they are not incorporated into the local government plans. Ideally, once the community is now connected to the national grid, the street lights could have been fitted with new batteries and moved to other communities in the hinterlands which do not have access to electricity. The current situation in the community also highlights the problem of integrating on-grid and off-grid applications in terms of end-use. For example, since the solar street lights are already in the community, the national grid could have been connected only to the households without attaching any street lights to it. The solar street lights could lighten up the community at night while the grid electrification will be used at the household level and for in-house activities.

4.1.3.2. Case study 2: A 780 watts solar water pumping scheme in Busa

Also located to the north-eastern (geographic coordinates 10.019271, -2.390471) part of Wa, Busa is a rural community with more than two thousand inhabitants. The community has a health center which relied on water from a manually pumped borehole. A key informant from the community recounted that drawing water manually from the borehole made the delivery of healthcare at the health center very difficult. Midwives at the center, in particular, find it difficult, especially in times of delivery to get adequate water for their work. This situation made the leaders of the community to come together with health workers at the center to find a solution to the problem. They set up a management committee for the health center, which is made up of 14 people (5 females and 9 males). The assembly member and two health workers were part of the committee. The committee requested WaterAid (an NGO) to assist them with a mechanized borehole at the health center. Their request was approved and WaterAid decided to conduct a feasibility study of the project. After the feasibility study, it was decided that a solar water pumping system is best suited for the project due to the unreliable nature of electricity from the national grid. WaterAid then contracted PUMPTECH to carry out the installation of the project.



Plate 4.3: Installed solar pumping system with a water storage tank at Busa health center

In an FGD with some of the project’s committee members, they indicated that the community members provided manual labor for the project. The committee played a supervisory role in the project and is currently managing it. Some of the members of the committee have also been trained on how to operate the system. Participants of the FGD narrated that they have encountered no challenges with the project thus far and that the project has significantly improved healthcare delivery at the health center. Again, this project demonstrates that many sustainable energy initiatives do not originate from the local government agencies. In this project, no local government agency was involved. The project was carried out between the community, WaterAid and PUMPTECH.

4.2. Integrating Sustainable Energy Planning into The Local Government Planning System.

This section presents results from the content analysis of the Wa municipal MTDPs (2010-2013 and 2014-2017), the NDPC guidelines for district-level planning, the MTDF (2018-2021) and other key documents. This analysis is done to understand the extent to which sustainable energy issues are captured in these documents, how policy frameworks and planning guidelines affect local level planning for sustainable energies and how they can be mainstreamed into the MTDPs.

problems related to sustainable energies are identified in the 2010-2013 MTDP (underdeveloped solar energy sources due to lack of technology and high consumption of charcoal). However, the only energy-related projects formulated in this plan do not address the problems mentioned above. All three projects are focused on extending the national grid.

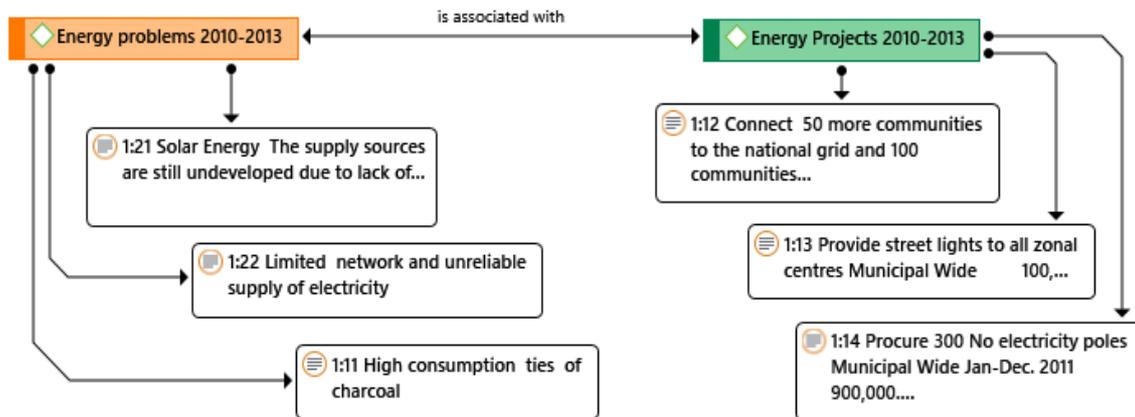


Figure 4. 7: Energy problems and projects in the 2010-2013 MTDP.

A principal energy-related objective set out in the ‘Municipal Development Objectives and Strategies’ section of the 2014-2017 MDTP is to “*expand energy supply to meet the needs of residents and local industry*” and one of its corresponding strategies is to “*encourage the use of improved stoves and environmentally friendly energy sources (solar, biogas, etc)*” (Wa Municipal Assembly, 2014, p. 74). However, no projects were found on this strategy in the Composite Programs of Action of the MTDP. Out of 188 projects, only 1.1 percent of the projects in the 2014-2017 MTDP deal with energy and they are all focused on electricity access through grid extension. Even though high charcoal consumption is mentioned as a problem in the MTDP (see figure 4.8), no projects were formulated to address this issue. The presence of this problem in both MTDPs highlights the severity of the issue of unsustainable use of wood-based fuels in the municipality. This problem prompted the EPA to embark on its sustainable cookstoves and woodlots projects. Data gathered from the EPA indicate that they organize sensitization programs on sustainable wood fuel usage and train rural women on how to make improved cookstoves and also create woodlots in the municipality.

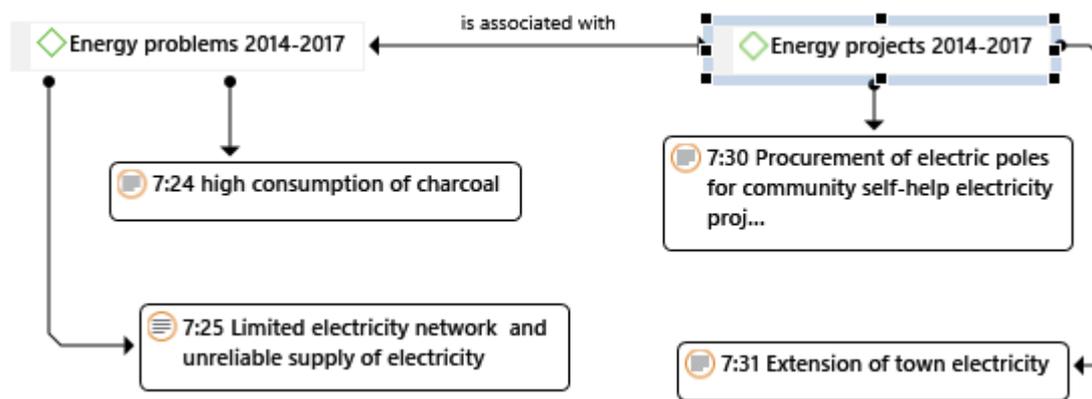


Figure 4. 8: Energy problems and projects in the 2014-2017 MTDP

The findings above affirm Bawakyillenuo et al. (2018) findings that local governments involvement in decentralized renewable energy generation in Ghana is limited. They pointed out that the local government has limited powers while the central government does the “lions share. In an attempt to understand this situation, the ensuing section presents the results of a content analysis of various documents concerning sustainable energy planning at the local level with the aim of ascertaining how planning guidelines and policy frameworks affect local government involvement in sustainable energy planning at the local level.

