RENEWABLE ENERGY: A RESPONSE TO CLIMATE CHANGE IN LIBERIA

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Abstract: Liberia isa poor income country with a limited transition to renewable energy sources and consumption. While the Government of Liberia and other credible institutions ensure to electrify the entire country, many impoverished Liberians use charcoals for cooking their foods. Some are still burning firewood, particularly those rural residents. Therefore, Liberia continues to experience climate change.

This study aimed to determine much renewable energy there is now and how much it could be used in the future, including the major impediments and obstacles that the energy sector faces in Liberia. Also, the research was intended toexamine measures required to facilitate deployment and orient Liberia's future design, delivery, and adoption of affordable and sustainable energy solutions. In fulfillment of the study, a qualitative research method was employed whereby relevant literature ranging from theoretical and empirical were examined.

The study findings reveal that the continuous usage of charcoal and burning of woods emits a high rate of carbondioxide in Liberia, affecting many Liberians' health, especially children with a weak immune system. It was reported that 70% of urban residents in Liberia still use charcoal for cooking, while 91% of rural residents use firewood (AfDB, 2017). This report poses huge challenges to Liberia's national growth and human development. However, the study found out that the Liberia Environmental Protection Agency (EPA) has developed a National Climate Change Policy and Response Strategy (NCCPRS) to ensure appropriate measures are instituted to protect those sectors that are often affected and establish a resilient for avoiding or preventing further phenomena (Liberia's Climate Policy, 2018) Former Liberia EPA Director confirmed and disclosed the plans of the Liberian Government towards mitigating climate change issues across Liberia.

Keywords: Renewable energy, climate change, carbondioxide

1. Renewable Energy Accessibility in Liberia

Renewable energy is important to sustain growth and development (Dince & Omer, 2000). It is critical for meeting fundamental human and community needs such as lighting, transportation, education, health, food, and water (Kanagawa, 2007). Because all of these services are indicators that measure progress and development, energy is a key determining predictor for development (Nakata, 2008). In addition, any country's future economic development is ensured when an uninterrupted energy supply is accessible, affordable, environmentally friendly, and sustainable. However, the quality of life (health, education, and security) of any nation's citizens is highly dependent on the availability of sufficient energy (Kanagawa, 2007).

Liberia is still struggling as a small income country to transition energy consumption. On scaling up renewable energy projects in low-income countries, less than 2% of the rural population has access to predominantly biomass electricity, the lowest electrification rate globally (AfDB, 2017). In addition to this statement, the Liberia energy situation in 2020 father explains that biomass has dominated Liberia's energy consumption with a portion of more than 80% of the used primary energy sources. Most importantly, Liberia accounts for higher biomass and heating caused by wood cooking. Based on LIGIS (2008) report, it was observed that Liberia's rural population is highly dependent on firewood and charcoal cooking. Also, the urban population has been observed in the use of this cooking method. To address this issue and make it a priority, the Liberian Government has received assistance from the World Bank to make electricity available and affordable for all Liberians (AfDB, 2017).

2. Renewable Energy Response to Climate Change

Studies have indicated that energy response to the fight against climate change is either through mitigation or adaptation. These responsive reactions to renewable energy have resulted in a serious academic debate, thus leaving an author/researcher to deed the most efficient response strategy. However, few acknowledgeable authors on climate change have raised attention to using two strategies or either of them. The European Environmental Agency (2018) differentiation between adaptation and mitigation in response to climate change asserted that adaptation is a series of strategies formulated to prevent wealth effects or reduce expected damage. In contrast, mitigation lessens the negative impact and prevents GHG (EEA, 2018).

