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Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

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PhD Consumer Science (General)

Supervisor: Prof A.C. Erasmus
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Plattelandse Malawi huishoudings se kommer oor die omgewing en hulle bewustheid van doeltreffende energieverbruikspraktyke in heersende sosio-ekonomiese omstandighede

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PhD Verbruikerswetenskap (Algemeen)

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by

Mphatso Grace Kachale Mchakulu

Submitted in fulfilment of the requirements for the degree PhD in Consumer Science (General)

In the Faculty of Natural and Agricultural Sciences

Department of Consumer and Food Sciences

University of Pretoria

November 2019

DECLARATION

I, Mphatso Grace Kachale Mchakulu, declare that the thesis, which I hereby submit for the degree PhD Consumer Science at the University of Pretoria, has not previously been submitted at this or any other tertiary institution, that this is my own work in design and execution and that all reference material in the thesis has been duly acknowledged.

_____

Mphatso Grace Kachale Mchakulu

February, 2020

ABSTRACT

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Malawi rural households' dependence on fuelwood as a form of energy and as a source of income is contributing to alarming rates of deforestation in the country with detrimental consequences for climate change. This study targeted two of the rural areas in the southern part of Malawi, worst affected by climate change in recent years. The study aimed to generate empirical evidence of households' energy consumption as a consequence of their way of life, and to gather evidence of their practical- and discursive consciousness concerning sustainable consumption practices and climate change as pre-requisites to facilitate and promote behavioural change. This research was conducted in three sequential phases. Phase 1 entailed a quantitative survey that involved 231 non randomly selected households from two rural areas, namely Balaka and Phalombe, in the south of Malawi. Questionnaires were completed in interview format, facilitated by trained research assistants following a pre-test in a nearby village. Phase 2 entailed focus group discussions with selected members from phase 1, to allow opportunity for discussion of main topics. Phase 3 involved the contribution of government officials and important role players to share their views about environmental issues, the issue of indiscriminate deforestation and use of energy sources by communities.

Results show that biomass, including fuelwood, is still the predominant source of energy that most rural households use for diverse activities because other sources of energy are either inaccessible, or too expensive. Negative consequences such as respiratory problems caused

by smoke inhalation are therefore common among females and children who are constantly exposed to toxic substances that are present in the air in their homes and immediate surrounds. The wood that is used, is mostly collected by females who perform this tedious task almost daily, collecting from nearby woodlots and forests, further aggravating deforestation.

Households' practical consciousness of sustainable energy consumption practices seem fairly good and their discursive consciousness, specifically with regard to the effect of climate change on rainfall patterns, micro- and macro factors that are responsible for climate change, are fairly impressive. This may be attributed to first-hand experience of the environmental challenges that they have experienced in recent years. Unfortunately, lack of knowledge concerning the implications of their behaviour in terms of the economic growth of the country, as well as nearby countries' well-being, confirm the complexity of the phenomenon that may be difficult for them to comprehend. Concerted effort is thus required by local- and Governmental bodies to educate and empower communities socially and economically, also to supply safer sources of energy to replace what they are obliged to use presently. Rural households are struggling financially and will not be able to adapt their behavioral practices without the premeditated support of government and relevant role players who have an interest in environmental issues and who have the well-being of Malawi citizens at heart.

Keywords: energy consumption, rural African households, sustainable development, sustainable consumption, environmental consciousness, Malawi consumers

OPSOMMING

Plattelandse Malawi huishoudings se kommer oor die omgewing en hulle bewustheid van doeltreffende energieverbruikspraktyke in heersende sosio-ekonomiese omstandighede

deur

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Plattelandse huishoudings in Malawi se afhanklikheid van brandhout as ‘n energiebron en as ‘n bron van inkomste veroorsaak bekommerenswaardige vlakke van ontbossing in die land wat onrusbarende nadelige gevolge vir klimaatsverandering inhou. Hierdie navorsing het twee plattelandse gebiede in die suide van Malawi, wat in onlangse tye erg deur klimaatsverandering geraak is, geteiken. Die studie het gepoog om empiriese bewys in te win van huishoudings in die betrokke areas se daaglikse energieverbruik en tipiese alledaagse aktiwiteite. Dit is ondersoek as aanduiding van huishoudings se bewustheid en begrip van wat die gevolge van hulle gebruikspraktyke vir klimaatsverandering mag inhou. Hierdie inligting is ‘n belangrike voorvereiste om gedragsverandering aan te moedig. Die navorsing is in drie fases uitgevoer. Die eerste, kwantitatiewe opname het 231 huishoudings betrek wat in twee landelike gebiede, Phalombe en Balaka in Malawi, gewerf is. Gestruktureerde vraelyse is in onderhoudsformaat onder toesig van opgeleide navorsingsassistente voltooi, nadat ‘n vooraftoets in ‘n aangrensende dorpie geloods is. Fokusgroepgesprekke het gevolg met geselekteerde individue uit die eerste fase om kernkwessies wat in die vraelys aangespreek is, te bespreek. Fase 3 het regeringsamptenare en lede van amptelike organisasies betrek om die kwessie van ontbossing en huishoudelike energieverbruik uit ‘n gesagsperspektief te bespreek.

Resultate het getoon dat organiese material, insluitende hout, steeds die belangrikste bron van energie vir platteleandse huishoudings is vir ‘n verskeidenheid van aktiwiteite aangesien alternatiewe ontoeganklik, of eenvoudig te duur is. Negatiewe gevolge van die gebruik van

organiese materiaal om vuur te maak, sluit asemhalingsprobleme in wat deur rookinaseming veroorsaak word. Dit kom algemeen onder vroue en kinders voor wat gereeld blootgestel word aan giftige partikels wat in die lug in hulle huise en die nabye omgewing voorkom. Vroue onderneem meestal die tydrowends taak om hout in te samel, ten koste van hulleself en hulle gesinne deurdat hull ever stap na omliggende beboste areas. Hierdie praktyke dra verder by tot ontbossing.

Resultate toon dat huishoudings se praktyke ‘n goeie bewustheid van volhoubare energieverbruikspraktyke reflekteer, en hulle was redelik ingelig oor die gevolge van hulle praktyke op mikro- en makrofaktore wat klimaatsverandering bevorder, soos verandering van reënvalpatrone. Dis waarskynlik toe te skryf aan persoonlike ervaring van omgewingsuitdagings wat hulle in onlangse tye geteister het. Ongelukkig is gebrekkige kennis oor die implikasies van hulle energieverbruik vir die ekonomiese groei in die land en die welsyn van omliggende lande raak, onvoldoende. Dit bevestig die kompleksiteit van die saak wat moeilik mag wees om te begryp. Doelbewuste pogings deur plaaslike- en regeringsinstansies is nodig om gemeenskappe as ‘n saak van erns, in te lig en op te voed, en om huishoudings sosiaal en ekonomies te bemagtig sodat hulle toegang kan verkry tot veiliger, en skoner tipes energie in wat die ondoeltreffende bronne waarop hulle tans aangewese is, kan vervang. Plattelandse huishoudings sukkel finansieel en sal nie sonder doelgerigte ondersteuning en ingrype van die regering en groter organisasies die lewenstylveranderinge kan maak wat nodig is om hulle toekomstige welsyn te verseker en die nadelige gevolge van bestaande ongewenste energieverbruikspraktyke te keer nie.

DEDICATION

This dissertation is dedicated to my parents, husband and siblings.

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- To GOD Almighty for making this possible (GOD sees completion of things that HE started!)
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ADDENDA

LIST OF ABBREVIATIONS

AIDS	Acquired Immunity Deficiency Syndrome
BRICS	Brazil, Russia, India, China, South Africa
CABMACC	Capacity building for managing climate change in Malawi
CCS	Carbon Capture and Storage
CFC	Chlorofluoro-carbon
CH_4	Methane
CLA	Consumer Lifestyle Approach
CO	Carbon monoxide
CO_2	Carbon dioxide
DADO	District Agriculture and Development Officer
ECA	Economic Commission for Africa
ETS	Emission Trading System
ESCOM	Electricity Supply Corporation of Malawi
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross Domestic Product
GHGs	Greenhouse gases
HIV	Human Immuno Virus
IAP	Indoor air pollution
IEA	International Energy Agency
IIASA	International Institute for Applied Systems Analysis
IPCC	Intergovernmental Panel on Climate Change
LPG	Liquefied Petroleum Gas
MEET	Malawi Environment Endowment Trust
NSO	National Statistics Office (Malawi)
N_2O	Nitrous oxide
OECD	Organization for Economic Co-operation and Development
OVC	Orphans and Other Vulnerable Children
PES	Payment of Ecosystem Services
PPM	Parts per million
RAs	Research Assistants
REDD+	Reduced Emissions from Deforestation and Forest Degradation
SDGs	Sustainable development goals
SPSS	Statistical Package for Social Sciences
SSA	Sub-Saharan Africa
UNDP	United Nations development Programme
UNFCCC	United Nations Framework Convention on Climate Change
VDC	Village Development Committee
WHO	World Health Organization
WWF	World Wide Fund for Nature

CHAPTER 1

INTRODUCTION AND BACKGROUND

This chapter presents the background of the research supported by a brief literature review to explain the research problem and to justify the research, where after the theoretical perspective and methodology are described.

1.1 INTRODUCTION AND BACKGROUND

The research concerns households' energy consumption practices in selected rural areas in Malawi. The research was performed amidst concerns about deforestation in the country, especially in rural areas. Presently, forests are chopped down indiscriminately to acquire the fuelwood that is needed to meet households' energy needs. These practices have devastating consequences for the future of Malawi's forest reserves, as well as for climate change. The scope of the study is subsequently introduced.

1.1.1 Energy, the cornerstone of development

Energy is critical for economic development (Adkins *et al*., 2010). It is argued that without the supply of affordable, reliable and clean energy services to a population, sustainable development cannot be achieved (Bhattacharyya, 2012). Provision of adequate, reliable and affordable energy is a precondition for meeting basic human needs. It is considered a cornerstone of development (McCollum, Echeverri, Busch, Pachauri, Parkinson, Rogeji, Krey, Minx, Nilsson, Stevance and Riahi, 2018; Banerjee, Moreno, Sinton, Primiani and Seong, 2017; Kowsari and Zerriffi, 2011:7505). Energy sufficiency and security are key factors to prosperity and development in general, as it provides essential inputs for socio-economic development at regional, national and sub-national levels, thereby providing vital services that are necessary to improve the quality of life. In 2015, heads of state and government discussed ways and means of solving the challenges that the world are facing as part of their sustainable development agenda for 2030. They came up with 17 Sustainable Development Goals (SDGs) (UNDP, 2015), emphasising that access to affordable and clean energy is essential for achieving the United Nations' SDGs and global efforts to improve households' access to better and more reliable energy sources (McCollum, et al., 2018). SDG number 7, in particular, talks about access to affordable and clean energy, aimed at alleviating energy poverty that is fundamental to meeting the said SDGs. Issues of sustainability and energy poverty reduction have been growing concerns on public policy agenda for some time (Zhou and Yang, 2016; Pachauri and Spreng, 2011; Amigun, Musango and Stafford, 2011). Although the other SDGs do not explicitly

refer to energy, none of the goals could be achieved without the availability of adequate and affordable energy. Undeniably, provision of energy services promote development (Nerini, Tomei, To, Bisaga, Parikh, Black, Borrion, Spataru, Broto, Anandarajah, Milligan and Mulugetta, 2018; Sovacool, 2012). Unfortunately, political and economic factors make it almost impossible to alleviate energy poverty, including factors such as private sector participants who are more concerned with profits; conservative government officials who have competing priorities; development donors with ulterior motives, and lingering socio-technical barriers. These are unfortunate reasons why so many households still do not have access to modern sources of energy, or cannot afford it (Tawney, Miller and Bazilian, 2015; Brew-Hammond, 2010; Sovacool, 2012).

Access to energy is an important component in strategies that aim at mitigating poverty, expanding healthcare and education services, addressing food insecurity, mitigating climate change and enhancing economic development. Notwithstanding, the current state of energy provision in Africa remains critically low. Malawi is among the countries in the sub-Saharan Africa that have low access rates. Admittedly, Malawi struggles with structural challenges such as insufficient generational capacity and unreliable energy supply as well as high unit costs of energy (Oseni, 2019; Ouedraogo, 2017; Taulo, Gondwe and Sebitosi, 2015; Hailu, 2012). According to the International Energy Agency (IEA), over 1.3 billion people in the world have no access to electricity of which almost 95% live in Sub-Saharan Africa (including Malawi that is the focus of this study) and Asian developing countries, (Dagnachew, et al., 2018; Dagnachew, Lucas, Hof, Gernaat, Boer and Vuuren, 2017).

1.1.2 Malawi in context

It is reported that Malawi is one of the least developed countries in the world that also lacks sufficient domestic resources and institutional capacity to address climate change-related changes effectively (Pasquini, 2019; Fiorenza, Jangda, Malcomb and Mao, 2013, in Weaver and Peratsakis 2013). Malawi is a landlocked country of 11.8 million hectares, 600 km from the coast of Mozambique (Suckall, Fraser, Foster and Mkwambisi, 2015; Openshaw, 2010). It is located in southeastern Africa and lies between 32.5 degrees E and 35.9 degrees E longitudes, and 9.3 degrees S and 17.1 degrees S latitudes. Malawi is bordered by Tanzania to the north, Zambia to the west, and Mozambique to the south and east). Malawi's economy is heavily dominated by the agricultural sector (To, Masala, Navarro, Batchelor, Mulugetta, Barnett and Karekezi, 2017; Chirambo, 2016; Wood and Moriniere, 2013; Jumbe, 2004). Maize is the staple food crop in the country, while tobacco is the principal export crop, while arable agriculture is the main occupation (Schuenemann, Thurlow, Meyer, Robertson and Rodrigues, 2018; Wood, Nelson, Kilic and Murray, 2013; Openshaw, 2010). Other crops that contribute significantly to the economy of the country apart from tobacco, are tea, sugarcane and cotton (Magombo,

Edreiss and Phiri, 2016; Gamula, Hui and Peng, 2013). Over 80% of the country's export earnings is from agriculture, and the agriculture sector provides 85% of employment, also contributing 35% of GDP. Malawi is a very poor country with 50% of its population living below 2 USD per person per day (Benfica, Squarcina and Fuente, 2018; Zalengera *et al*., 2014).