4.2.1. Planning guidelines, policy frameworks and local level energy planning: the missing link.

As posited in the conceptual framework (figure 2.6), national policy frameworks are expected to significantly shape how sustainable energy activities are undertaken at the local government level. From a theoretical perspective, these planning guidelines and policy frameworks form part of the ‘landscape’ within which the local governments operate. As discussed in section 2.3.4.3, development planning in Ghana follows a bottom-up process where local government units prepare MTDPs for the development of their districts with guidelines from the NDPC. To ensure that these plans are in line with the developmental objectives or priorities of the central government, MMDAs are often required to organize their plans in accordance with the Medium-Term Development Policy Framework (MTDPF) of the government. For instance, it is clearly stated in 2010-2013 guidelines for district-level planning that; “*The Guidelines are designed to provide focus and direction on national development priorities and enhance harmonization and rationalization of development programs, projects and activities initiated from the*

community, district and national levels respectively” (NDPC, 2009, p. i). Hence for every medium term (which is usually four years) a new set of guidelines are prepared under the MTDPF of the ruling government for the preparation of MTDPs by the MMDAs. This process is also stated in the preface of the 2010-2013 NDPC guidelines for district-level planning; “...*the current Guidelines are therefore designed to facilitate the preparation of DMTDPs under the Medium-Term Development Policy Framework (MTDPF 2010-2013)*” (NDPC, 2009, p. i). Similarly, the linkages between district-level planning and the MTDPF is reiterated in the 2014-2017 NDPC guidelines as:

The Guidelines, which are a set of proposals based on the synergy between the National Medium-Term Development Policy Framework (NMTDPF) and the principles of Programme Based Budgeting (PBB), are meant to assist MMDAs in translating the policies and strategies in the NMTDPF into their Medium- Term Development Plans (MTDP) for implementation (NDPC, 2013, p. 1).

The NMTDPF is often organized into thematic areas, and consequently, MMDAs are required to organize the programs and projects in their MTDPs according to these thematic areas. Both NMTDPFs for 2010-2013 and 2014-2017 NMTDPF had seven thematic areas. The thematic areas of the NMTDPF for 2010-2013 are;

- Improvement and Sustenance of Macroeconomic Stability
- Expanded Development of Production Infrastructure
- Accelerated Agriculture Modernization and Agro-Based Industrial Development
- Sustainable partnerships between Government and the Private Sector
- Developing Human Resources for National Development
- Transparent and Accountable Governance
- Reducing Poverty and Income Inequalities (NDPC, 2009)

Thematic areas of the 2014-2017 NMTDPF are listed below

- Ensuring and sustaining macroeconomic stability
- Enhancing the Competitiveness of Ghana’s Private Sector
- Accelerated Agriculture Modernization and Sustainable Natural Resource Management
- Infrastructure and Human Settlement

- Oil and Gas Development
- Human Development, Productivity and Employment
- Transparent and Accountable Governance (NDPC, 2013)

Energy is not explicitly mentioned in the thematic areas of the 2010-2013 NMTPDF. A difference is, however, observed between the thematic areas spelled out in the district guide and those enshrined in the NMTPDF 2010-2013 (also known as the Ghana Shared Growth and Development Agenda-GSGDA I). For instance, the sixth thematic area in the GSGDA I is ‘Infrastructure, Energy and Human Settlements Development’. This thematic area is, however, missing among by those spelled out in the district guidelines for 2010-2013 MTDP by the NDPC (NDPC, 2009). This situation perhaps explains why energy issues have not received much attention in the MTDP. The three energy projects found in the MTDP were listed among projects found under ‘Expanded Development of Production Infrastructure’ section in the 2010-2013 MTDP of the Wa municipal district. A possible reason for the difference in thematic areas presented in the NDPC guidelines and those spelt out in the GSGDA 1 is that, the NDPC stresses in 2010-2013 guidelines that: *“using the MTDPF 2010- 2013 as the main source of reference to prepare the DMTDPs, particular attention should be paid to sections where the DAs have been mentioned as either lead or collaborating agencies”* (NDPC, 2009, p. 6). Hence, the local government agencies are encouraged to mainly focus on policy objectives and strategies that mention them as lead or collaborating agencies. Consequently, a review of the GSGDA 1 showed that, even though issues of sustainable energy development are well-captured and discussed in detail, policy objectives and strategies for their development did not list MMDAs or local government units as lead or collaborating agencies.

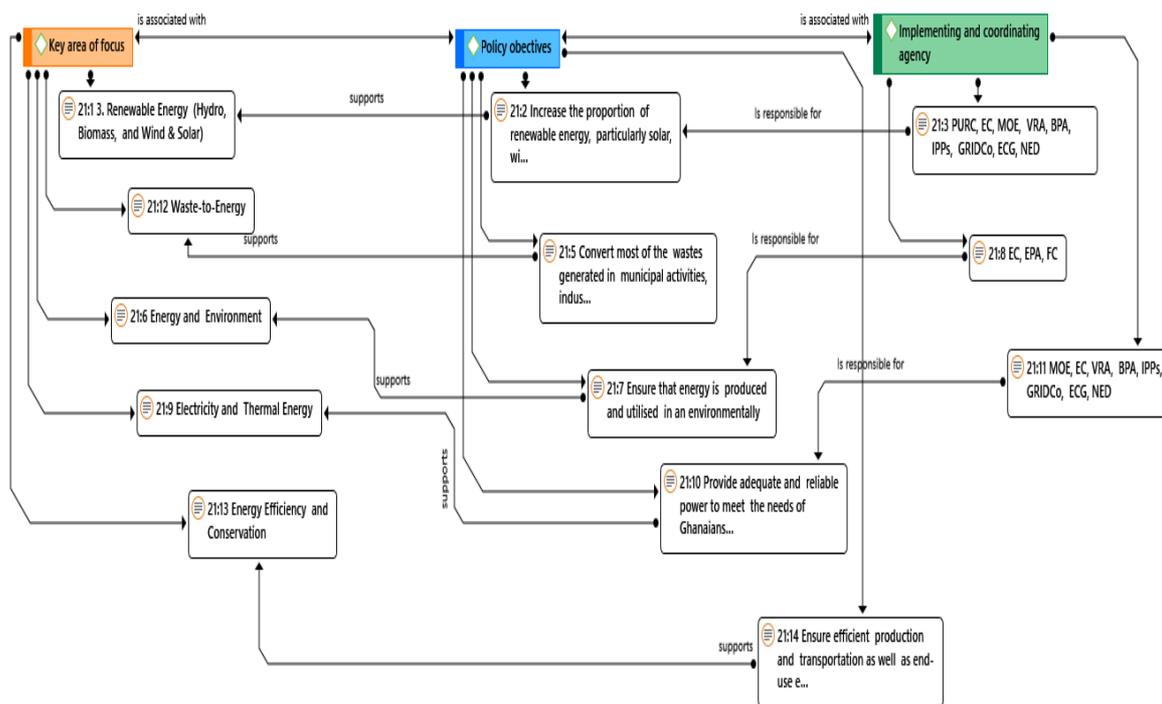


Figure 4. 9: Policy objectives and their implementing/coordinating agencies in the NMTDPF, 2010-2013.