2.1.1 Mitigating Climate Change

In response to the debate regarding which strategy must be applied to combat climate change, the following authors vehemently took a side on mitigation strategy and thus provided possible justifications to authenticate their positions. According to Barbato et al. (2014), "the impact on the mitigation of climate change by this route is large, up to potentially 7 Gt CO2 equivalents, and at least comparable with that of carbon capture and storage (CCS)." They further noted that a mitigation strategy is important to address climate change because it "lowers costs, reduces environmental impact, and enhances energy security" (Barbato et al., 2014). On account of sharing similar views, Owusu & Asumadu-Sarkodie (2016) added that mitigating climate change reduces greenhouse gases and promotes environmental sanitation. For example, carbon dioxide is one of the obvious GHGs found in Liberia. Moreover, if this strategy should be applied, there will be less carbon dioxide in the market (Xiaodong, 2007). Furthermore, a study conducted in India resolved that mitigating climate change should be prioritized to reduce CO2 in the environment (Raghva & Chandra, 2007). Several energy sources are eligible for mitigation, including solar cookers, water heaters, dryers, biofuel, improved cookstoves, and hydrogen. (Panwar et al., 2011).

2.1.2 Adapting to Climate Change

Climate adaptation can effectively address environmental issues, such as reducing carbon dioxide. McDonald (2011) asserted that climate change adaptation is unique, responsive, and adaptive. He linked the concept and teaching of laws with his adaptation energy. Besides, Team (2010) disclosed that "Effective Adapting can limit damage, reduce costs, and ease the transition to a changing regional climate." In addition to justifying this position, Rousseau (2004) asserted that what tends to become a view is developed into a policy. Those who would believe strongly in adapting to the environment have enough trends to appropriate. Finally, the "IPCC claims that climate adaptation and sustainable development can be compatible if policies are made to lessen resources prepared."

2.1.3 Both Energy Response Strategies

As Liberia holds both strategies constant to address climate change, Venema and Rehman (2007) found out that these two strategies complement each other. Any attempt to utilize one without the other might be ineffective. Combining both strategies to combat the irregularity and variability of climate change is relevant at every level, including local, national, and international levels. Both strategies are relevant to growth and human development (Suman, 2021). The research established that China had implemented these strategies to address and manage the climate change effects (Lin, 2016). In the article, "Scaling the policy response to climate response," Savocool and Brown (2009) conducted their research with a serious assessment of the advantage and disadvantages of combating climate change. He considered adaptation on a smaller scale to be adapted by small countries, but upon implementation, they cautioned others to observe how big countries are appropriately utilizing the mitigation strategy. Laukkonen et al. (2008) indicated that renewable energy could be achieved at the expense of collaborative efforts between the community and the local Government, focusing on implementing common development goals. In Algebra, these strategies were proposed and used simultaneously (Sahnoune et al., 2021).

3. Research Method

The research was designed to review the pertinent theoretical and empirical literature on renewable energy and assess its response to climate change in Liberia. Therefore, the study employed the qualitative research method.

3.1 Theoretical Framework

Based on the Non-Cooperative Game Theory analysis (Aquirre, 2009), this study adopts its framework from Liberia's National Policy and Response Strategy on Climate Change (2018) and Liberia's Revised Nationally Determined Contribution (RNDC, 2021). The Environment Protection Agency (EPA) of Liberia, as one of the leading contributors to the formation of the climate response strategy, proposed to adequately and effectively address the threats imposed by rapid climate change availability and variability. These policy documents revealed that Liberia commits to incorporating mitigation and adaptation strategies to fight against climate change. The EPA suggested energy as an important sectorthat can integrate the mitigation and adaptation strategies (PRSCC, 2018 & RNDC, 2021). Despite the advantages and disadvantages of applying either or both of these strategies, Boub and Stephan (2010) "suppose that adaptation and mitigation are substitutes in protecting a region against impacts of global climate change." Such integration is relevant and compelling to create a convenient climate in Liberia.

4. Tables and Figures

Table 1 shows the Greenhouse Gases emissions from the energy section in Liberia. The survey conducted by the Environmental Protection Agency (EPA) reveals several percentages of GHG emissions that continue to pollute the Liberian environment and affect the health of the population. The Table indicates that 67.5% was accounted for the high rate of carbon dioxide in the total emissions in Liberia.