The country is divided into three administrative regions, namely the northern-, the central- and the southern regions. The 2008 census indicates that 45% of people in Malawi live in the southern region; 42% live in the central region and 13% live in the northern region (NSO, 2008). Balaka and Phalombe, the districts that were targeted in this study, are located in the southern region, which is also the largest region (Gamula *et al*., 2013) as shown in Figure 1.1, which presents a map of Malawi. The Malawi population is estimated at 18.63 million in 2019. The southern region where Balaka and Phalombe are situated, has the highest population, followed by the central- and then the northern regions. The population composition of the two districts that were targeted in this investigation, Phalombe, having 429,450 and Balaka having 438,379 residents (NSO, 2018). Noteworthy, is that between the 1998 and 2008 census, the Malawi population had increased by 32%. The country's population grew from 13 million in 2008, to 15.91 million in 2013. As of 2016, Malawi's population is estimated at 16 million, of whom 85% reside in rural areas (Chirambo, 2016). Currently (30th July, 2019), the Malawi population is at 19,763,839 according to the United Nations estimates.

Undeniably, Malawi's population growth rate increases the demand for fuelwood, which is the most accessible source of energy (Toth, Ramachandran-Nair, Jacobson, Widyanisih and Duffy, 2019; Stringer *et al*., 2012). This also means that the demand for fuelwood for cooking as well as many other energy services is also growing significantly, putting further pressure on the energy infrastructure and resources in the country (Zalengera *et al.*, 2014). As Malawi's population increases, the need for land for agricultural production increases in addition to the increased demand for fuelwood and charcoal, resulting in increased deforestation. Currently, the fuelwood and charcoal industries in Malawi are important employers: Openshaw (2010) estimates that the relevant industries account for an estimated 133,000 jobs and 2% of the country's labour force (Toth, *et al.,* 2019; Smith, 2016).

Fuelwood is the most important subsistence forest product that rural households in sub-Saharan Africa harvest. In sub-Saharan Africa, fuelwood accounts for 75% of total wood harvest, contributing to the problem of deforestation (Kramer, 2018; Bone, *et al.*, 2017; Jagger and Jumbe, 2016). Access to electricity in sub-Saharan Africa has been restrained by factors such as limited capital investment; lack of technological knowledge on renewable energy development; limited power generation planning; deficient electricity supply resulting from frequent power systems failure and unreliable equipment; low rate of electrification in the region;

high cost of electrical energy generation, as well as high transmission losses (To, *et al.,* 2017; Suberu *et al*., 2013). This explains why sub-Saharan Africa is lagging behind many other regions in the world in terms of electrification.

Although Malawi is relatively endowed with vast forest resources, the forests are not evenly distributed across the country. Of the total forest area of 2.6 million ha, 42%, is in the northern region where only 12% of the country's population are situated, compared to 30% in the southern region where half of the population lives. Surpluses in the north of Malawi are economically and/ or physically inaccessible to the bulk of the population living in the south and centre of the country (Ngwira and Watanabe, 2019; Openshaw, 2010:368; Kayambazinthu and Lockie, 2002). Another problem, is that the bulk of the forest resources (1.8 million ha) constitute protected areas such as forest reserves, national parks, catchment areas and wildlife reserves. For many years, local people surrounding forest reserves were not allowed to collect fuelwood or any other forest and non-forest products from these reserves. Generally, therefore, forest reserves are not accessible to the local community because they are protected areas. Plantation forests represent the third most important source of fuelwood, contributing 11% of the total fuelwood supply. These however consist of exotic tree species, most of which were established by government in the mid-1970s with support from the donor community and the private sector. The government established 0.5 million ha of softwood plantation (mainly Pinus patula) across the country for pulp, paper and timber, and hardwood species (Eucalyptus species) for fuelwood and poles. Of the total area under plantation forests (111 000 ha), only 0.8% is owned by the private sector - mainly for processing of tea and tobacco (Jimu, Mataruse, Musemwa and Nyakudya, 2017; Taulo and Sebitosi, 2015; Government of Malawi, 2001).

Malawi is one of the countries in the SADC region that have been worst affected by climate change. Climate change contributes to, and exacerbates poverty in Malawi (Jagger, Pedit, Bittner, Hamrick, Phwandaphwanda and Jumbe, 2017; Chirambo, 2016). Malawi has experienced numerous climatic hazards such as dry spells, seasonal droughts, intense rainfall and flooding (Coulibaly, Mbow, Sileshi, Beedy, Kundhlande and Musau, 2015; Fiorenza, *et al*., 2013:18). Climate projections indicate that Africa is experiencing the worst effects of climate change, apart from being the most vulnerable in the world (Coulibaly, *et al.,* 2015; Kakota, Nyariki, Mkwambisi and Kogi-Makau, 2012). Generally, climate change is projected to further reduce potential energy availability through reduced water flows to major hydropower dams and worsening the depletion of biomass energy sources. The future scenario for Malawi therefore seems bleak, and therefore research that could provide answers and logic to improve the situation, is long overdue.

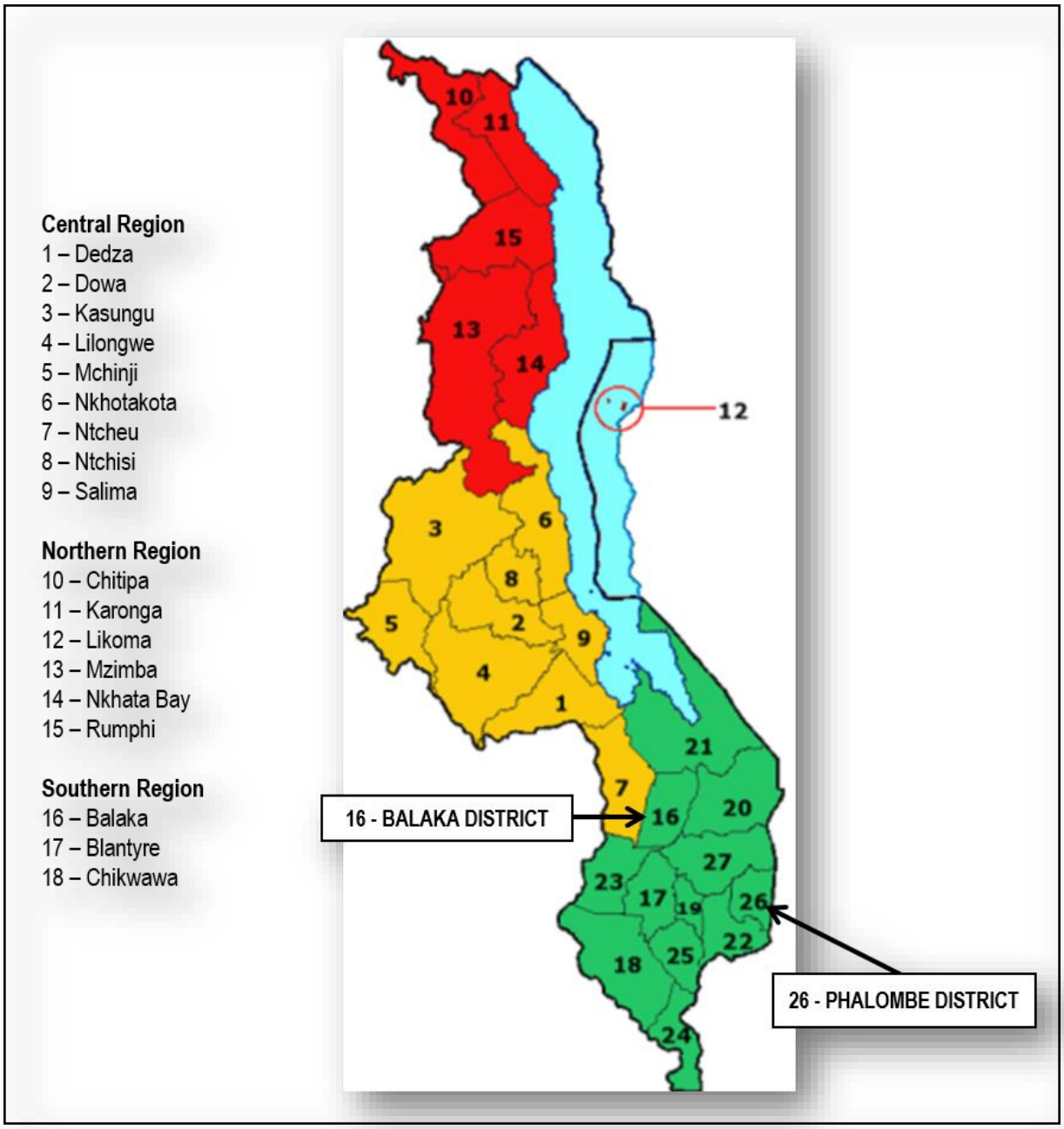

FIGURE 1.1: MAP OF MALAWI (Source, Wikipedia)

1.1.3 Electricity supply in Malawi

In Malawi, only 8% of households are connected to the electricity grid. To make matters worse, even those that are connected to the grid often receive intermittent and unreliable energy or are sometimes unable to pay for electricity. Electricity in Malawi is supplied and operated by the state owned Electricity Supply Corporation of Malawi (ESCOM) (Seim and Robinson, 2019; Chirambo, 2016; Zalengera *et al*., 2014; Adkins, Eapen, Kaluwize, Nair and Modi, 2010). Numerous rural households in developing countries such as Malawi have many unmet energy needs with regard to daily activities such as cooking, lighting, heating, transportation and

telecommunication services (Toth, *et al.*, 2019; Schuenemann, Msangi and Zeller, 2018; Johnson and Bryden, 2012). In Malawi, rural households depend on fuelwood for most of their energy needs (Behera and Ali, 2017; Zalengera *et al*., 2014; Brouwer, Hoorweg, and Van Liere, 1997). According to the International Energy Agency (2010), energy poverty comprises a lack of access to electricity and reliance on traditional biomass fuels for cooking (Sovacool, 2012). In reality, having no electricity, and having to depend on cooking fuels such as wood, charcoal and/ or dung, is generally associated with poverty.

1.1.4 Energy sources and consequences of their consumption

In the poorest areas in many developing countries, most sources of energy are fuelwood, charcoal and agricultural residues, with a high dependence on biomass fuels for cooking, heating and lighting. In Malawi, like in many African countries, the cultural traditions are that women are responsible for collecting fuelwood even though the collection of fuelwood is time consuming and entails heavy physical labour. This is to the disadvantage of women's health and takes up time that could have been used for taking care of their families, educating themselves and engaging in income-generating activities (Datta, 2018; Tsusaka, Orr, Msere, Harris , Rao and Ganga, 2018; Neupane, Clark and Lambert, 2017; Economic Commission for Africa [ECA], 2009).

In Malawi, rural households rely on fuelwood for nearly all their energy needs, while urban and semi-urban households have increasingly turned to charcoal, contributing to deforestation on a large scale (Bone, Parks, Hudson, Tsirinzeni and Willcock, 2017; Jagger and Jumbe, 2016; Jumbe and Angelsen, 2011; Ngwira and Watanabe, 2019). It is concerning that the country's forest resources have gradually been reduced from 50% land cover in the 1960s to 34% in 2010 (Bone, *et al.,* 2017; Saka, Siable and Hachigonta, 2012). The same authors report that agriculture, forestry and other land use accounted for 88% of Malawi's reported greenhouse emissions in 2000. Increased reliance on biomass has impacted the environment negatively, for example causing indoor pollution, deforestation and soil erosion (Jagger and Perez-Heydrich, 2016; Gamula *et al*., 2013). The smoke from burning biomass fuels contain high concentrations of particulate matter, carbon monoxide and other pollutants that are associated with increased rates of infant mortality and respiratory disease. The WHO (World Health Organization) identifies indoor air pollution (IAP) as the single leading environmental risk factor to female mortality, attributing five percent of all female deaths to indoor smoke in developing countries (Barron and Torero, 2017; Njenga, Iiyama,Jamnadass, Helander, Larsson. Leeuw, Neufeldt. Nowina and Sundberg, 2016; Miller and Mobarak, 2013:2).

Fuelwood extraction is one of the leading causes of deforestation and environmental degradation in Malawi (Bone, *et al.,* 2017; Katumbi, Nyengere and Mkandawire, 2015; Gamula

et al., 2013; Government of Malawi, 2006a, b, cited in Jumbe and Angelsen, 2011). In Malawi, there are three main sources of fuelwood: customary forests, forest reserves and plantation forests. Customary forests are the most important source of fuelwood and consist of natural (tropical) woodlands dominated by Uapaca, Parinari, Julbernadia and Brachystegia species. A study conducted in central and northern Malawi, found that 35% of households collect their fuelwood exclusively from customary forests. Forest reserves are the country's second most important source of fuelwood, contributing 26% of the final energy consumption (Schuenemann, *et al.,* 2018; Nerfa and Rhemtulla, 2019; Jumbe and Angelsen, 2011). Like customary forests, these are natural woodlands, mainly dominated by Brachystegia, Julbernadia and Isoberlinia species (Timko and Kozak, 2016; Ngulube, 1999). Apart from fuelwood, other sources of biomass energy include crop residues and animal dung.