As seen in figure 4.9, the implementing and coordinating agencies for all the energy related-projects in the NMTDPF do not include MMDAs. Instead, central government agencies such as the Ministry of Energy, Energy Commission, Volta River Authority, Electricity Company of Ghana, among others are those given the responsibility to implement and coordinate these policy objectives. The NMTDPF of 2014-2017 has a major energy-related theme (oil and gas development). However, as seen in figures 4.7 and 4.8, energy-related projects are fewer in the 2014-2017 MTDP (two projects) than the 2010-2013 MTDP (three projects), and none of the projects is on oil and gas development. The absence of oil and gas issues in the MTDP is due to the fact there are no crude oil or natural gas resources in the Municipality and even if present, the exploration of such resources is the duty of the state and not the local government. The absence of oil and gas resources is the same for the majority of districts in Ghana because the oil resources are only found in the Western Region of Ghana and the exploration of these resources is overseen by the state agency known as the Petroleum Commission Ghana.

A review of the NMTDPF for 2014-2017 yielded virtually the same results as those obtained above. In exception of waste-to-energy development where MMDAs were listed as implementing and collaborating agencies, all other sustainable energy projects had

central government agencies and ministries as the implementing and collaborating agencies. Similarly, the current NMTDPF (2018-2021) does not assign the responsibility for implementing policy objectives related to sustainable energy development to MMDAs. As seen in figure 4.10, MMDAs are not listed as implementing or collaborating agencies for policy objectives that deal with sustainable energy development.

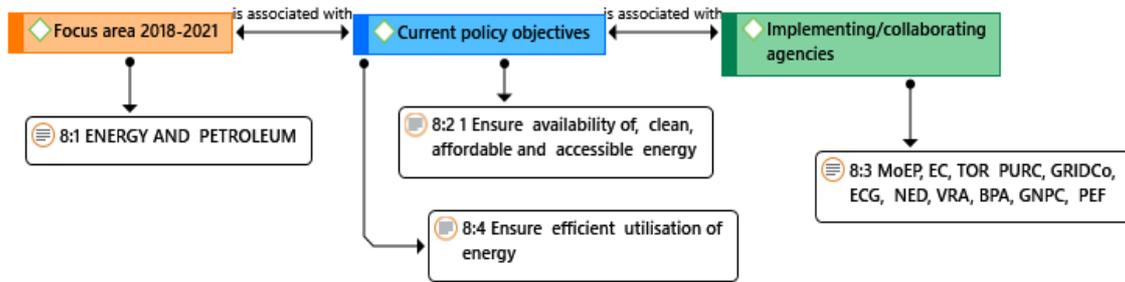


Figure 4. 10: Sustainable energy-related policy objectives and their implementing/coordinating agencies in the NMTDPF, 2017-2021.

Findings from figure 4.10 affirm the assertion made by an interviewee at the MPCU that “*even though issues of renewable energy are incorporated under the Infrastructure and Human Development dimension of the new Medium-Term Development Framework, it does not mention local government agencies as implementing or collaborating agencies*”. Havet et al. (2009) argued that enhancing sustainable energy access especially in rural areas can be rapidly achieved if national policies promote decentralized planning and local governments are given the mandate to address energy needs at the community level. From the above findings, it is clear that national policy frameworks that guide development planning activities at the local government level in Ghana have not paid much attention to giving local governments the responsibility to plan and implement sustainable energy initiatives. This situation is acknowledged in the Ghana Renewable Energy master which identifies the lack of clear initiatives to integrate renewable energies into development plans as one of the challenges to RE development at the MMDA level (Energy Commission, 2019). The EC also recognize the fact that “*at the national level, significant advances have been made in the development and promotion of renewable energy, however not much focus has been placed in decentralizing the planning and development process*” (Energy Commission, 2019, p. 43).

Consequently, incorporating REs into district development plans has been identified in the Renewable Energy Master Plan as one of the strategies to address the above challenge.

However, the plan does not state specifically how this integration will be done and very little emphasis is placed on the role of MMDAs in the implementation arrangements of the plan. As seen in the quotation below, MMDAs are not listed among the main institutions identified as implementors of the master plan. According to the Energy Commission (2019, p. 48), the plan will be implemented by Components “Implementation Entities and Beneficiaries (CIEBs)”, and these CIEBs include;

Energy Commission, Public Utilities Regulatory Commission, National Petroleum Authority, Forestry Commission, Ministry of Food & Agriculture, Ghana Irrigation Development Authority, Ghana Grid Company, Training & Research Institutions, Electricity Distribution Companies, Public Electricity Generation Companies, Renewable Energy Private Sector Companies, Civil Society Organizations, etc.(Energy Commission, 2019, p. 48).

Inferring from Havet et al. 's (2009) standpoint, the failure of the various NMTDPFs to assign sustainable energy development responsibilities to the MMDAs is a significant limitation to the rapid development and utilization of sustainable energies at the local level. As stressed by the NDPC in the 2010-2013 guidelines for district-level planning, the MMDAs are often encouraged to focus on aspects of the NMTDPF that mentions them as implementing and collaborating agencies. Obviously, the above content analysis has shown that policy objectives dealing with sustainable energy virtually have no MMDAs as collaborating and implementing agencies. Thus, the low level of attention paid to sustainable energy issues in the MTDPs of the Wa municipality can be attributed to the failure of the NMTDPF to assign such responsibilities to the MMDAs and also the lack of clear initiatives to mainstream sustainable energies in local plans as identified by the EC. These findings also support Havet et al.'s (2009) findings that the connections between energy and decentralization were hardly addressed in policy documents of many LDCs and SSA countries.