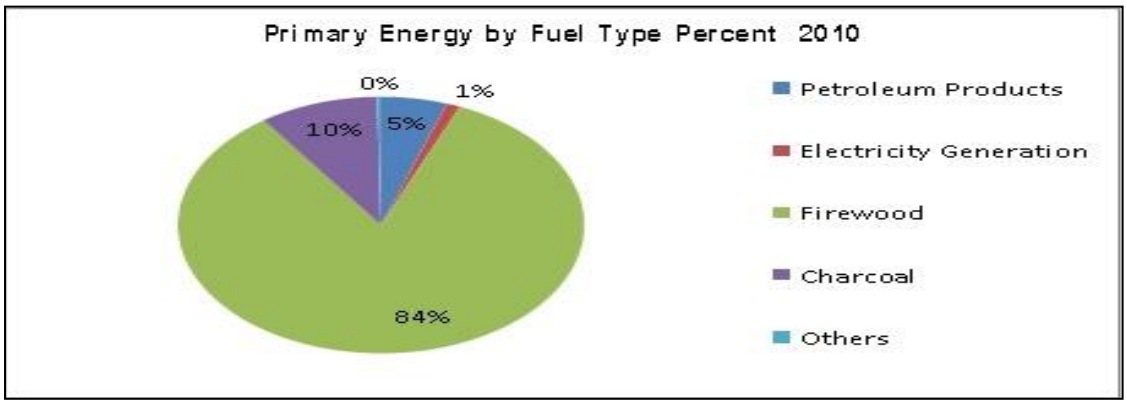
SUMMARY REPORT OF 2000 GHG EMISSIONS ESTIMATIONS FOR THE ENERGY SECTOR

GHG Source and Sink Categories	CO_2 Gg Co_2 eq.	CH_4 Gg Co_2 eq.	N_2O Gg Co_2 eq.	Year 2000 Gg Co_2 eq.	Contribution To National Total (%)	Contribution To Sector (%)
Total National Sector GHG Emissions	3.571	4.141	310	8.022	8.022	
Energy Sector (in Gg and as percent of total energy sector emissions) Contribution of Energy to Total (%)	3.571 (66%)	1.533 (28.3%)	310 (5.7%)	5.414 (100%)	67.5%	
GHG emissions from fuel combustion (by sub-sector)						
1. Energy industries	1.117	0	0	1.117	13.9%	20.6%
2. Manufacturing industries and construction	105	0	0	105	1.3%	1.9%
3. Transport (road vehicles)	2.152	21	0	2.173	27.1%	40.1%
4. Other Energy Sub-Sectors	197	1512	310	2.019	25.2	37.3%

Source from EPA Survey, 2010

Figure 1 illustrates the factors contributing to Liberia's increased carbon dioxide levels. Among these

primary energy by fuel types, energy generated from firewood accounts for 84% of the total percentage, thus indicating that most Liberians still use firewood for cooking their food, and a few of them use charcoals to generate energy. By observation, many people residing in rural Liberia are accustomed to utilizing pieces of firewood, while charcoal users are mostly from urban settings.



Source from EPA Survey, 2010

5. Conclusion

In 2008 the National Policy for Climate Change was developed. In partnership with international organizations, Liberia's Government, particularly the Paris Agreement on Climate Change, has contributed to building resilience to mitigate the vulnerability and risks of the energy sector. Such evidence has accounted for improvements that increased renewable energy in Liberia at an affordable price and reduced carbon dioxide emissions. Today, Liberia is proud to be known as one of the ten countries to have developed an Adaptation Communication to track and mitigate threats of climate change (Clayeh, 2021). By 2033, the country gradually hopes to make massive improvements in climate change issues through the National Renewable Energy Action Plans (NREAPs, 2015).

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