Due to deforestation, households cope with scarcity by for example walking longer distances to collect wood. Those who can afford to, pay more for charcoal and fuelwood or change cooking stoves or cooking practices to whatever is more accessible and suitable at the time. In extreme cases, households resort to cooking with inferior fuels such as crop residues. Estimates indicate that crop residues contribute 10% of the total biomass energy consumption (Taulo, et al., 2015; Government of Malawi, 2001). Crop residues are available seasonally and are crucial in the south because of wood shortages (Schuenemann *et al.,* 2018; Das, Jagger and Yeatts, 2017; Openshaw, 2010). As mentioned previously, increased use of crop residues exposes households, especially women, to air pollution that can have a negative impact on their health. Zhang *et al*. (1999) cautioned some time ago, that burning crop residues for one hour, produces carbon monoxide (CO) concentration of 241 parts per million (ppm), which exceeds the exposure limit of 30 ppm according to the WHO Air Quality Guidelines (WHO, 1999). It is estimated that worldwide, more than 4.3 million people, mostly women and children, die every year from inhaling noxious fumes from inferior energy forms such as biomass and coal (Bruce, Pope, Rehfuess, Balakrishnan, Adair-Rohani and Dora, 2015; Burke and Dundas, 2015; WHO 2014; Parikh, 2011).

Apart from the health hazard of using crop residues, the removal of these substances from gardens exposes the soil to erosion and deprives livestock of fodder. It also reduces agricultural productivity, since most farmers who cannot afford chemical fertilizers depend on these crop residues as compost manure to replenish soil nutrients (Gwenzi, Chaukura, Mukome, Machado and Nyamasoka, 2015; Heltberg, 2005; IEA, 2002). In tobacco growing areas of Malawi, tobacco stems are popularly used for cooking, which can have even more devastating health impacts - especially on infants who are carried on their mothers' backs inside the kitchen when cooking and when tending to fires. Tobacco smoke contains more than 5,000 toxic and

carcinogenic compounds (Talhout, Schulz, Florek, Benthem, Wester and Opperhuizen, 2011; Jantunen *et al*., 1997).

It is reported that indoor air pollution in developing countries caused by exposure to domestic smoke from biomass fuels is a major cause of respiratory diseases (Balmes, 2019; Van Vliet, Kinney, Owusu-Agyei, Schluger, Whyatt, Jack, Chillrud, Boamah, Mujtaba and Asante, 2019; Adkins *et al*., 2012). Energy poverty thus causes public health concerns that are related to indoor air pollution, physical injury during fuelwood collection, in addition to lack of refrigeration and medical care in areas that lack electricity (Balmes, 2019; Kirenga, Wise, Gianella, Checkley, Crocker, Roa, Goodman and Simkovich, 2019; Sovacool, 2012). According to the World Health Organization, indoor pollution can result in acute respiratory infections, tuberculosis, chronic respiratory diseases, lung cancer, cardiovascular disease, asthma, low birth weights, diseases of the eye and adverse pregnancy outcomes (Balmes, 2019; Kirenga, *et al.*, 2019; Sovacool, 2012). Apparently, 50% of all deaths from indoor air pollution in sub-Saharan Africa can be attributed to the burning of wood. Death from indoor air pollution is even greater than from malaria and tuberculosis (Balmes, 2019; International Energy Agency, 2006; WHO 2006, 2014). It is projected that between 2005 and 2030, 10 million women and children will die from the smoke produced by cooking stoves in Sub-Saharan Africa apart from women and children also being exposed to health related risks during the burdensome and time-intensive process of collecting fuelwood (Kelly, Crampin, Mortimer, Dube, Malava, Johnson, Unterhalter and Glynn, 2018; Scheunemann, et al., 2018; Sovacool, 2012).

Measures or policies that aim to ease biomass scarcity in Malawi have provided clear economic welfare gains (Schuenemann, *et al.,* 2018; Bandyopadhyay *et al.,* 2011). One such measure in rural areas has been to expand the areas under plantation forests from which fuelwood can be collected, to reduce the pressure on customary forest reserves (Nerfa and Rhemtulla, 2019; Toth, *et al.,* 2019; Jumbe and Angelsen, 2011). Currently, in Malawi, policy makers are challenged to introduce policies to move towards a low-carbon future given the present scenario of reliance on fuelwood and charcoal production (Abdilahi, Mustafa, Abujarad and Mustapha, 2018; Stringer *et al*., 2012).

1.1.5 Governmental interventions

In 2003, a National Energy Policy was compiled by the Department of Energy Affairs to shift energy use away from “traditional biomass” toward “modern” sources of energy that include electricity, liquid fuels and renewable sources of energy. The aim was to reduce poverty, stimulate economic development and improve labour productivity (Adams, Klobodu and Apio, 2018; Chirambo, 2016; Government of Malawi, 2009:12). Unfortunately, the Government has

not been able to fulfill its plans as stipulated in the policy document, which attributes the energy supply problem to three factors (Chirambo, 2016; Zalengera, *et al*., 2014), namely:

- Inadequate, unaffordable, unreliable and inaccessible electricity due to monopolistic structures, under-developed services, poor management, lack of competition and cultural inertia;
- Over dependence on imported and relatively high cost of petroleum products; and
- Over dependence on fuelwood, largely produced from indigenous forests as aggregate consumption exceeds levels of sustainable fuelwood yields by about 30% (Scheunemann, et al., 2018; Chirambo, 2016; Zalengera *et al*., 2014; .

The Malawi Energy Policy (2003) stipulated that it would reduce the proportion of households that use three stone fireplaces that are highly energy inefficient, to 50% by 2020. Presently, biomass is the most common and readily available source of energy in households in Malawi and will continue to be in the short and mid-term in both urban and rural areas. In the Malawi Biomass Energy strategy of 2009, there is a political statement that fuelwood will remain the major source of energy for cooking in years to come because alternative sources of energy are not readily available in Malawi yet (Schuenemann, *et al.,* 2018; Taulo, *et al.,* 2015; Zalengera, *et al.,* 2014; Kaunda, 2013).

The Government of Malawi has a number of programmes and projects in place to improve the standard of living for the rural population. Notwithstanding, less than one percent of the rural population have access to electricity and the system is also unreliable. Presently, the energy sector is not effectively contributing to the economic development of the country because it is unreliable and insufficient. As a result, it is not able to meet the overall energy demand (Chirambo, 2017; Taulo, *et al*., 2015; Gamula, *et al*., 2013).

1.1.6 Barriers to alleviating energy poverty in Malawi

Several barriers jeopardise the alleviation of energy poverty in Malawi (Eales and Unyolo, 2018; Schwerhoff and Sy, 2017; Taulo and Chirambo, 2016; Gondwe and Sebitosi, 2015; Sovacool, 2012), namely:

Technical problems are prevalent, such as lack of high quality equipment and/ or standards and certifications, constrained manufacturing capacity, difficulty to provide maintenance, logistical problems including transport and installation, as well as inability to conduct proper environmental impact assessments.

With regards to **economic and financial challenges**, lack of capital, low electricity tariffs, failure to include externalities in energy prices, unfavourable power purchase agreements, and under-investment in electricity infrastructure generally, difficulties procuring financing, extended project lead-times, as well as comparatively lower rates of return on investment are challenging.

Political and institutional challenges relate to political instability, poor institutional capacity, fragmentation in energy policy making and integration obstacles, lack of information, corruption, and political patronage, commitment to fossil fuels and/ or subsidies and licensing issues.

Social and cultural factors include local opposition and protests, unfamiliarity and lack of knowledge, theft and vandalism, unrealistic expectations, donor driven priorities and aid dependence that prevent progress).

1.2 RESEARCH PROBLEM AND CONTRIBUTION OF THE STUDY

Malawi is among the poorest countries in Africa. Due to high costs of electricity and the fact that relatively expensive electrical appliances are required when homes obtain access to electricity, Malawi's rural households largely depend on natural woodland and forest resources for fuelwood for daily use and as a source of income (Toth, *et al.,* 2019; Jagger and Perez-Heydrich, 2016; Jumbe and Angelsen, 2011). Unfortunately, the growing consumption of fuelwood at household level in Malawi exceeds the supply of fuelwood and has subsequently placed immense pressure on forests and woodlands around the villages and communities, contributing to alarming rates of deforestation (Bone, *et al.,* 2017; Currier and Lewis, 2015; Smith, *et al.*, 2015; Bandyopadhyay, Shyamsundar and Baccini, 2011) with detrimental consequences for climate change (Shackleton *et al*., 2001). Additional causes of over exploitation of woodland and forestry resources, are open access to forest areas, high levels of poverty, weak management and lack of coordination between local and traditional governance on local woodlands and forests. Consequently, Malawi is losing up to 2.8% of its forests annually. For example, 13% of the country's land surface forest cover was lost between 1990 and 2005, principally due to demand for fuelwood (Ngwira and Watanabe, 2019; Bone, *et al*., 2017; Stringer, Dougill, Dyer, Kalaba and Mngoli, 2012; FAO, 2010). This phenomenon is not unique to Malawi in Southern Africa, as even more economically advanced countries such as South Africa experience similar problems (Nerfa, 2018; Bone *et al.,* 2017; Lewis and Currier, 2015; Maphiri, 2009; Prasad and Visagie, 2005) due to an over-reliance on fuelwood for energy by poorer communities. The predicament is that fuelwood consumption has become an integral aspect of the Malawian rural social context and it is unfortunately not clear how informed households are about the consequences of their fuelwood consumption, and how willing households and communities are to adapt their current fuelwood consumption practices. What

complicates matters further, is that change will entail effort to be made in terms of a higher order need, namely that households will have to save global resources for the sake of the future of our planet while they are struggling to cope themselves. Without empirical evidence of consumers' behavioural practices, ability and /or willingness to make sacrifices or adapt, it would be difficult to convince Government to prioritise concern about climate change, and to encourage and enable access to alternative energy sources that would curb deforestation (Ngwira and Watanabe, 2019; Dagnachew, Lucas, Hof, and Vuuren, 2018; Wiyo, Fiwa and Mwase, 2015; Maphiri, 2009; Prasad and Visagie, 2005).

Studies in other developing countries that have accounted for household wealth, income and location indicated that households depend differently on forests and agroforestry for fuelwood supply (Iiyama, Neufeldt, Dobie, Njenga, Ndegwa and Jamnadass, 2014; Ashton *et al.,* 2011; Jumbe and Angelsen 2011; Baland, *et al.,* 2010). An exploration and analysis of the energy consumption patterns of households in Malawi will enable context specific recommendations to households on how to sustainably use fuelwood in the light of dwindling forests and woodlots with an empathetic understanding of practical challenges and household energy needs. Findings will furthermore provide evidence of the role of consumers' knowledge of the consequences of their fuelwood consumption practices and the probability that they could adopt alternative energy sources in the foreseeable future. In addition, the study will shed light on the role and interaction of external stakeholders such as government and non-governmental organisations in these areas in terms of facilitating households' and communities' energy consumption practices.

1.3 THEORETICAL PERSPECTIVE: STRUCTURATION THEORY

Structuration theory served as the theoretical perspective that guided the formulation of the research objectives, the content and design of the measuring instrument, interpretation of the data as well as the formulation of the findings. Structuration theory was particularly ideal for this study because it allowed the researcher to explore how "agent" and "structure" that are involved in the household energy consumption system can function in harmony despite them being heterogeneous. Per the definition of Giddens (1984), the "agent" - in this study - is the rural (Malawi) household that is involved in, and committed to the consumption of different sources of energy within proximity. The "structure" refers to the systems of provision that are operating in these areas.

Structuration as proposed by Anthony Giddens in 1984 concerns the creation and reproduction of social systems and concerns the examination of both structure and agent/s within particular social systems. Structuration theory recognises a social cycle in which agents and structure

mutually endorse particular social systems, and where social systems become part of the duality. It examines the structure, modality and interaction within social systems that represent the social practices that are reproduced over time and space in a particular context through the actions of households (as the so-called actors). Structures, on the other hand, refer to the rules and resources that are rooted in agents' memory and that provide the structuring properties that connect and bind existing social practices within a social system (Spaargaren, 2003; Giddens, 1984). This theory allowed the researcher to study the relationship between the activities/ practices of human actors (households) and the existing social systems, thus the interaction between agency and structure, and how this interaction shapes practices (Stones, 2017; Middlemiss, 2011).

According to structuration theory, individual behaviour, for example, Malawi households' fuelwood consumption practices and underlying reasons, interests, and motives (for such practices) are studied in the context of existing social practices in a given context (time and space). Inevitably, the norms, beliefs and values regarding environmental friendly action/ behaviour are intertwined when describing households' circumstances and their practices. Eventually, these encompass the rules that are associated with specific social practices that are shared with others, for example, a community. Rules and resources constitute the structures that are relevant in the reproduction of social practices (Stones, 2017; Middlemiss, 2011; Spaargaren and Van Vliet, 2007; Spaargaren, 2003). Households' practices are not simply ordinary acts but constitute habits and practices that constantly create and recreate social order that is framed by circumstances (Hobson, 2003). Routine practices reflect "hidden" knowledge, also referred to as practical consciousness, i.e. habitual processes, which enable someone to continue with daily life without constantly having to make new decisions, as the decisions become almost automated over time. This is generally embodied and experienced in daily/ frequent practices such as collecting fuelwood. On the other hand, the awareness with which individuals think and communicate, is referred to as discursive consciousness (i.e. cognitive and affective processes). This body of understanding represents an on-going expansion of ideas and possibilities that are anchored in knowledge, values and experience, which also reflect people's concerns and understanding of certain phenomena, for example sustainable energy consumption practices or global warming (Kennedy, Cohen and Krogman, 2015; Middlemiss, 2011; Hobson, 2003).

The core assumptions of structuration theory entail:

The explication of the relevance of agents, agency and structure: Structuration theory acknowledges the role and importance of the so-called agent because of the agent's ability to act out of free will with knowledge at hand. Agents use knowledge to "reflexively monitor"

frequent, routine behaviour, such as household energy consumption practices, within their context and the setting they find themselves in (Kennedy *et al.,* 2015; Mathieu, 2009).