4.2.2. A proposed framework for integrating sustainable energies into local development plans

According to van Standen (2017), local governments understand where challenges with regards to sustainable energy come from, they can assess local renewable energy

resources and how these resources can be optimized, and they can also identify the strengths, weaknesses, opportunities and threats with regards to renewable energy development in their respective jurisdictions. This standpoint implies that local governments are better placed in planning for sustainable energy needs of their communities. In accordance with the principle of subsidiarity and the recognition of the fact that local governments can better assess local resources and plan development in general, the NDPC has established a decentralized planning system which is conceptualized in figure 2.4 by Inkoom (2009). Based on figure 2.4, a framework for integrating sustainable energies into the decentralized planning system is proposed in figure 4.11. The blue boxes and lines with black color represent the original decentralized planning system as conceptualized by Inkoom (2009) whiles the yellow boxes and yellow lines represent the proposed additions for integrating Sustainable Energies into the MTDPs.

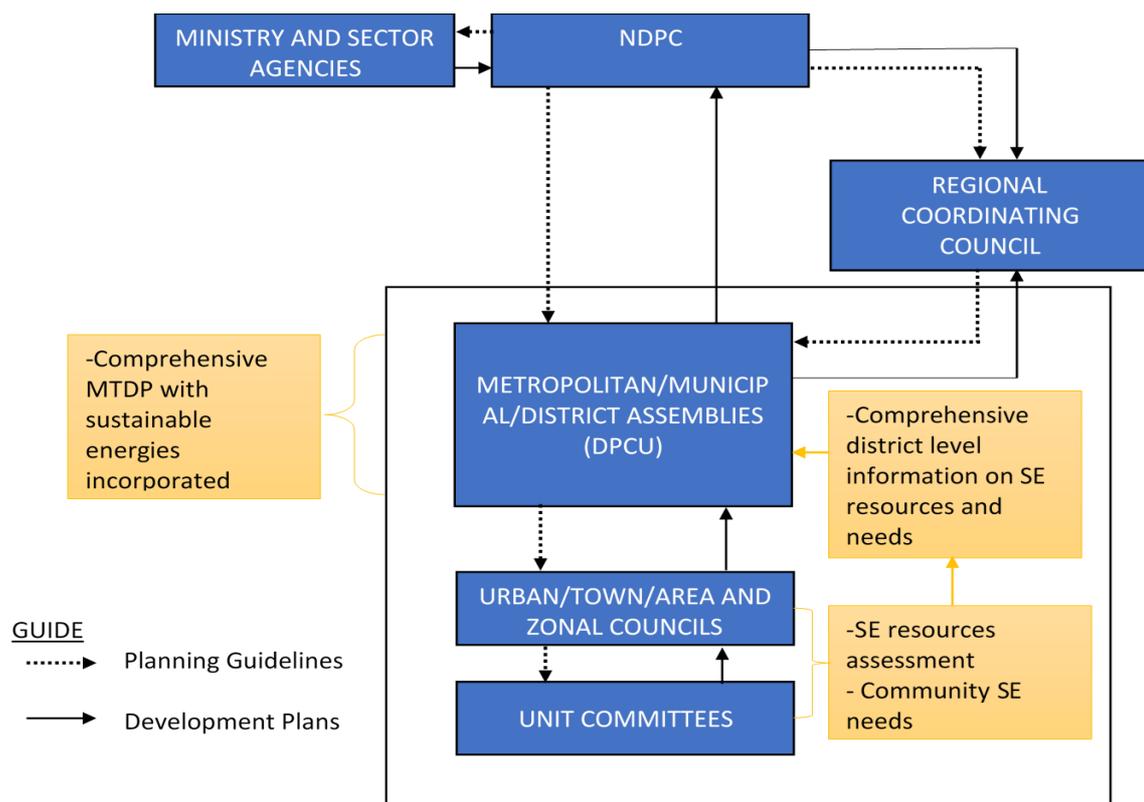


Figure 4. 11: Proposed framework for integrating sustainable energy planning into local development plans (Adapted from Inkoom, 2009).

Development planning in Ghana generally follows a bottom-up approach which begins with the preparation of community action plans by unit committees with the guidance of the District Planning and Coordinating Unit (DPCU). These plans are a valuable source of

data for planning and decision making and, where such plans are unavailable, each district is required to gather data on the real needs of at least 50% of their communities (NDPC, 2013). In figure 4.11, it is proposed that in addition to health, education, water, sanitation and other social services that are usually planned from the community level, the community action plans should also include sustainable energy needs and priorities of each community. Unit committees and urban/town/area and zonal councils, through the same participatory approaches they use in identifying the needs of their communities for the other sectors, should identify sustainable needs of their communities and incorporate them into their community action plans. By the NDPC guidelines, these local plans become inputs into the DMTDP and enable the district to have realistic targets.

The DPCU can also initiate studies to identify potential large scale mini-grid and off-grid RE projects in the district and incorporate them into the DMTDP. Various sustainable energy needs related to clean cooking fuels, lighting and productive activities such solar-powered irrigation schemes and water pumping systems will thus be an integral part of the DMTDP thus, providing comprehensive information on the state of sustainable energy needs at the local level. Such information is vital for government intervention and will also attract investors into the district since they will know where the need exists and what potentials are available. These investments will facilitate the deployment and usage of RETs and consequently facilitate sustainable energy transitions. As noted by Bawakyillenuo et al. (2018a), decentralized sustainable energy programs such as rooftop solar, efficient cookstoves, off-grid wind energy amongst others are most likely to be effective when local governments are involved in their planning and implementation.

4.3. Institutional Capacity Analysis of Local Government Agencies

This sub-section presents results from the analysis of data gathered on the institutional capacity of local government units in the Wa municipality. These results include the current staffing situation, the academic qualifications of various staffs and the logistics available in the various departments.

4.3.1. General staffing situation of local government units in Wa municipality

For local government agencies to effectively carry out the planning and implementation of sustainable energy initiatives, the adequacy of both human resources and logistics is an important factor that cannot be overlooked. In this regard, this study assessed the human resource and logistics capacity of local government units responsible for development planning and implementation at the local level. These units are the RPCU, the MPCU, the CDD and the GSS. The number of staffs in the various units ranged from four in the MPCU to ten in the GSS. Overall, there is a total of 31 staffs in all four units with proportions of 51% and 49% for males and females respectively. These proportions indicate some sort of gender parity even though males are more than females in all units except at the CDD, which has more females than males (see figure 4.12).