Two different levels of consciousness exist (Giddens, 1984), therefore the behaviour of agents results from practical- and discursive consciousness (McPhee and Canary, 2016; Nonaka and Toyama, 2015). ***Practical consciousness*** is the knowledge that an agent possesses about everyday tasks in life. and guides most conventional, routine or habitual activities on a level where the individual does not really intentionally think about his behaviour, for example, collecting fuelwood near the home for cooking purposes (Nonaka and Toyama, 2015; Nye and Burgess, 2008). Reflexive monitoring refers to the agents' ability to monitor their actions and the setting and contexts of their actions. Usually, knowledge related to one's practical consciousness is hardly noticed as it is ingrained and entangled in daily practices (Bernardi, 2017; Giddens, 1984). ***Discursive consciousness*** is the ability to vocally express knowledge (verbalise knowledge), which includes ideas and cognitions that consumers have a reflective relation with, for example, understanding that using fuelwood has consequences for deforestation, and by extension, also has consequences for climate change (McPhee and Canary, 2016; Nonaka and Toyama, 2015; Hobson, 2003:103-104). In this study, discursive consciousness is about questioning household practices, because consumers possess environmental information that may start a change of undesirable habits. It is about linking practical knowledge with discursive consciousness, which could be out of concern for environmental issues and their impact on climate change (Nonaka and Toyama, 2015; Bartiaux, 2008).

The duality of structure implies that social structure is both the medium and outcome of social action. It is vital to note that agency and structure are interdependent and intertwined with one another. The notion of duality of structure is important when analysing household practices. For example, households are viewed as part of the system: as agents, as well as agents of change in terms of their consumption patterns - in view of climate change - in pursuit of sustainable consumption. The dualism is restrained in terms of the physical infrastructure as well as the social ideals, norms and values that affect how the household participate in specific household energy consumption practices (Stones, 2017; McPhee and Canary, 2016).

Structuration refers to how the duality of structure evolves and reproduces over time. Agents can reflexively monitor their own social behaviour as well as that of others at the practical consciousness level (Giddens, 1984). Structuration theory allows some reflexivity on the part of the consumer in which the individual takes a stance based on knowledge (Stones, 2017; McPhee and Canary, 2016). The duality of structure provides the "structure" to the social practices.

1.4 RESEARCH AIM AND OBJECTIVES

The study focused on households in selected rural areas in the southern part of Malawi, namely Balaka and Phalombe. The research aimed to generate empirical evidence of households' energy consumption as a consequence of their way of life (lifestyle) and the systems of provisions as largely determined by Government policies through the Department of Forestry and Ministry of Agriculture DADO (district and agriculture development office) and traditional leadership. The study envisaged a contribution towards initiatives that may encourage sustainable household energy consumption behavior amidst expressed concern about deforestation in the country and irrevocable consequences in terms of climate change. The study intended to gather evidence of rural Malawi households' practical- and discursive consciousness concerning their energy consumption practices as pre-requisites to facilitate and promote behavioural change. The aim was to indicate the potential contribution of households within selected communities in reducing their own carbon emissions that are potentially detrimental to the future health of the planet, and to contribute to the formulation of policies that would serve the cause.

Reflecting on rural Malawi households, the following research objectives directed the research design:

Objective 1: To investigate and discuss aspects of households' lifestyles specifically relating to their consumption of sources of energy for daily use, i.e.:

1.1 types of energy used for different activities;
1.2 origin of the different energy sources and related implications;
1.3 involvement and habits of household members in the collection of fuelwood and charcoal for different activities and occasions;
1.4 time (hours) spent on collecting fuelwood and charcoal by households, and
1.5 money spent on energy for the household.

Objective 2: To investigate and discuss heads of households' practical consciousness about climate change and sustainable consumption practices in terms of:

2.1 its manifestation in the sources of energy used for different activities, and
2.2 their demonstration of thoughtful practices when using energy sources.

Objective 3: To explore and discuss households' *discursive consciousness* of climate change with regard to their consumption of different energy

sources, specifically their ability to explain their choice of energy sources.

Objective 4: **To explore and discuss the role and interaction of systems of provision (i.e. government, non-governmental organizations) in these areas in terms of households' and communities' consumption of energy sources.**

1.5 RELEVANT LITERATURE

A comprehensive literature review is presented in Chapter 2. The following section provides a brief overview.

1.5.1 Climate change and household energy consumption

Energy access is important to address global development challenges such as poverty, inequality, climate change, food security, health and education. Energy is also important in the achieving of the Sustainable Development Goals (SDG), while energy poverty undermines achievement of the SDG 7 in particular (Nussbaumer, Bazilian and Modi, 2012). Essentially, all of the SDGs are highly dependent on the availability of adequate and affordable energy (UNDP, 2015; Sovacool, 2012).

1.5.1.1 Household energy consumption in sub-Saharan Africa

Unmistakably, household practises are important to reduce greenhouse gas emissions, which are of major concern in terms of global warming and the future of our planet. Uncertainty however exists as to whether consumers are cognisant of their energy consumption and the possible contribution thereof towards environmental degradation (Sulaiman, Abdul-Rahim, Mohd-Shahwahid and Chin, 2017; Pierce, Schiano and Paulos, 2010) considering that consumers are viewed as agents of change (Spaargaren and Oosterveer, 2010). It is, therefore, imperative that consumers, service providers and governments cooperate to accomplish energy efficiency (Sulaiman, et al., 2017; Gaspar and Antunes, 2011).

1.5.1.2 Vulnerability to climate change in Sub-Saharan Africa

In discussing ways of adapting to climate variability and change in sub-Saharan Africa, two established strategies are acknowledged in literature (Buhaug, Benjaminsen, Sjaastad and Theisen, 2015; Smith, 1997), namely *anticipatory adaptation* that involves advance preparation for the consequences of change, and *reactive adaptation* that involves coping with the effects of change following a natural disaster or once gradual climatic changes have started to have significant impacts. Fisher, Cadbury and McCusker (2010) argue that rural households in low-income countries should simultaneously respond to a much broader range of factors, including

environmental, societal, political and economic impacts (Thornton and Herrero, 2015). Therefore, it is difficult to determine the degree to which a single stressor, such as climate change, impacts households' behavior.

Previous studies have shown that rural households and governments use forests to prepare for, and to mitigate the impacts of climate inconsistencies. In Senegal, which has been struck by successive droughts since the 1970s, people practice agroforestry, using trees as windbreaks that help protect soils, create microclimates for a variety of crops, and reduce desertification (Bayala, Kalinganire, Sileshi and Tondoh, 2018; Oxfam, 2006). In drought-prone areas of north-eastern Nigeria, farmers actively protect trees on farms and in forests to manage biodiversity and to reduce desertification (Krishnamurthy, Krishnamurthy, Rajagopal and Solares, 2019; Masebo and Menamo, 2016; Mortimore and Adams, 2001). As part of the National Action Plan for Adaptation, the government of Burkina Faso has initiated large-scale reforestation programs, planting fast growing, and drought tolerant trees to reduce the impacts of desertification (Kalame, Nkem, Idinoba, and Kanninen, 2009). In Kenya and Tanzania, six out of 16 strategies for dealing with drought, involved the use of indigenous plant species that grow in forests (Ibrahim, Balzter and Kaduk, 2018; Makondo and Thomas, 2018; Fandohan, 2016; Eriksen, *et al*., 2005).

1.5.1.3 Factors affecting the use of fuelwoods in sub-Saharan Africa

Several factors affect the demand and supply of fuelwood and charcoal in Sub-Saharan Africa (Njenga, Gitau, Iiyama, Jamnadassa, Mahmoud and Karanja, 2019; Sola, *et al.,* 2017; Falcao, 2005), e.g. population, income, technology, institutions and policies as well as the price of forest products, substitute products and wood raw material. Every one of these factors affects both demand and supply of wood. Demand for and supply of fuelwood are controlled by factors such as population and economic growth, government policy and the price of forest products. A complication is, however, that where fuelwood scarcity exists, alternatives are presently lacking, complicating life even more. Moreover, where alternative fuel energy sources are available and affordable, they are often preferred.

1.5.1.4 Population growth and subsequent needs for energy

According to Njiti and Kemcha (2003), 40% of people worldwide - at the time - depended on wood or charcoal as a source of domestic energy, while up to 90% of the energy consumption of Africans came from fuelwood and charcoal. Thus, in the savanna zones of Africa, wood is the major source of energy. It can hence be expected that as the population of Sub-Saharan Africa grows, the dependency on fuelwood and charcoal will also increase (Amoah, 2019). It is estimated that 3 billion people in Africa, Asia and Americas use solid fuels such as wood, crop residues, dung and charcoal for energy (Quinn, *et al.,* 2018). Falcao (2005) argues that

“population growth has historically been a major factor influencing wood consumption and it is not likely that the close relationship between population growth and growth in consumption will change significantly in the foreseeable future”. Njenga *et al.,* 2019, report that 90% of the population in Sub-Saharan Africa relies on fuelwood and charcoal for their energy needs and this puts pressure on the sources as the population has to make sure that the consumption has to be “economically viable, socially acceptable and ecologically sustainable”.

1.5.1.5 Economic growth and energy consumption

According to IIASA (1998), the world’s energy consumption has tripled in the first fifty years of the 20th century and then increased fourfold in the forty years up to 1990. This increase is attributed to population increase, urbanization and economic growth (Cabeza, Palacios, Serrano, Urge-Vorsatz and Barreneche, 2018). IIASA (1998) expected that energy consumption would double or triple between 1990 and 2050. Economic growth, especially with the advent of the Industrial Revolution in the 18th and 19th centuries, marked the rise of fossil fuels to replace fuelwood, which was the most important source of fuel. The discovery of technology to retrieve, process, transport and use fossil fuels meant that world economies relied less on fuelwood. Thus Falcao (2005) argued that: “. . . over the span 150 years of the 19th and 20th century, the contribution of fuel consumed in today’s developed economies has changed from virtually 100% fuelwood and charcoal to the situation where fuelwood contributes only 1-2%.” (Bithas and Kalimeris, 2016; Fouquet, 2016) However, according to IIASA (2005), in the developing countries, fuelwood remains the main source of energy with dependency and consumption being as high as 80%. An important economic factor influencing fuelwood consumption, however, is the shrinking of forest resources (Bervoets, Boerstler, Dumas-Johansen, Thulstrup and Xia, 2016; Scheid, Hafner, Hoffmann, Kachele, Sieber and Rybak, 2018).

It is not surprising that fuelwood consumption levels also vary greatly within countries. In Tanzania, for instance, household consumption in villages near wooded areas is three times higher than in villages with little or no woodland (Bervoets, Boerstler, Dumas-Johansen, Thulstrup and Xia, 2016; Agarwal, 1986). The same is true for Malawi (Jagger and jumbe, 2016; Jagger and Perez-Heydrich, 2016; Fisher, Chaudhury and McCusker, 2010). Similarly, in Nepal, people moving to the well-wooded plains, consume twice as much as those remaining in the forest-depleted hills. In essence, people use more wood when it is readily available than when it is scarce. Levels of use of fuelwood also depend on the availability and price of alternative fuels. Much uncertainty therefore exists about households’ fuelwood needs, and this uncertainty also relates to the availability of fuelwood (Mohammed, Bashir and Mustafa, 2015). For example, the main sources of domestic energy in Mozambique, Malawi, Tanzania and Zambia are electricity, liquid petroleum gas, kerosene, charcoal and fuelwood. The first three are available only in urban centers, and to the wealthy members of the community. Kerosene is

usually used by the lower income groups for lighting, while charcoal and fuelwood are the main sources of heat to the majority of rural people and town dwellers (Kayambazinthu and Oeba, 2019; Behera and Ali, 2016; Falcao, 2008).

1.5.1.6 Policies and institutions

Another factor influencing the production and consumption of fuelwood and charcoal in Sub-Saharan Africa, is the policy and institutional energy frameworks. According to Solberg (1996), energ policy can affect forestry and forest products in several ways (Adams, Klobodu and Opoku, 2016). Economic policy that leads to increased demand for energy can force consumers and industry to revert from other sources of energy such as electricity and oil, towards fuelwood, that can increase the demand and price of fuelwood. Increased energy costs also increase the cost of transportation, which has an impact on supply (Ebhota and Inambao, 2017). Another role that policy plays in the production and consumption of fuelwood, relates to subsidization of commercial energy, which has the effect of reducing the demand for fuelwood. Subsidization is also a measure that has been used to reduce the pressure of fragile protection forests in some arid countries (Rasagam and Zhu, 2018). Brooks, *et al.* (1996:67**)** argue that the effect of subsidies on smokeless fuels, and restricting the use of smoky fuels and fire places, tend to reduce air pollution in urban areas, although this tends to reduce the demand for fuelwoods (Sharma, 2018; Kroon, 2016; Mohammed, *et al*., 2015).

According to Falcao **(2**005), in the Sub-Saharan Africa countries of Malawi, Mozambique, Tanzania and Zambia, the forestry sector that is associated with natural forests and less developed areas, has through history had a lower priority in societies' choices for institutional development (Sulaiman, *et al.,* 2017). Critical issues such as forestry education and local governance of natural and forest resources have been lacking. Similarly, most government forestry organizations are only recently established. Some countries do not yet have such organisations, or only have them in very preliminary forms. Many government agencies responsible for the implementation of forest policy lack the resources to establish or implement the measures to carry it out (Sola, Schure, Atyi, Gumbo, Okeyo and Awono, 2019). Solberg (1996) caution that there are many cases where the legal framework for the implementation of forest policy is weak or lacking and that it is imperative that governments in Sub-Saharan Africa should develop appropriate institutional and policy frameworks to govern the critical issues surrounding the acquisition and consumption of fuelwood (Eberhard, Gratwick, Morella and Antmann, 2017; Behera and Ali,2016).