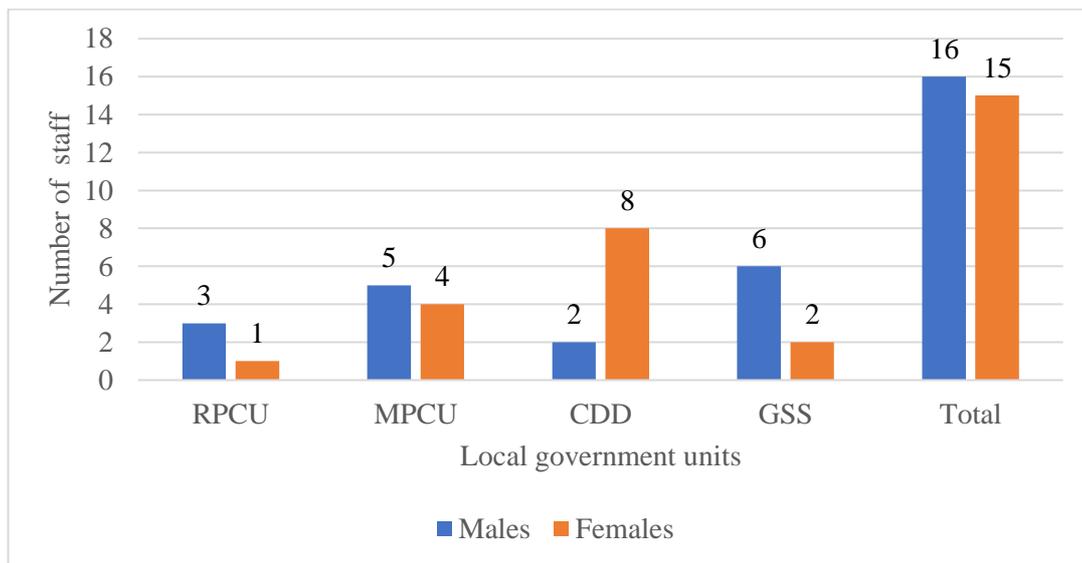


Figure 4. 12: Staffing situation of local government units.

4.3.2. Human resource strength of the various local government units/departments

Table 4.3 presents the results of an assessment of the various positions available in each unit and their current staffing situation to ascertain whether each unit has adequate human resource capacity in terms of the number of staffs and their required qualifications. Despite having a few gaps, all the units except the GSS acknowledged that their current human resources capacity is good enough to enable them to undertake the planning and implementation of sustainable energy initiatives. A respondent at the CDD, for instance, remarked that; *“our human resource base is quite good but we lack a few logistics which*

sometimes make our work difficult". However, an interviewee at the GSS lamented that *"the current human resource strength of the region is 8. This is woefully inadequate to work effectively and produce the needed data for the region"*. As a result of the inadequacy of staff, the GSS is unable to gather statistical data specifically at the district level. When queried whether or not they gather data at the district level, the respondent at the GSS recounted that *"No. Because we do not have available personnel at the district level to collect data. Efforts are underway to recruit officers for all districts"*. Disaggregated data is a key requirement for planning, especially at the local level. Hence, the inability of the GSS to collect data specifically at the district level implies that the MPCU has to plan with regional level data, which is often aggregated data of all districts within the region.

However, this situation no longer poses a problem to district level planning because in 2010 (when a national population census was conducted), the national headquarters of the Ghana Statistical Service ensured that the national population and housing census data gathered were disaggregated into district-level data. District-level reports (known as district analytic reports) which presents in-depth data on various aspects of the district including energy issues were prepared for all the districts in Ghana. In terms of the required qualifications, it can be inferred from Table 4.3 that all the units are adequately equipped with the right personnel. In exception of one staff at the CDD who holds a Diploma instead of a Bachelor's degree, all other staff in all the units had the required qualifications which range from Senior High School Certificate (SSCE) to master's degree.

Table 4. 3: Human resource capacity of various local government units/departments

Unit	Position	Number Existing	Number required	Gap	Existing Qualification	Required Qualification
RPCU	Regional Planning Officer (RPO)	1	1	-	Master's degree	Master's degree
	Assistant RPOs	3	6	3	Bachelor's degree	Bachelor's degree
	Total	4	7	3		

MPCU	Municipal Development Planning Officer	1	1	-	Master's degree	Master's degree
	Development Planning Officers	3	3	-	Bachelor's degree	Bachelor's degree
	Total	4	4	-		
CDD	Unit Head	1	1	-	Bachelor's degree	Bachelor's degree
	Field officers	7	10	3	Diploma	Diploma
	Secretary	1	1	-	Higher National Diploma (HND)	HND
	Head of home science unit	1	1	-	Diploma	Bachelor's degree
	Total	10	13	3		
GSS	Regional Statistician	1	1	-	Master's degree	Master's degree
	Accountant	0	1	1	Bachelor's degree	Bachelor's degree
	Statisticians	5	8	3	Masters	Masters
	Admin/Secretary	1	2	1	Bachelor's degree	Bachelor's degree
	Driver	1	1	-	SSSCE	SSSCE
	Total	8	13	5		

4.3.3. Logistics capacity assessment of the various units/departments

Unlike the human resource base, all the units/departments are facing significant logistical deficiencies. The inadequacy of logistics is posing several challenges for the various departments. In the RPCU, the inadequacy of computers has resulted in the absence of a

database for storing vital information. The unit requires a total of 40 logistics ranging from hard disk drives to pick-up trucks but only 20 of this logistics exist and out of the twenty, only 13 are functional. An interviewee at the MPCU asserted that the unit has the capacity to plan for sustainable energy initiatives; however, the respondent was not aware of any software used for energy planning. The MPCU is challenged with inadequate logistics. When queried on the effects that the inadequacy of logistics has on the unit's performance, the respondent indicated that the inadequacy of pick-up trucks and motorbikes in particular *"makes monitoring and supervision difficult"*. Also, logistics at the CDD are woefully inadequate because out of a total of 15 logistics that are required; the department has only five functional ones. This situation reflects the assertion made by an interviewee that the department lacks some logistics which sometimes makes their work difficult. In addition to not having enough staff, the GSS is also challenged with inadequate logistics. Out a total of 40 logistics required, the unit only has 14 functional ones. This logistics range from internet connection to printers.

Table 4. 4: Logistics capacity assessment of the various units/departments

Unit	Type of logistic/ Equipment	Number Required	Number Existing	No. functioning	Gap
RPCU	Computers	10	9	4	6
	Printers	9	3	2	7
	Scanners	2	2	2	-
	Internet connection	1	1	1	-
	Pick-up trucks	5	3	2	3
	GPS	5	2	2	3
	Cameras	3	0	-	3
	Hard disk drives	3	0	-	3
	Projectors	2	0	-	2
	Total		40	20	13
MPCU	Vehicles (pick-up truck)	2	1	1	1
	Motor bikes	3	0	-	3
	Computers	4	2	2	2

	GPS device	2	0	-	2
	Digital camera	4	0	-	4
	Total	15	3	3	12
CDD	Motor Bikes	10	2	2	8
	Printers	1	0	-	1
	Internet connection	1	1	1	-
	Photocopier	1	0	-	1
	Computers	2	2	2	-
	Total	15	5	5	10
GSS	Desktop Computers	13	9	9	4
	Printers	4	1	1	3
	Laptops	7	2	2	5
	Internet connection	1	0	-	1
	Air conditioners	5	2	2	3
	Total	30	14	14	16

The findings above affirm the challenges identified in the Renewable Energy Master Plan by the Energy Commission (2019) which indicates that inadequate human and institutional capacity at the district level is a constraint to decentralizing renewable energy development in Ghana.