1.5.1.7 The situation in Malawi, Mozambique, Tanzania and Zambia

According to Falcao (2005), communities' fuelwood needs should refer to the least possible amount of the commodity that is indispensable for household consumption, artisanal purposes

and rural industries, amidst local conditions and the share of fuelwood as part of their available energy supplies (Toth, *et al*., 2019; Taulo, *et al*., 2015). Researchers such as Falcao (2005) and Karekezi *et al.* (2003) explain that charcoal in Malawi, Mozambique, Tanzania and Zambia is produced from Miombo woodland and therefore, these woodlands are very important to the livelihoods of the people (Chidumayo, 2019; Gumbo, Dumas-Johansen, Muir, Boerstler and Zuzhang, 2018). Not only does the local population harvest these woodlands for home consumption, they also harvest it for sale in the urban areas where the fuelwood is used instead of electricity and gas. Luoga *et al.* (2000) furthermore note that most of the charcoal in these countries is produced by the traditional earth kiln method that is very labour intensive, and is mainly carried out by men (Sparrevik, Adam, Martinsen and Cornelissen, 2015; Hardy, Cornelis, Houben, Lambert and Dufey, 2016).

The demand for fuel is rising due to the relatively high cost of electricity and petroleum-based fuels (e.g. paraffin) as well as the rapid human population growth, particularly in urban areas in Mozambique, Malawi, Tanzania and Zambia (Behera and Ali, 2017). Usually, the demand for fuelwood is higher in the urban areas of developing countries than in rural areas: a main reason being households' inability to gain access to other fuels such as gas and fossil fuels in the energy mix of the urban areas. A kind of ladder of energy sources exists in the urban areas: from fuelwood at the bottom, through charcoal, kerosene and gas, to electricity at the top. People generally climb this ladder as their income increases. Therefore, charcoal, which is seldom used in the rural areas because of availability of free wood, is quite popular in urban areas because of higher incomes and factors such as its lightness and its non-smoking nature (Behera and Ali, 2017; Bervoets, Boerstler, Borelli, Duma-Johansen, Thulstrup and Xia, 2017; Kroon, 2016; Brouwer and Falcão, 2004).

1.6 CLIMATE CHANGE, ENERGY SOURCES AND ENERGY CONSUMPTION IN MALAWI

Malawi's contribution to global greenhouse gas emissions is generally small, estimated at 29 million tons in 1990. GHG emissions in Malawi have however increased by 14% between 1990 and 2011. The total GHG emissions were at 10.85 metric tons of carban dioxide equivalent (MtCO2e) (USAID, 2016). In 2016, the CO_2 emissions per capita was 0.1 metric tonnes (USAID, 2016). This is mainly attributed to agriculture and small components of livestock ruminants and rice production, which are emitters of methane; limited burning of rainforests and crop residues; and small industrial and transport components (CO_2 and NOx- emitters). As such, efforts to mitigate climate change will probably be small. Climate change in Malawi will largely be a function of emissions from elsewhere (Bie, Mkwambisi and Gomani, 2013). However, Malawi has undertaken several actions and projects in the wake of climate change.

For instance, it is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) that was hosted in 1992 by the United Nations Conference on Environment and Development. Malawi is also a signatory to the Convention of Biological Diversity (CBD). National Environmental Action Plan was also developed in 1994 after experiencing the adverse impacts of droughts and floods, essentially caused by climate change (Chirambo, 2016; Bie*, et al.,* 2013). The Government of Malawi has also adopted two primary strategies to address climate change mitigation and sustainable development through the National Adaptation Programme of Action (NAPA, 2006) and also the Malawi Growth and Development Strategy (MGDS, 2006). The NAPA is a follow-up to the United Nations Framework Convention on Climate Change (UNFCCC) that advised least developed countries to identify and prioritize critically important adaptation activities to mitigate adverse impacts of climate change among rural communities in vulnerable areas of the country. On the other hand, MGDS provide Malawi's medium-term road map for advancing sustainable development (Chirambo, 2017; Jagger and Jumbe, 2016; Brown, 2011).

1.6.1 Climate variability in Malawi

Malawi is one of the world's twelve most vulnerable countries in terms of the adverse effects of climate change (Murray, Gebremedhin, brychkova and Spillane, 2016; Asfaw, McCarthy, Lipper, Arslan, Cattaneo and Kachulu, 2013). The country is relatively densely populated compared to other low-income countries with 160 inhabitants per square kilometer compared to other countries that average is 40 inhabitants per kilometer (Behera and Ali, 2017). Agriculture accounts for one-third of the gross domestic product (GDP), half of total export earnings and two-thirds of employment (Scheunemann, *et al.,* 2018; Arndt, Schlosser, Strzepek and Thurlow, 2014) and therefore climate change is a major concern for Malawi in general. The climate in Malawi is highly variable: 40 weather-related disasters occurred during 1970–2006, including 16 drought or flood events after 1990 (Action-Aid, 2006). These weather events resulted in chronic food shortages, greater poverty, and deterioration in health conditions (Ngongondo, Jamu, Sagona, likongwe, Chiotha, Chapotera and Mwale, 2018; Nangoma, 2007). For example, flooding in 2001/ 02 led to famine and an estimated 1000 deaths, while a drought in 2005 caused food shortages for more than 4.7 million of the 13 million people in Malawi (Devereux, 2006). Indisputably, Malawi has been experiencing climate change in a form a variety of climatic hazards (Mubaya, Ngepah and Seyama, 2015; Nkomwa, Joshua, Ngongondo, Monjerezi and Chipungu, 2014). Malawi is apparently highly vulnerable to climate change because of the sensitivity of its eco-systems, food supplies, natural resources and human settlements. Its projected impacts; the exposure of these systems to the projected impacts; as well as its low adaptive capacity, which is a result of limited financial resources, education, information skills, infrastructure, access to resources, and stability of institutions and management capabilities, makes climate change a daunting challenge to the nation. Climate change in Malawi is not just

an environmental problem but it is also a principal development challenge (Ngongondo, *et al.,* 2018; Mubaya, *et al,* 2015; Nkomwa, *et al.,* 2014; Brown, 2011).

The impact of future climate variability and change in Malawi will depend partly on the adaptive ability of rural households. Like other African countries, Malawi is vulnerable to climate change, because (a) the country is already drought prone (Ngongondo, et al., 2018; Devereux, 2006); (b) rain-fed agriculture contributes about 40% of gross domestic product; and (c) the country is very poor, with 65% of the population living below the poverty line (World Bank, 2018; Orr, Kambombo, Roth, Harris and Doyle, 2015; Mukherjee and Benson, 2003). Furthermore, technologies for coping with climate variability, such as early warning systems and irrigation, are limited; access to information and the population's ability to process that information is low; and political, social, and economic institutions are weak (Nangoma, 2007).

1.6.2 Malawi's forests and forest management

Malawi's forests are dominated by closed, deciduous woodland known colloquially as Miombo, which are the most common vegetation type in central, southern, and eastern Africa (Missanjo and Kamanga-Thole, 2015; Ngulube, 1999). Miombo provides a wide range of products and services that are essential to rural communities. However, Malawi is losing forest cover at a rate of 2.4% per year, which is likely to reduce the usefulness of forest resources as a strategy for adapting to effects of climate variability (Ngwira and Watanabe, 2019; Currier and Lewis, 2015; UNEP, 2002).

The primary threat to Malawi's forests is forestland clearing for agricultural expansion (Bone, et al., 2017; Government of Malawi, 1998). Smallholder farmers often have to clear forestland to grow sufficient food, and in many communities, open access to land is customary, due to the weakening of traditional controls over land allocation (Ngwira and Watanabe, 2019; Government of Malawi, 1998). Intensive extraction of wood is another threat to Malawi's forests: approximately 90% of the country's total energy needs is provided by biomass (Jagger and Perez-Heydrich, 2016; Government of Malawi, 1998). Moreover, the productivity of Miombo woodlands is generally low, and at current levels of demand, wood harvest rates far exceed sustainable yield. The estimated deficit for fuelwood rose from 1.6 to 4.9 million cubic meters during 1983–90 (Taulo, *et al.,* 2015; Government of Malawi, 1998).

Forests in Malawi have not yet been utilized as a resource for reducing the impact of extreme weather events. Vision 2020, a long-term government plan that promotes sustainable development and public awareness about climate change issues, does not mention the role of forests. Tree planting schemes to combat deforestation and protect forest resources during extreme weather events have not yet been integrated into the government's adaptation

strategies (ActionAid, 2006). Although the National Adaptation Plan of Action (NAPA) of 2006 contains some forestry activities, such as afforestation and reforestation programs to control siltation, it largely ignores the role of forests in minimizing the impact of droughts and floods. Finally, Malawi's forest conservation policies, such as the National Forest Policy of 1996 and the National Forestry Program of 2001, do not link forests with adaptation to climate change (Kambewa and Utila, 2008). Subsequently, in 2016, Malawi Government developed the Malawi National Forest Policy with the aim of protecting anf conserving forestry resources in the country. This time around, the government recognized the need for inclusion of emerging issues, globally, regionally and nationally that impact the management of the forest that the 1996 policy did not envisage. These emerging issues would include the payment of ecosystem services (PES); reduced emissions from deforestation and forest degradation (REDD+); clean development mechanisms and HIV and AIDS (Government of Malawi, 2016). Meanwhile, the Malawi government also introduced the national charcoal strategy in 2016, aimed at setting the nation on a path towards diversified, sustainable and regulated household energy sector. There is also a national climate change management policy (Government of Malawi, 2016), which provides an institutional framework for the application and implementation of adaptation, mitigation, technology transfer and capacity building measures. All these are efforts and strategies by the Malawi government in the area of energy (Wiyo, *et al.,* 2015).

1.6.3 Household energy consumption in Malawi

Malawi has been endowed with different energy sources that include coal, hydropower, petroleum, fuelwood, thermal- and new and renewable energy resources (Chirambo, 2016; Taulo *et al.,* 2015; Government of Malawi, 1993). Notwithstanding, Malawi is a low and inefficient energy consumer (Taulo, *et al.,* 2015; Openshaw, 2010). Eighty percent of the population in Malawi lives in rural areas where biomass energy is a more important source of energy for rural households than for urban households (Zalengera, *et al*., 2014): approximately 90% of the energy used in rural households are from biomass, mostly in its raw form (Kambewa and Chiwaula, 2010). This is because of high levels of poverty that make the purchase of alternative sources of energy almost impossible; low electricity coverage in the country any way; and limited alternative energy sources in the country (Chirambo, 2017; Taulo, *et al.,* 2015; Government of Malawi, 1993).

Biomass accounts for 97% of the energy sources used in urban areas in Malawi, with 52% in its primary form as fuelwood; 7% originating from crop residues, while the rest are converted into charcoal (41%) (Kambewa and Chiwaula, 2010). Because wood is the most affordable form of energy for poor households, it encourages an over-reliance on fuelwood and over-exploitation of natural woodland leading to further deforestation (Toth, *et al.,* 2019; Jumbe and Angelsen,

2011). Rural areas consume the bulk of household fuelwood while the urban centers consume only 17% of this fuelwood nationally (Schuenemann, *et al.,* 2018; Government of Malawi, 1993).

According to the Government of Malawi (2006), fuelwood extraction for energy is one of the leading causes of deforestation and environmental degradation apart from the permanent land conversion for agriculture, settlement and infrastructural development (Nerfa and Rhemtulla, 2019; Katumbi, *et al.,* 2015). Kambewa, *et al.* (2007) state that wood harvesting for charcoal production is estimated to contribute about one-third of Malawi's total deforestation. Jumbe and Angelsen (2011) report that 46% of households in Malawi collect their fuelwood from forest reserves and that the main sources of fuelwood in Malawi are forest reserves, customary forests and plantation forests. According to Ngulube (1999) most of Malawi's forest reserves consist of natural woodlands dominated mainly by Brachystergia, Julbernadia and Isoberlinia species (Schuenemann, Msanji and Zeller, 2018; Jagger and Perez-Heydrich, 2016).

Due to deforestation, some households have no option other than to resort to the use of agricultural residues and cow dung as sources of energy at household level (Sola, Ochieng, Yila and Iiyama, 2016; Government of Malawi, 1993). Households tend to turn to crop residues when wood is not available or scarce: up to 97% of rural households use fuelwood and grass for cooking; 1% use charcoal for cooking and another 1% uses crop residues, which translates into 99 % reliance on biomass for cooking in rural areas (Jagger and Perez-Heydrich, 2016; Kambewa and Chiwaula, 2010). To the contrary, urban households use a combination of wood and charcoal (Government of Malawi National Charcoal Strategy 2017:2027; Government of Malawi, 1993).

Less than 10% of the population in Malawi have access to electricity (Dasappa, 2011), and less than 1% of the population have access to modern fuels (Chirambo, 2016; O'Shaughnessy, Deasy, Doyle and Robinson, 2014). Generally, in Malawi, the energy sector is confronted with energy supply problems such as "inadequate, unaffordable, unreliable and inaccessible electricity due to monopolistic structures, under-developed services, poor management, lack of competition and cultural inertia; overdependence on imported and relatively high cost petroleum products; and overdependence on fuelwood largely produced from indigenous forest with aggregate consumption exceeding levels of sustainable fuelwood yields" (Toth, *et al.,* 2019; Zalengera *et al*., 2014). The high cost of imported appliances, connection fees, connection policy that stipulates that electricity will only be connected to houses with tin roof or modern housing materials further limit the adoption of electrification in both urban and rural areas in Malawi (O'Sullivan and Fitzgerald, 2007). In the end, low disposable income is a primary reason why most households in Malawi still use fuelwood for cooking (Toth, *et al.,* 2019; Openshaw, 2010).

Although solar panels, solar lanterns, and medium powered hand crank generators can be used as electricity generating devices to provide lighting and phone charging capabilities for off grid rural communities, issues such as high capital investment, theft, long term reliability and poor maintenance have up to now hindered the penetration of these technologies in Malawi. Most households without grid connectivity therefore also lack household electricity from such off-grid technologies (Eales, Frame, Dauenhauer, Kambombo and Kamanga, 2017; O"Shaughnessy, *et al.,* 2014).