4.4. Summary

This chapter presented the results and discussions after analyzing data gathered from various sources. The findings showed that sustainable energy initiatives at the local level are ad-hoc, planned on a short-term basis and are often undertaken by central government agencies and NGOs. Nonetheless, local government units such as the MPCU and the CDD are the most popular in the sustainable energy actor-network in the municipality. Their popularity stems from the fact that they work hand in hand in coordinating all developmental activities at the local level hence, all sustainable energy projects (whether carried out by state agencies or NGOs) usually implemented with their participation even

though the initiatives do not originate from them. The failure to incorporate sustainable energy planning into their MTDP also has negative consequences for the monitoring and sustainability of projects as evidenced in the data gathered from Guropisi community where solar street lights provided to the community have become non-functional. This situation is due to the fact that the batteries of the solar street lights have elapsed their lifespan and there has been no monitoring of the facilities by the MMDA while the community has not also reported the issue because they are now connected to the national grid.

The review of the MTDPs of the municipality also showed that with regards to energy, emphasis is often placed on electricity access through grid extension to the neglect of distributed generation which has to do with sustainable energies. Also, key policy frameworks and guidelines for development planning at the local level planning have not provided any strategies to integrate sustainable energy planning into the MTDPs, a situation which possibly resulted in the absence of sustainable energies in the MTDPs. Challenges with regards to the institutional capacity especially the availability of logistics were identified in the local government units/departments responsible for planning and implementation at the local level. The ensuing chapter presents a summary of major findings, recommendations and conclusions based on the main objectives of this research.

5. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.0. Introduction

The main aim of this study is to examine how the role of local government can be enhanced in promoting sustainable energy transitions in Ghana. Specifically, the study examined actor involvement in sustainable energy development at the local level, the nature of sustainable energy initiatives at the local level, how planning guidelines and policy frameworks affect sustainable energy planning at the local government level, and the institutional capacity of various local government agencies to undertake sustainable energy planning. This chapter presents a summary of the major findings made under each objective, conclusions and policy recommendations.

5.1. Major Findings

Overall, the research has shown that local government agencies' involvement in sustainable energy planning is limited with many of the sustainable energy projects implemented originating from the activities of NGOs and central government agencies. Sustainable energies are virtually missing in the DMTDPs of the municipality, and this is attributed to the fact that policy frameworks that guide development planning at the local government level have not given the mandate to plan for sustainable energies to MMDAs. Significant logistical challenges were also found in all the local government agencies responsible for development planning at the local level. The ensuing sub-sections present the major findings for each research objective.

5.1.1. Local actors' involvement in sustainable energy initiatives in Wa municipality

Local government agencies, NGOs, Ministries, Departments and Agencies (MDAs), and private sector organizations were the main categories of actors identified in the municipality. Some of these actors are primary actors (their activities are primarily concerned with sustainable/renewable energy development and utilization) while others are secondary actors (their activities are not directly focused on sustainable energies but contribute to sustainable energy development and utilization). Out of thirteen actors involved in the study, WaterAid (an NGO), the EPA (a state agency) and the Statistical Service Department (a state agency) and the RPCU (local government unit) were identified as secondary actors. Despite being the most popular in the actor-network, results

from the analysis of data gathered through interviews with the various local government agencies show that their involvement in sustainable energy planning and implementation is low. The only sustainable energy initiatives that they participated in were those initiated by the MDAs or NGOs. Hence, the local government agencies themselves have not initiated and implemented any sustainable energy initiatives of their own. Their low level of involvement in sustainable energy planning is also reflected in their lack of awareness of the Ghana Renewable Energy Master Plan. Overall, majority (69%) of all the actors were not aware of the plan while the rest of them (31%) have only ‘heard about it.’

Results from the analysis of data gathered from two beneficiary communities also showed that sustainable energy projects are planned on an ad-hoc basis and often not through the local government planning system. While such projects have yielded numerous benefits to the communities, the lack of monitoring was identified as a major challenge in one of the communities (Guropisi). The batteries of all solar street lights installed in the community have elapsed their life span, hence, rendering them non-functional. Since the project was not planned and implemented through the MTDP process of the municipality, no records of it were found in the projects as well as the monitoring and evaluation sections of their 2010-2013 and 2014-2017 MTDPs. A situation which possibly led to the project not being monitored. Findings from the community suggest that monitoring of such sustainable energy projects at the local level becomes ineffective when they are not incorporated into the local government plans. The current situation in the Guropisi community also highlights the problem of integrating on-grid and off-grid applications in terms of end-use since the community has been connected to the national grid with a different set of street lights which would not have been necessary if the solar street lights were functioning.

5.1.2. Integrating sustainable energy planning into the local government planning system.

The content analysis of the MTDPs of the municipality revealed that very little emphasis is placed on energy issues in general with virtually no projects on sustainable energies. The term energy is often associated with electricity in the MTDP. Consequently, all energy-related projects found in the plans focused on increasing electricity access through extension of the national grid. Only 1.4 percent and 1.1 percent of all projects in the 2013-2014 and 2014-2017 MTDPs of the Wa municipality were related to energy. A review of

the NDPC guidelines for district-level planning showed that local government agencies are encouraged to focus mainly on policy objectives and strategies that mention them as lead or collaborating agencies in the NMTDPF. However, even though issues of sustainable energy development are well-captured and discussed in detail in the NMTDPFs, policy objectives and strategies for their development did not list MMDAs or local government units as lead or collaborating agencies. This situation possibly accounts for the little emphasis placed on sustainable energy issues in the local government plans and affirms the findings made from interviews conducted at the MPCU which indicated that even though issues of sustainable energy are captured in the current NMTDPF (2018-2021), it does not list MMDAs as lead or collaborating agencies.

5.1.3. Institutional capacity analysis of local government agencies

The third objective of this study is to study assess the human resource and logistics capacity of local government units responsible for development planning and implementation at the local level. These units are the RPCU, the MPCU, the CDD and the GSS. There is a total of 31 staffs in all four units with males and females constituting of 51% and 49% respectively. Despite a few gaps in the number of staffs, all the units except the GSS acknowledged that their current human resources capacity is good enough to enable them to perform their activities. All but one staff of the various units also have the requisite academic qualifications for their positions. These qualifications ranged from Senior High School Certificate (SSCE) to master's degree. All the local government units are faced with significant logistical deficiencies. The inadequacy of logistics is posing several challenges such as the absence of a database at the RCPU and difficulty in carrying out field monitoring exercises at the MPCU. The most common challenge reported across all the units is the inadequacy of computers. Insufficient vehicles (pick-up trucks and motorcycles), printers and lack of internet connection were also common in most of the units.