It is important to note that different energy sources are used for different activities, for example, rural households use fuelwood as the main cooking fuel and fuelwood and grass for lighting. Paraffin is often used for lighting but is rarely used for cooking anywhere in Malawi because it has become very expensive (Taulo*, et al*., 2015; O'Sullivan and Fitzgerald, 2007). The situation differs in urban areas where 59% of households use paraffin and diesel for lighting; 32 % use electricity; and 8% use candles (Kambewa and Chiwaula, 2010). Coal is only used in the industrial sub-sector. All petroleum products that are sold in the country are imported (Taulo, *et al.,* 2015; Openshaw, 2010).

1.6.4 Fuelwood problems in Malawi

Malawi was once heavily forested with 59% of the total land area of 9.4 million ha covered by forests in the 1960s. Since then, the country has lost a significant share of its remaining forest cover from 45% of the land area in 1972 to 25.3% in 1990, and an extra 25% (669,000 ha) by 2008 (Bone, *et al.,* 2017; Kambewa, *et al.,* 2007). Much of the forest cover was lost due to the opening of large estates for the growing of cash crops such as tea and tobacco to boost economic growth. Increased demands for food and agriculture production to sustain the economy have resulted in the increase of land under agriculture (Ngwira and Watanabe, 2019; Kambewa, *et al*., 2007).

Existing forests are not evenly distributed across Malawi: The northern region has 43.7% of the country's forests but with only 13% of the country's population of 13 million people (NSO, 2008) compared to 26.3% in the central region with 42% of the population, and 30% in the southern region where 45% of the population lives (Jagger and Jumbe, 2016; Taulo, *et al.,* 2015; Zulu, 2010). The relative abundance and scarcity of wood across different regions (i.e. supply and demand imbalance) partly explain the recent shift in energy use from mostly fuelwood, to include charcoal and electricity within the energy mix when possible (Taulo, *et al.,* 2015; Jumbe and Angelsen, 2011). The scarcity of fuelwood increases the burden of fuelwood collection, as people have to walk longer distances to fetch fuelwood (Senganimalunje, Chirwa,Babalola and Graham, 2016; Arnold *et al*., 2006).

Another factor related to the use of fuelwood and charcoal in Malawi, is that bulk of the forest resources (2.3 million ha) are protected areas such as forest reserves, national parks, catchment areas and wildlife reserves (Katumbi, *et al.,* 2015; FAO, 2010). Before, local people surrounding forest reserves were not allowed to collect fuelwood or any other forest and non-forest products from these reserves.

1.6.5 Reasons for Malawi households' energy consumption practices

Household energy use is a function of the structure of a household and the intensity of energy use in the household. The energy intensity is influenced by heating demand, use of energy-intensive devices/ appliances, occupancy work patterns, standards of living, comfort expectations, energy user behaviour, types and frequency of use of devices/ appliances and cultural habits (Cecelski, Dunkerley and Ramsay, 2015; Yohanis, 2012). Ultimately, the idea is to reduce energy consumption while also envisaging cultural and social changes related to high energy consumption (Cecelski*, et al*., 2015; Gram-Hanssen, 2011).

The total energy consumption of households differ, because of differences in their disposable income/ expenditure, with a strong correlation between energy and income/ expenditure (Raty and Carlsson-Kanyama, 2010). It has been found that CO_2 emissions and environmental impacts increase with household income increases, because increased affluence enables consumers to use more energy and to acquire more material goods that require more energy to produce or to operate (Cecelski, *et al.,* 2015; Tukker, Cohen, Hubacek and Mont, 2010).

Issues of affordability are crucial in households' use of different sources of energy. Apart from this, availability is also important (Kojima, Zhou, Han, Wit, Bacon and Trimble, 2016; Gram-Hanssen, 2011; Karekezi and Kithyoma, 2007; Bailis, Ezzati and Kammen, 2003). Location of a household, whether rural or urban also affects the forms of energy used (Behera and Ali, 2016; Ekholm, Krey, Pachauri and Riahi, 2010) in addition to household size and type; automobile ownership; food consumption patterns; international and interregional trade; social and cultural differences (Leimbach, Roming, Schultes and Schwerhoff, 2016; Waitt, Caputi, Gibson, Farbotko, Head, Gill and Stanes, 2012; Tukker, *et al*., 2010).

1.7 RESEARCH DESIGN

This multi-method, sequential research inquiry involved quantitative as well as qualitative data collection procedures. Data collection and data analysis techniques were chosen in accordance with the different phases of the research to enable a comprehensive understanding of the research problem (Bryman, 2017; Babbie, 2016; Creswell, 2014:4; Neuman, 2014; Creswell and Clark, 2011:2, 3). The sequential mixed-method approach entailed an initial quantitative

data collection phase of which the data was analyzed before the qualitative data collection phase commenced to incorporate findings in the subsequent phase (Almalki, 2016; Creswell, 2014:220). In explanatory, sequential, mixed-method research, quantitative and qualitative data are integrated and are not analyzed entirely independently (Almalki, 2016; Creswell and Clark, 2011:185). Therefore, the quantitative results were used to inform the type of participants to be purposefully recruited for the qualitative phase during the focus group discussions. Further to that, the quantitative phase was also used to inform the themes as well as type of questions asked to the participants during the qualitative phase. The qualitative phase involved key informant interviews with government officials and traditional leadership, as well as representatives of non-governmental organization that are working in the two districts. The qualitative phase also included the focus group discussions with participants that were involved in the quantitative phase (Deliens, Deforche, Bourdeaudhuji and Clarys, 2015; Creswell, 2014:224; Neuman, 2014; Creswell and Clark, 2011:6).

1.7.1 First phase: Quantitative data: Survey

1.7.1.1 The population

Phalombe and Balaka districts were chosen because they are in the denser populated regions in Malawi which are also among the six districts in Malawi that have been heavily impacted by climate change (Ngondondo,Jamu, Sagona, Likongwe, Chiotha, Chapotera and Mwale, 2018; Nkomwa, *et al*., 2014:164). A preliminary visit to the areas indicated that the two communities included 272 and 280 households respectively.

1.7.1.2 The measuring instrument

Quantitative data was collected through a structured questionnaire that was designed to be completed in interview format (refer to addendum A, questionnaire). This part of the research was conducted from the point of view of the positivist paradigm, where the world is regarded as consisting of observable, measurable facts (Antwi and Hamza, 2015; De Vos, Strydom, Schulze and Patel, 2014:7; Glesne and Peshkin, 1992). The questionnaire distinguished phenomena in terms of measurable and common categories (Winter, 2000) to capture the perspectives and experiences of people in predetermined response categories (Bryman, 2017; Patton, 2001:14). In this respect, the questionnaire provided a standardized guide based on constructs that were well defined in literature. In short, everything possible was done to ensure that the questionnaire measured what it is supposed to measure and that the predetermined procedures would be appropriate. Easy-to-complete ordinal scale questions were used, and numbers were assigned to indicate responses that could be summarized and statistically analyzed: focusing on households' lifestyles and energy consumption practices as well as consumers' practical and discursive consciousness of their behavior and consumption practices on climate change (Zhang, Kuchinke, Woud, Velten and Margraf, 2017).

1.7.1.3 Sample and sampling

For this study, the researcher employed random sampling as explained in 4.2.3.1.2 (every second house in the village was targeted). When the women were not available, every subsequent house was chosen. The women were specifically targeted because they are the ones who collect fuelwood and are also involved in the decision making regarding energy consumption at household level (Toth, Nair, Jacobson, Widyaningsih and Duffy, 2019; Nerfa and Rhemtulla, 2019). It is important to note that the villages do not have street names nor do they have house numbers, a typical henomenon in third world Malawi (Hafner, Tagliapietra, Falchetta and Occhiali, 2019; Bryant and White, 2018;Emerson, 2015; Creswell, 2014:158). A preliminary visit to the areas indicated that the two communities included 272 and 280 households respectively. After applying the '30-10' rule, which requires the sample size to be a minimum of 30 units or 10 per cent of the population of interest, whichever is greater and where a complete population of interest is known (Fugard and Potts, 2015; Grinnell, 2001), it was decided to target 100 households in every region for the main household survey. This study aimed to extend this recommendation and eventually involved a total of 231 households, of which 118 were located in Balaka and 113 in Phalombe.

The researcher sought permission from the village headmen (Chief Manjanja in Balaka and Chief Khamula in Phalombe) in each village before conducting the research. It is important to acknowledge that government extension workers (Rivirivi EPA in Balaka and Kasongo EPA in Phalombe) were involved in introduction of the research team to the village headship and the women who participated in the research.

1.7.1.4 Data collection

Prior to the data collection exercise, one week of training was provided by the researcher to selected research assistants (RAs) to orientate them to the research objectives and design, data collection methodologies to be employed and ethical issues in research such as sensitivity and confidentiality. The research assistants were also trained to administer the questions consistently (Hilton, 2017; Creswell and Clark, 2011:179). Part of the training included a pre-test (pilot test/study) of the baseline questionnaire in villages close to the Bunda Campus of the Lilongwe University of Agriculture and Natural Resources where the researcher is employed. The pre-test (pilot test/study) experiences were used to refine the questionnaire and to map out field logistics before the fully-fledged baseline survey. The respondents selected for this pre-test were similar to those required for the final study, namely, women who are involved in the collection and use of fuelwood and other energy sources in their households. This is in line with administering the research instrument to a sample for purposes of validation (Kumar, 2018; Creswell and Clark, 2011:189).

The three RAs implemented the baseline survey (231 households in total) through interviews with heads of households, or their proxies. The respondents that were recruited for the sample completed a structured questionnaire in interview format because they were not necessarily able to complete the questionnaires themselves. For this purpose, the researcher was accompanied, and assisted by trained fieldworkers. The first, household survey phase, took three months to complete (one and a half month each in Balaka and Phalombe). Apart from consulting with communities personally, the researcher personally supervised and monitored the data collection by the RAs. To optimize the quality of the data, remuneration of the RAs was based on each properly completed, checked and approved questionnaire. On average, six questionnaires were administered daily. All the household level interviews were held at respondents' homes using the interview guide. Immediately after completion of each round of the household survey, the questionnaires were coded and entered into the statistical analysis software SPSS by the researcher and one data entry assistant The questionnaires were pre-tested. This pre-testing was done as a training exercise for the research assistants before embarking on the main survey in the study sites (Khanal and Wilson, 2019). The pre-testing of the questionnaire was done in a different area to the study sites in order to ensure that the entire process did not influence the final study. It served as a practice exercise for the data collection (Adhikari, Falco and Lovett, 2004, Khanal and Wilson, 2019).

1.7.2 Second Phase: Qualitative data: Focus group discussions

Focus group discussions were held to discuss various aspects of fuelwood acquisition and use in households and communities aiming to gain a wider perspective of rural communities. The discussions involved participants that were previously involved in the quantitative data collection process and who therefore were familiar with the investigation, the nature of the topic and questions asked (Leedy, Ormod and Johnson, 2019; Creswell, 2014:220; Creswell and Clark 2011:185; Salkind, 2010). There was no pre-testing of the focus group discussions due to time and budgetary constraints. The focus group discussions were audio-recorded (Powell and Single, 1996; Gros *et al*, 2019). The quantitative phase guided the recruitment of participants for the focus groups.

1.7.3 Third Phase: Qualitative data: Key informant interviews

The researcher conducted a number of key informant interviews at district and community levels as part of the qualitative data collection exercise. In this regard it is important to note that a community in Malawi is typically referred to as a village or a group of villages. Villages are part of an informal, but officially recognized administrative structure of the traditional leadership (chieftaincy) system. Because they organize and influence people socially, culturally, politically and economically, they are important research entities (Kutengule, 2000). However, even with the presence of these structures, there are other structures that play an important role in village

development such as the Village Development Committees (VDCs) in order to target beneficiaries. The VDCs are part of the national decentralization policy introduced in the 1990s to promote local governance and development management and were framed around traditional leadership structure. As such, they play a very important role in managing community assets such as forests (more specifically the Village Natural Resource Management Committees) (Scheba and Mustalahti, 2015; Stringer, Dougill, Mkwambisi, Dyer, Kalaba and Mngoli, 2012). Key informant interviews were thus held with Government Development and Agriculture Development Officers; Government forestry officers and traditional leadership.

1.8 DATA ANALYSIS

In keeping with the mixed-methods approach, data was analyzed using appropriate methods even though both methods may have involved similar steps of preparing the data for analysis, exploring the data, analyzing the data, representing the analysis, interpreting the analysis and validating the data and interpretation (Walliman, 2017; Creswell and Clark, 2011:203, 204).

1.8.1 Quantitative data: Phase 1

Data collection for the quantitative survey was done within a one and half month period in each geographic area, starting in August 2015 and ending in November 2016. Data entry was an on-going exercise during this period. Questionnaires were coded and entered into SPSS (Statistical Package for Social Sciences). The data was then processed by means of descriptive statistics to summarise and quantify the amount of resources (energy, time, money) used by households. Percentages and means were calculated wherever relevant. Descriptive statistics were used to summarise the demographic information; exploratory factor analysis was used to analyse sections C1 and C2 in the questionnaire, pertaining to consumers' practical- and discursive consciousness. These analyses were followed by the calculation of Cronbach's Alpha to verify the internal consistency of the dimensions of the respective scales, where after means and standard deviations were calculated to interpret the results in accordance with objectives 2 and 3 of the study.