5.2. Conclusion

Local governments have been identified as very important actors in expanding energy services especially the deployment and utilization of renewable energies through distributed generation. Consequently, their potential role in facilitating SETs has been highlighted by several studies. Despite the recognition of the vital roles that local

governments can play in SETs, sustainable energy planning and implementation remain centralized in many SSA countries including Ghana. This study examined how the role of local governments can be enhanced in promoting SETs in Ghana by specifically analyzing how actors at the local government level engage in sustainable energy initiatives, how sustainable energy planning can be mainstreamed into local government plans and the institutional capacity of local government units to undertake such planning. Findings indicate that local government units play a facilitative rather than a direct role in sustainable energy initiatives at the district level with many of the initiatives being undertaken by central government agencies and NGOs. Minimal attention is paid to energy issues in the MTDPs with virtually no projects on sustainable energies development. A review of key policy frameworks and guidelines for local government planning revealed that the responsibility to plan and implement sustainable energy initiatives has not been given to the local government in the policy frameworks. Based on these findings, the study concludes that local governments role in SETs in Ghana is limited because planning for sustainable energies remains centralized with key policy frameworks failing to assign the responsibility to plan and implement projects on such energies to the MMDAs. An institutional capacity analysis showed that local government units in the Wa municipality have adequate staffing capacity to plan and implement sustainable energy projects. However, key logistical challenges constrain their activities.

5.3. Recommendations

In light of the major findings of the study, the following recommendations are made in order to ensure that local governments play a more active role in SETs in Ghana.

- The NDPC is strongly encouraged to mainstream sustainable energies into the district MTDP process. Figure 4.11 is proposed to help achieve this integration. The commission is advised to decentralize planning for sustainable energies through a bottom-up approach by ensuring that the guidelines for district-level planning explicitly spells out strategies and makes room for sustainable energies in the MTDPs. MMDAs should be made to undertake resource assessments and through their Unit Committees, prepare community actions plans on sustainable energy needs as part of the MTDP process.
- The Ministry of Energy and the Energy Commission are advised to give a greater role to local governments in sustainable energies development by making the

MMDAs lead and collaborating agencies for policy objectives that deal with sustainable energies in both National Energy Policies and in the National Medium-Term Development Planning Frameworks.

- The Energy Commission, Ministry of Energy and NGOs working on sustainable energies development are also encouraged to work with the MMDAs in raising awareness about the benefits of renewable energies in local communities. Local communities should be sensitized for them to recognize the development and utilization of sustainable energies as a priority. This recognition will enable them to push their local government representatives to facilitate the development of such energies.
- It is paramount for the Wa Municipal Assembly to monitor various sustainable energy projects that have been implemented in the municipality. The Ministry of Local Government is thus encouraged to provide the needed logistics for the MMDAs to enable them to undertake such monitoring exercise.
- The study also recommends that the Energy Commission should raise awareness about the Renewable Energy Master plan especially among local stakeholders to ensure that local governments, NGOs, private sector actors and other stakeholders understand their roles in making the plan a success.
- The Commission is also advised to conduct training programs on renewable energy planning for District Planning Units. Officers at the unit should be trained on how to use software such as Long-Range Energy Alternatives Planning (LEAP) for simulating future energy scenarios. This training will help them to set realistic targets which is essential for planning at the local level.

5.4 Further Research

This study posited that SETs can be facilitated in Ghana if sustainable energies are mainstreamed into local development plans. For sustainable energies to be rapidly deployed and utilized, especially at the local level, there is the need to ascertain the willingness to accept and ability to afford and utilize Renewable Energy Technologies. Further research could thus focus on the community acceptability and socio-economic determinants of sustainable energy usage in Ghana.

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7. APPENDIX

7.1. Data Collection Instruments



Pan African University
**Institute of Water
and Energy Sciences**

MASTERS PROGRAMME IN ENERGY SCIENCE (POLICY TRACK)

Research Topic: Enhancing the role of local government in promoting sustainable energy transitions in Ghana. A case study of Wa municipality.

Introduction (Informed Consent)

Good morning/afternoon. My name is Mark Akrofi. I am a final year MSc. Energy Policy student at the Pan African University Institute of Water and Energy Sciences (including Climate Change)-PAUWES, in Tlemcen, Algeria where I am currently completing my master's thesis on the research topic mentioned above. Your department/organization is of particular interest to the research because the topic falls within the domain of your activities. Therefore, I would like to ask you a number of questions about your department/organizations work in relation to my research topic. The information provided will contribute greatly to understanding the dynamics of energy transition in Ghana and help to make informed policy decisions. Your name or identity will not be associated with any part of the report of the assessment. All your information and interview responses will be kept confidential. I also assure you that the information you give will be used only for the purposes of the project.

Name of Department/organization/community:

Category of organization:

Address of organization:

Sex of respondent:

Date of Interview:

1. MUNICIPAL PLANNING AND COORDINATING UNIT—Interview guide

1. Please describe your involvement in renewable/sustainable energy development in the municipality?
2. Which other agencies and stakeholders do you work with in sustainable energy initiatives?
3. Which of the above-named agencies/stakeholders are you most engaged with in terms of communication/exchange of information?
4. Compared to other sectors such as education and health, how will describe your level of involvement in the planning and implementation of sustainable/renewable energy initiatives?
5. Sustainable/renewable energy planning is virtually missing in the district planning process and consequently in the Medium-Term Development Plan. Why is this so?
6. How does the Energy Commission involve you in its sustainable energy initiatives?
7. How do you collaborate with other decentralized department in the planning and implementation of the DMTDP?
8. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your departments activities and what part do you have to play in it?

2. COMMUNITY DEVELOPMENT DEPARTMENT—Interview guide

1. How do you participate in the district planning and implementation process?
2. As the community development department, how are you working to ensure that communities' energy needs are met?
3. Which agencies/stakeholders are you most engaged with (in terms of communication) in meeting the needs of communities?
4. Has your department been involved in any renewable/sustainable energy initiative? If yes, what roles did you play?
5. Compared to other sectors such as education and health, how will describe your level of involvement in the planning and implementation of sustainable/renewable energy initiatives?
6. How do you work with the Municipal Planning and Coordinating Unit in planning and implementing projects?

7. How does the Energy Commission involve you in its sustainable energy initiatives?
8. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your departments activities and what part do you have to play in it?

3. STATISTICAL SERVICE DEPARTMENT—Interview guide

1. Please describe your involvement in renewable/sustainable energy development in the municipality?
2. Which agencies/stakeholders are you most engaged with in terms of communication/exchange of information?
3. Do you gather data on energy statistics at the municipal level? If yes, for what purposes are these data gathered and if no, why?
4. Do you collaborate with the Energy commission in gathering national energy statistics? If yes please describe the nature of your engagement with the commission.
5. Has your department been involved in any renewable/sustainable energy initiative? If yes, what initiatives and what roles did you play?
6. Compared to gathering general demographic data, how will you describe your level of involvement in generating, storing and disseminating energy statistics at the municipal level?
7. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your departments activities and what part do you have to play in it?