1.8.2 Qualitative data: Phases 2 and 3

The individual data set were firstly transcribed verbatim by the researcher. Content analysis was done by applying open coding and axial coding to the data sets (Richards and Hemphill, 2018; Scott and Garner, 2013:95). The interviews were open-coded in order to yield a list of keywords and associated concepts. The codes were divided into relevant themes (Richards and Hemphill, 2018; Neuman, 2014; Creswell and Clark, 2011:205). Essentially, during open coding, the researcher read through the data several times and created tentative labels for the chunks of data that were summarized. These words and associated concepts were continuously grouped

into coherent structures until data saturation was reached. This stage was followed by the axial coding stage whereby the concept structure was broadened and concepts were defined in more detail. According to Charmaz (2006), axial coding integrates the data by connecting categories and sub-categories logically. In the case of this study, triangulation of data was achieved through the focusgroup discussions with female household representatives and further insight was gained during interviews with the different stakeholders (traditional leaders and government officials) (Richards and Hemphill, 2018; Gallicano, 2013; Scott and Garner, 2013:95; Wagemans *et al.*, 2013; Kendall, 1999).

1.9 ENHANCING THE QUALITY OF DATA

Measures were taken throughout the study to eliminate error and to enhance the quality of the data as well as the findings in terms of its reliability, validity and the trustworthiness of qualitative data and related inferences.

1.9.1 Phase 1: Quantitative research

The validity and reliability of the process and data were attended to in several ways.

1.9.1.1 Validity

Validity is about making sure that the research results remain consistent after replication in quantitative research and that the research truly measures that which it was intended to measure (Antwi and Hamza, 2015; Joppe, 2000:1). The traditional criteria for validity are rooted in a positivist tradition where validity is regarded as the culmination of other empirical conceptions (Antwi and Hamza, 2015; Winter, 2000). In this study, the questionnaire was designed with specific constructs in mind that were generated from literature. Then the questionnaire was pre-tested in nearby villages before the actual survey was conducted in Balaka and Phalombe districts.

Triangulation is a validity tool used, especially when different sources and participants are used in the data collection (Nunes, Barroso and Santos, 2019; Babbie, 2016; Neuman, 2014; Creswell and Clark, 2011:211). In this study, qualitative data was used to verify the validity of quantitative data. As noted earlier, focus group discussions were held with selected women from the community to triangulate the data. In addition, key informant interviews were held with traditional leaders and government officials to gain further insight into topic of investigation.

1.9.1.2 Reliability

Quality of data in a research should also be attended to in terms of repeatability over time with a similar methodology (Walliman, 2017; Joppe, 2000:1). Three types of reliability were

considered in this research, namely (1) the degree to which a measurement, if repeated, will remain the same; (2) the stability of measurement over time; and (3) the similarity of measurements within a given time period (Walliman, 2017; Kirk and Miller, 1986:41-42). The methodology is fully explained in Chapter 3 of this thesis. The questionnaire and in-depth interview guide are included appendices in this thesis (Appendix I and II) for inspection. The researcher tried to ensure that the questionnaire and the procedures for administering the questionnaire would stand the test of repeatability by carefully attending to the pilot study where clarity was sought for the items in the questionnaire as well as the intended procedure (Walliman, 2017; Creswell, 2014:161). A pilot study was conducted to ensure that the items included in the questionnaire were relevant, understandable and would produce suitable information in terms of the research objectives. The second objective of the pilot study was to ensure that procedures for administering the questionnaire were executable. Three research assistants (RAs) who assisted with data collection were trained by the researcher before the time and were supervised during the data collection process. Before the qualitative phases, the researcher held focus group discussions with women in another area in order to evaluate the clarity of the questions/ items on the checklist (Walliman, 2017; Creswell and Clark, 2011:189). The focus group discussions were held before the key informant interviews as an exercise to clarify the issues in the survey as well as to triangulate the findings of the survey. It was an exercise that was done to prepare the researcher for in-depth perceptions and issues in household energy consumption in the study areas (Balaka and Phalombe) as experienced by the rural women (agents) before meeting the key informants who formed part of the systems of provision (Giddens, 1984; Spaargaren and Oosterveer, 2010).

1.9.2 Phase 2 and 3: Qualitative research

1.9.2.1 Credibility/Authenticity

Credibility of the qualitative data was ensured through the process of constant comparison and reflexivity (Noble and Smith, 2015; Kolb, 2012). Data from focus group discussions and key informant interviews were used to augment the quantitative data. The researcher maintained vigilance by constantly comparing the outcome of the analysis in one particular dataset with other datasets.

Further, in ensuring credibility and authenticity of focus group and in-depth interviews data, the interviewee and the subjects were adequately identified and described. Reflexivity was employed by matching the research participants' views and researcher's reconstruction and representation of them, i.e. member checks were performed (Graneheim, Lindgren and Lundman, 2017; De Vos, Strydom, Fouche and Delport, 2014:419-420). Credibility in qualitative research involves establishing that the results are credible or believable from the perspective of

the participant in the research, which required of the researcher to take the findings back to the participants for member checksl (Graneheim, *et al*., 2017; Kumar, 2011:185).

1.9.2.2 Transferability

Triangulation of multiple sources of data strengthened the study's usefulness for other settings. Therefore, other researchers would be able to follow and replicate the study if it is thoroughly and extensively described (Connelly, 2016; De Vos *et al.*, 2014:420; Kumar, 2011:185).

1.9.2.3 Dependability

For the sake of dependability, the researcher ensured that the qualitative data was logical and well documented and audited (Simon and Goes, 2016; De Vos *et al.*, 2014:420, 421). However, in qualitative research, flexibility and freedom are important, which means that it might be difficult to precisely reproduce the outcome if the study is repeated (Simon and Goes, 2016; Kumar, 2011:185).

1.10 ETHICS

Ethics need to be observed in all research that involves human participants. Ethical implications are especially important when human subjects are involved as was the case with this research (Sovacool, Heffron, McCauley and Goldthau, 2016; Maree, 2007:306; Leedy and Ormrod, 2005:101; Welman, Kruger and Mitchell, 2005:181, 201). Ethical conduct was incorporated as an integral part of both the quantitative as well as qualitative research phases. Participants were informed that they could withdraw at any stage of the research process. Anonymity was also preserved for all participants throughout the data collection (Lancaster, 2017; Maree, 2007:306; Welman *et al.*, 2005:153). Informed consent was also sought from participants before the interviews began (Lancaster, 2017; Creswell, 2014: 96) in accordance with the ethics guidelines of the Faculty of Natural and Agricultural Sciences (NAS) of the University of Pretoria. Consent forms were only presented to legally and psychologically competent research participants as explained in Chapter 3.

To respect participants' right to privacy, no oral or written report or publication of the findings will be presented in a manner that may lead to the identification of any particular individual, their responses or individual specific behaviour (Lancaster, 2017; Creswell, 2014: 92; Maree, 2007:307; Leedy and Ormrod, 2005:101). Complete and honest accounts of the research findings will be presented with full acknowledgment and recognition of the thoughts, ideas and other intellectual property of external parties (Leedy and Ormrod, 2005:102). The researcher obtained necessary permission from relevant authorities and selected study sites with vested interests in the information (Walliman, 2017; Creswell, 2014:96).

1.11 PRESENTATION AND STRUCTURE OF THE THESIS

This document is presented in the following chapters:

Chapter 1: INTRODUCTION

This chapter presents the background of the research supported by a brief literature review to explain the research problem, and justify the research where after the theoretical perspective and methodology are presented.

Chapter 2: LITERATURE REVIEW

This chapter presents a relevant literature review on climate change and household energy consumption at the global level, in sub-Saharan Africa and also puts Malawi in context.

Chapter 3: THEORETICAL FRAMEWORK

This chapter presents the theoretical perspective that was used to organize the theoretical content of the research, to refine the research methodology and measuring instruments, as well as the organization and structure of the findings.

Chapter 4: RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research design and the methodology that was used for the study that entailed three phases that involved quantitative as well as qualitative techniques to gather the data.

Chapter 5: RESULTS AND DISCUSSIONS

This chapter presents a description of the demographic profile of the sample, their lifestyles and energy consumption practices followed by the results that are integrated in accordance with the objectives for the research.

Chapter 6: CONCLUSIONS AND RECOMMENDATIONS

The conclusion of the thesis presents a summary of the results in terms of the objectives of the study. Specific attention is awarded to the intricate issues of climate change and their link to rural Malawi households' energy acquisition and consumption. Shortcomings of the research are indicated. Recommendations for future research and policy making are based on the research findings.

CHAPTER 2

LITERATURE REVIEW

This chapter presents a literature review attending to climate change and household energy consumption at the global level, in sub-Saharan Africa and also puts Malawi in context

2.1 CLIMATE CHANGE: THE GLOBAL DILEMMA

2.1.1 Climate change at global level

Climate change has become a significant global phenomenon and is characterised by changes in the long-term weather patterns across the world (Hao, Chen, Wei and Li, 2016; Urry, 2015; VijayaVenkataRaman, Iniyan and Goic, 2012), with overwhelming consequences (Kellogg, 2019; Berrang-Ford, Ford and Paterson, 2011; Adger, Arnell and Tompkins, 2005). For example, climate change will likely affect energy consumption in the sense that there will be decreases in the demand for space heating but increases in demand for cooling (Invidiata and Ghisi, 2016; Schaeffer, Szklo, Lucena, Borba, Nogueira, Fleming, Troccoli, Harrison and Boulahya, 2012; Hitz and Smith, 2004;).

The fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC) (2007) and the Stern report (Stern 2007), caution about the impact of human actions on the global environment (Urry, 2015; Ostrom, 2012). Human beings are, in turn, impacted by climate change significantly (Crate and Nuttall, 2016; Gifford, Kormos and McIntyre, 2011; Gifford and Comeau, 2011). Climate change is caused by increased carbon dioxide emissions into the atmosphere (Hao, et al., 2016; Meyer and Odeku, 2009:49), which are precursors of climate change (VijayaVenkataRaman, et al., 2012). Companies, farms, as well as households emit some greenhouse gases. Admittedly, greenhouse gas concentrations per person are higher in developed countries than in developing countries and although emissions of greenhouse gases are principally from developed countries, the negative effects of climate change largely culminate in developing countries. Even in countries that experience the devastating consequences of climate change, the adverse effects differ in different sectors, for example, on the agriculture sector versus coastal zones (Davidson, 2016; Tol, 2009:29, 36). The Intergovernmental Panel on Climate Change (IPCC) assessment in 1995 indicated that there is a discernible human effect on the global climate. In 1976, scientists identified chlorofluoro-carbon (CFC), methane (CH_4) and nitrous oxide (N_2O) as greenhouse gases that produce emissions that are associated with global warming, and eventually, climate change. The UN Framework Convention on Climate Change (UNFCCC) of 1992, indicated that human beings

are interfering with the climate and was then mandated to stabilize greenhouse gases (GHGs) in the atmosphere. The intention was to curb the greenhouse effect that refers to the rising atmospheric concentrations of GHGs where carbon dioxide (CO_2) is the major component. This is usually emitted from burning fossil fuels such as coal and gas; and other human activity (Covert, *Greenstone and Knittel* 2016; Paltsev, 2001:53).

Collaborative efforts are nowadays made to understand the consequences of climate change as well as the mitigation of environmental degradation and methods required to reduce the emission levels of hazardous gases (Covert, *et al.*, 2016; Azevedo, *et al.,* 2011). In this respect, forward thinking governments and businesses have started promoting the use of renewable energy to help mitigate the effects of climate change (Creutzig, Agoston, Goldschmidt, Luderer, Nemet and Pietzcker, 2017; WWF, 2012:10) because they realize the role of consumers and their consumption patterns. Further to that, this has also attracted the interest of researchers, in the hope that positive changes in consumption will result in good public policies that would mitigate the effects of climate change and even help to reverse climate change (Creutzig, Agoston, Goldschmidt, Luderer, Nemet and Pietzcker, 2017; Bin and Dowlatabadi, 2005). However, the starting point for positive change should be the realisation that a link between climate change and human activities exists, particularly from greenhouse gas emission as a result of using fossil fuels such as coal or gas (Covert, et al., 2016; Lorenzoni and Pidgeon, 2006). This cannot be ignored, because energy is one of the key resources required for inter alia, food production that is crucial for human survival (Cecelski, *et al*., 2015; WWF, 2012:88).

Generally, climate change is likely to result in problems such as more frequent high temperatures, with heat-related deaths, floods, drought, extreme storms, as well as infectious disease epidemics. Further to that, there is also evidence of decreases in crop yields and water quality (Wu, Lu, Zhou, Chen and Xu, 2016; Gifford, *et al*., 2011). In essence, the entire planet is threatened by climate change as evidenced by changes in temperature and weather patterns, rises in sea level, loss of species, destruction of habitats, warming of oceans, shrinking ice sheets, declining Arctic sea ice, glacial retreat and ocean acidification (IPCC assessment report, in Vijaya Venkata Raman, Iniyan and Goic, 2012). Energy and transportation are at the core of climate change, as they account for two-thirds of greenhouse gas emissions. Climate change is undeniably the most daunting collective problem to have ever hit the international stage and is a cross-border environmental issue that requires global address (Ordner, 2017; Florini and Sovacool, 2011).

In both the developed world and developing countries, the general public has some knowledge of climate change (Pettenger, 2016; Lorenzoni and Pidgeon, 2006). There is a call for global measures to address climate change so that the excessive consequences of climate change on

the world's ecosystems and economies can be curbed (Creutzig, 2016; Henderson, Golub, Pambudi, Hertel, Godde, Herrero, Cacho and Gerber, 2017). The need to deal with climate change at the world political and government level, is reflected in the Kyoto Protocol and preceding events. The Kyoto Protocol was first held in Kyoto, Japan in 1997 at the Conference of Parties, where world leaders agreed - for the first time - to set specific targets and rough timetables for reducing greenhouse gases (Grubb, Vrolijk and Brack, 2018). A subsequent meeting was held in Montreal Canada (Bergeson, 2017; Skinner, 2011; Houghton, 2009; Schneider, 1998:1). The Kyoto Protocol was considered a milestone in climate protection that set a framework and initial commitments for limits on greenhouse gases emissions, also aiming to stabilize greenhouse gas concentrations in the atmosphere, especially in developed countries as a step towards stabilizing the climate. With regard to developing countries, the industrialized countries were supposed to reduce the catastrophic effects on developing countries, through trade protocols such as removing existing fuel taxes and subsidies; and preferential tariff reduction (Bergeson, 2017; Skinner, 2011; Babikier, Reilly and Jacoby, 2000). It is important to note that the effects of climate change are worst felt in developing countries such as Malawi (Warnatzsch and Reay, 2019; Sato, Joshua, Ngongondo, Chipungu, Malidadi and Monjerezi, 2020).