4. REGIONAL PLANNING AND COORDINATING UNIT—Interview guide

1. Do you coordinate the activities of the Energy Commission in the region/municipality? If no, please explain why?
2. Which other local government agencies do you engage with in the coordination of development plans and programs in the region?
3. Compared to other sectors such as education and health, how will describe your level of involvement in the coordination of sustainable/renewable energy initiatives in the municipality?

4. How does the Energy Commission involve you in its sustainable energy initiatives?
5. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your departments activities and what part do you have to play in it?

5. VOLTA RIVER AUTHORITY-Interview guide

1. Please describe your involvement in renewable/sustainable energy development in the municipality?
2. Which other agencies and stakeholders do you work with in sustainable energy initiatives?
3. How do you collaborate with the Municipal Assembly in the planning and implementation of renewable/sustainable energy initiatives?
4. How do you involve local communities/energy users in the planning and implementation of renewable/sustainable energy initiatives?
5. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your departments activities and what part do you have to play in it?

6. ENVIRONMENTAL PROTECTION AGENCY—Interview guide

1. Please describe your involvement in sustainable/renewable energy initiatives in the municipality?
2. Which other agencies do you engage with (in terms of communication) in your sustainable energy efforts?
3. How do you collaborate with local government agencies in the conduct of your activities?
4. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your activities and what part do you have to play in its implementation?

7. FOCUS GROUP DISCUSSION GUIDE

1. What is the total number of people in the group?.....
2. Number of females.....Number of males.....

3. Age range of participants.....
.....
4. Please provide a brief description of how the project was initiated in the community.
5. Were you involved in the planning and implementation of the current RE project your community is benefitting from? If yes, please explain the role you played
6. If your answer is yes in Q1, which agencies/organizations were you engaged with in the planning and implementation of the project?
7. What benefits has this project brought to your community?
8. What challenges has the project faced?

8. NGOS AND PRIVATE SECTOR---INTERVIEW GUIDE

5. What is the total number of people in your organization?.....
6. Number of females.....Number of males.....
7. Please describe your involvement in sustainable/renewable energy initiatives in the municipality?
8. Which other agencies do you engage with (in terms of communication) in your sustainable energy efforts?
9. How do you collaborate with local government agencies in the conduct of your activities?
10. Are you aware of the Ghana Renewable Energy Master Plan? If yes, how does it relate with your activities and what part do you have to play in its implementation?
11. How do you involve end-users in your initiatives?

9. QUESTIONNAIRE FOR INSTITUTIONAL CAPACITY ASSESSMENT

Human/Logistical Resource Assessment of Institutions

1. Should renewable/sustainable energy planning and implementation be integrated into the MTDP process, will your department be able to fulfil that obligation?
2. Are you aware of any software that can be used for sustainable/renewable energy planning? If yes, kindly mention them (for MPCU).

Human Resource Assessment

1. What is the total number of people in your department?.....
2. Number of females.....Number of males.....

Position	Number Existing	Number required	Qualification	Required Qualification	Remarks

Logistics and equipment

Type of logistic/ Technical Equipment's	Number Existing	Number Required	Effect on Performance

7.2 SNA Data Matrix

	RP C U	M PC U	G SS	C D D	V R A	S N V	PU MP TE CH	Pr on et	Bu sa	Gu ro pis i	E C	EP A	W ate rAid	M O E	Be st So lar	PI
RPCU		1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MPCU	1		0	1	1	0	0	0	0	1	0	1	0	0	0	0
GSS	0	1		0	0	0	0	0	0	0	0	0	0	0	0	0
CDD	0	1	0		0	0	0	0	0	1	0	0	0	0	0	0
VRA	0	1	0	1		0	0	0	0	0	1	0	0	0	0	0
SNV	0	0	0	1	0		0	0	0	0	0	1	0	0	0	0
PUMP TECH	0	1	0	0	0	0		1	0	0	0	0	1	0	0	1
Pronet	0	0	0	1	0	0	1		1	0	0	1	0	0	0	0
Busa	0	0	0	0	0	0	1	0		0	0	0	1	0	0	0
Guropi si	0	1	0	0	0	0	0	0	0		0	0	0	0	0	0
EC	1	1	1	1	1	0	0	0	0	0		1	0	1	0	0
EPA	0	1	0	1	0	0	0	1	0	0	0		0	0	0	0
Water Aid	0	0	0	0	0	0	1	0	1	1	0	0		0	0	0
MoE	0	0	0	0	0	0	0	0	0	0	1	0	0		1	0
Best Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1
PI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

7.3 Introduction Letter

 **Pan African University**
Institute of Water and Energy Sciences

Ref. **643/PAUWES/2018**

Subject **Introduction Letter**

Dear Sir/Madame,

The Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES) is located on the campus of the University of Tlemcen, Algeria.

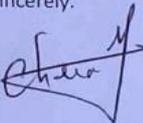
PAUWES is one of the five hubs of the Pan African University established under the African Union aimed at revitalizing African higher education and at boosting research and postgraduate training. PAUWES is the fourth institute after the Institute of Governance, Humanities and Social Sciences (PAUGHSS) at the University of Yaounde II in Cameroon; the Institute of Basic Sciences, Technology and Innovation (PAUSTI) at Jomo Kenyatta University of Agriculture and Technology in Kenya; and the Institute of Life and Earth Sciences (PAULESI) at the University of Ibadan in Nigeria.

The PAUWES Institute offers graduate students access to leading academic teaching, research and hands-on training in areas vital to the future of African development – water, energy and the challenge of climate change.

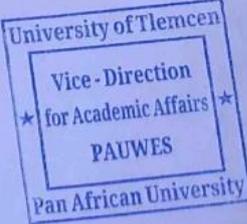
In this context, the student at PAUWES, **Mr. Mark McCarthy Akrofi** from Ghana, preparing a Master in Energy Science, Policy Track wishes to carry out a summer internship in your institution.

In this regard, we are addressing to you **Mr. Mark McCarthy Akrofi** for consideration as an intern in your institution.

Sincerely,



Dr. Chewki Ziani-Cherif
Deputy-Director - PAUWES



PAU Institute of Water and Energy Sciences, (including Climate Change) PAUWES
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Date: January 23th, 2018

From:
Dr. Chewki Ziani-Cherif
Deputy-Director - PAUWES

To:
To whom it may concern



7.4. Plagiarism report

Plagiarism Checker X Originality Report



Plagiarism Quantity: 8% Duplicate

Date	Wednesday, July 24, 2019
Words	2235 Plagiarized Words / Total 28075 Words
Sources	More than 390 Sources Identified.
Remarks	Low Plagiarism Detected - Your Document needs Optional Improvement.