The Kyoto Protocol was adopted by 160 nations in 1997 to cooperate to limit emissions of greenhouse gases. As of now, more than 180 countries throughout the world have ratified the protocol, except for the USA (Karp and Zhang, 2016; Ostrom, 2012). The then President Bush of USA, called for more time to do research before the country could approve the Kyoto Protocol. This was despite the fact that the USA contributes 21.4% of global CO_2 emissions. The USA is the largest energy producer, consumer and net importer as well as being home to largest coal reserves in the world (Grossman, 2019; Bang, 2010). Eventually, the USA withdrew from the protocol, and its government's lack of commitment to the Kyoto Protocol is concerning to many who are anxious about the greenhouse gas emissions (Grossman, 2019; Parker and Karlsson, 2018; Bang, Hovi and Sprinz, 2012). Apart from the USA, Switzerland and Australia also resisted endorsement of the Protocol as of 2005 (Freedman and Jaggi, 2005), but reconsidered in 2003 and 2007 respectively (Parker and Karlsson, 2018; Akter and Bennett, 2011).

Europe, however, endorsed the Kyoto Protocol, with the UK in the forefront as a supporter and in terms of promoting it (Capstick, Whitmarsh, Poortinga, Pidgeon and Upham, 2015; Lorenzoni and Pidgeon, 2006), even though some argue that national governments in Europe "are not necessarily reliable and credible in diffusing information or taking decisions about climate change" (Lorenzoni and Pidgeon, 2006:88). By 2050, the UK intends to reduce greenhouse gas levels by 80% (Gossling and Buckley, 2016; Moser, 2016; Corner and Randall, 2011).

In December 2009, representatives of 193 governments gathered at the 15th session of the Conference of Parties of the United Nations Framework Convention on Climate Change and the 5th session of the Conference of Parties as the Meeting of the Parties to the Kyoto Protocol that involved 120 Heads of State. The aim of the meeting was to promote implementation of the Convention so that the countries would prevent dangerous anthropogenic interference with the climatatic system. The countries agreed about the need for making cuts in global emissions so that essentially, the global temperature can be stabilised to deter dangerous anthropogenic interference with the climate change (Rogelj, Elzen, Hohne, Fransen, Fekete, Winkler, Schaeffer, Sha, Riahi, and Meinshausen, 2016; Riahi, Kriegler, Johnson, Bertram, den Elzen, Eom, Schaeffer, Edmonds, Isaac, Krey, Longden, Luderer, Méjean, McCollum, Mima, Turton, van Vuuren, Wada, Bosetti, Capros, Criqui, Hamdi-Cherif, Kainuma, Edenhofer, 2015; Rogelj, Chen, Nabel, Macey, Hare, Scheffer, Markmann, Hohne, Andersen and Meinshausen, 2010).

In 2015, different governments came up with the Paris Agreement, which is a first global accord on climate change with policy obligations for all countries, including the USA, concerning global climate governance. This was a very important achievement, referred to as the twenty-first conference of parties (COP-21) interested in climate change as one of the most contentious issues at present (Dimitrov, 2016). At this conference of the United Nations Framework Convention on Climate Change (UNFCCC), the participating countries agreed in principle to commit towards reducing the GHG emissions (Nationally Determined Contributions (NDCs) (Pradhan, Shrestha, Hoa and Matsuoka, 2017).

2.1.2 Climate change and related initiatives at First World level

Climate change mitigation and adaptation are two general responses to global warming. Climate change mitigation is designed to reduce greenhouse gas emissions, to curb the impact on global warming. Climate adaptation is designed to change actions in society, to deal with climate changes that are already evident or that are likely consequences of current greenhouse gas emissions (Ren, Grozev and Higgins, 2016; Ren, Chen and Wang, 2011). Developed countries have made some emission reduction commitments, while developing countries are under pressure to do the same. Developing countries have been resisting such commitments on the grounds that they have contributed little to the current concentrations of greenhouse gas in the atmosphere, and because they are poor and have lower standards of living that complicate matters in terms of changing people's behaviour (Martimort and Straub, 2016; Shalizi and Lecocq, 2009). There are some exceptions regarding some developing countries and emissions of GHG: developing countries such as Mexico, South Africa and Brazil produce more GHG relative to developed countries such as United Kingdom and Sweden (Kuramochi *et al*, 2019).

There is growing need to accelerate the development of new low-carbon technologies and then promoting their global application to stabilize atmospheric greenhouse gas emissions. This also entails appropriate policies for the development and diffusion of such technologies. Environmentally friendly technologies have been developed primarily in developed countries and are required to mitigate their greenhouse gas emissions that are evident in fast-growing emerging countries such as Brazil, Russia, India, China, and South Africa (BRICS). Another challenge facing the adoption and diffusion of novel technologies, is lack of information: there is no clear and widely accepted definition of what constitutes a "climate-change-mitigation technology". Also, there is no understanding of how such technologies are diffused globally (Gosens, Hedenus and Sandén,2017; Dechezleprêtre, 2011). Low-carbon technologies have been identified as a key element for mitigating climate change although there is not yet a clear indication about the role of individual climate change mitigation technologies (Riahi, *et al*, 2015; Kriegler, Weyant, Blanford, Krey, Clarke, Edmonds, Fawcett, Luderer, RiahI, Richels, Rose, Tavoni and Van Vuuren, 2014). Low-carbon technologies and energy-efficiency improvements can help countries and regions to achieve energy security goals by promoting more dependable, resilient and diversified energy portfolios (McCollum, Krey, Riahi, Kolp, Grubler, Makowski and Nakicenovic, 2013).

Challenges exist that national and global decision-makers have to deal with in terms of a massive decarbonisation of the world economy that requires a 50 to 85% reduction of global carbon CO_2 emissions by 2050, whilst improving the standards of living for the global population. These challenges are more pronounced in the world regions that have benefitted less from the developments that have resulted in the current greenhouse gas emissions and subsequent high atmospheric concentrations. A delicate balance is required between satisfaction of the needs of the present generations and the effective protection of the rights of the future generations to enjoy a stable and safe climate (Diprose, Liu, Valentine, Vanderbeck and McQuaid, 2019; McQuaid, Vanderbeck, Valentine, Liu, Chen, Zhang and Diprose, 2018; Ürge-Vorsatz, 2012). The cooperation of countries is crucial in the mitigation of the impacts of climate change as no one country or group of countries can provide its own solution to the predicament. There is therefore a need for coordination of national initiatives within regional and international frameworks (Hoel, Kittelsen and Kverndokk, 2019; Nema, Nema and Roy, 2012). Mitigation of the impact of climate change also requires cooperation between different levels of governments and the private sector (Hoel, *et al.*, 2019; Broto and Bulkeley, 2013).

Energy efficiency is an essential topic in policies concerning energy and climate change mitigation as it promotes reductions in the greenhouse gas emissions and air pollution. Moreover, energy efficiency reduces investments in energy infrastructures, lower fossil fuel dependency, increases competitiveness and improves consumer welfare. In Europe, energy

efficiency practices include retrofitting walls and roof insulation in residential buildings, improved energy management systems in commercial buildings, replacement of equipment in manufacturing industries, as well as alternative modes of transport (Nijkamp and Perrels, 2018; Lopes, Antunes and Martins, 2012).

Essentially, energy conservation is divided into two sub-categories, namely *low-cost energy behaviour* and *high-cost energy behaviour*. For example, filling up a dishwasher and switching off lights in vacant rooms are examples of low-cost energy behaviours. Recycling is another example of low cost energy behaviours, while the use of more environmentally friendly transport modes and avoiding charter flights, calls for greater sacrifices and are examples of high-cost energy behaviours (Nijkamp and Perrels, 2018; Borgstede, Andersson and Johnsson, 2013; Lopes, *et al.,* 2012;). Empirical analyses in Europe show that consumers who are concerned about climate change are more likely to undertake actions to mitigate climate change, to agree to energy conservation policies and to believe in change of future energy consumption patterns unlike their counterparts (Nijkamp and Perrels, 2018; Wicker and Becken, 2013).

Energy saving behaviour at household level is a very encompassing phenomenon, involving actions such as turning appliances off at the wall; using cold water to wash hands and to rinse dishes; reducing heating in unoccupied rooms; reducing hot water temperature; only washing full loads in a washing machine or dishwasher; putting on more clothing rather than turning up the heating; keeping household heating low to save energy; line drying rather than tumble drying laundry; taking shorter showers; doing dishes by hand; cooling one's house by opening windows; cooking with gas; installing double glazing to better maintain the interior temperature in buildings; installing energy-efficient household appliances, heating systems and light bulbs; buying smaller refrigerators where possible; insulation heating pipes; and improving house insulation (Nijkamp and Perrels, 2018; Mirosa, Lawson and Gnoth, 2011). Admittedly, some of these actions may be expensive, for example energy efficient bulbs are much more expensive than ordinary light bulbs.

Malawi has a hydro-electric power plant on the Shire river, in Mwanza district. This is managed by ESCOM (Electricity Supply Commission of Malawi). It is a Government of Malawi initiative to alleviate the electricity crisis in the country, and which is supposed to provide electricity to the country. However, because of climate change and low rainfall, the station fails to supply grid electricity to meet the national demands. The problem is that the power supply fluctuates due to the drying of the Shire river due to climate change (Milanzi and Daw, 2018; Mzuza, Zhang, Kapute and Wei, 2019; Falchetta, Kasamba and Parkinson, 2020). Rural Malawi will not benefit soon from the national grid electricity because of issues of affordability as well as poor construction of houses that needs to be improved before wiring can be installed safely.

Presently, rural Malawi households cannot even buy charcoal to meet their daily energy needs (Mchakulu, Erasmus and Sonnenberg, 2019). While it is true that Malawi has access to the hydro power station, because of climate change, the opportunity to develop this sector is hindered (Milanzi and Daw, 2018 Kapute and Wei, 2019; Falchetta, Kasamba and Parkinson, 2020).

2.1.3 Climate change and energy consumption practices in the developing world

Energy provision is fundamental to poverty reduction and development in developing countries (Kanagawa and Nakata, 2007). It is argued that access to clean, affordable and appropriate energy is an important enabler of development. Energy per se, allows households to meet their most basic subsistence needs. It is a central feature of all the Sustainable Development Goals (SDGs) and, while a lack of access to energy may not be a cause of poverty, addressing the energy needs of the impoverished provides access to services that alleviates the causes of poverty (Nerini, *et al*., 2018; Louw, Conradie, Howells and Dekanah, 2008). This explains why it is so unfortunate that climate change has made it difficult for the vulnerable populations of the developing world to access the energy that is desperately needed to make life more bearable (Muhumuza, Zacharopoulos, Mondol, Smyth and Pugsley, 2018).

Many households in the developing countries use solid fuels such as wood, coal and dung for cooking (Balmes, 2019; Grieshop, Marshall and Kandlikar, 2011). Up to 75% of the people in developing countries use fuelwood from their immediate environment for cooking and to keep themselves warm (Karimu, Asiedu and Abor, 2018; WWF, 2012:78). In Africa for instance, up to 90% of energy originates from burning fuelwood that is obtained from nearby forests/ environments. Incidentally, fuelwood is the most important source of energy in most developing countries and is essential in their preparation and cooking of most staple foods (Njenga, *et al.,* 2019; Mendum and Njenga, 2018; Biran, Abbot and Mace, 2004).

Furthermore, up to 75% of the urban population in Africa rely on charcoal for cooking. Charcoal is unsustainably produced from wood, obtained from natural woodlands and forests, which leads to *inter alia* deforestation, forest degradation, CO_2 emissions and hence climate change as well as significant biodegradation (Bergmann, Roden And Nusser, 2019; WWF, 2012:78). Most households in developing countries cook on open fires and generally, these are not fuel efficient and have high pollution emissions (Ruiz-Mercado, Masera, Zamora and Smith, 2011). Economic and social development in these countries are hindered by lack of access to affordable and modern energy sources (Mendum and Njenga, 2018; Kaygusuz, 2011, 2012) and this lack of access to modern energy sources will have to be resolved to achieve the SDGs (Mendum and Njenga, 2018;Kaygusuz, 2011, 2012).

According to Gagnon-Lebrun and Agrawala (2006), larger populations in developing countries rely heavily on climate sensitive resources. Climate change is not a problem for the poor rural populations only; it is also a problem for the poor, as well as the elderly and children in urban populations who are defenceless with respect to the effects of climate change (Nabanoga, Namaalwa and Bomuhangi, 2019). For instance, reduced agricultural yield has a direct impact on food prices, thereby negatively affecting the welfare of the urban poor (Grasham, Korzenevica and Charles, 2019; Casillas and Kammen, 2012). Developing countries are at higher risk to the implications of climate change due to their perceived vulnerability or restricted adaptability to the effects of climate change (Grasham, Korzenevica and Charles, 2019; Nabanoga, Namaalwa and Bomuhangi, 2019; Lorenzoni and Pidgeon, 2006). Therefore, developing countries need to become more involved in terms of issues relating to climate change, attending to sectors that may be useful to manage the present climate variability (Inglesi-Lotz and Dogan, 2018; Heltberg, Siegel and Jorgensen, 2009). Concerted effort is needed to make available clean and affordable energy for the rural poor households in developing countries (Mulugetta, Hagan, and Kammen, 2018; Ekholm, *et al.,* 2010) - an issue that this study was highly concerned about.

Even though developed countries and rapidly developing countries (BRICS) are the largest emitters of energy-related carbon-dioxide (CO_2) and other greenhouse gases (Dong, Dong, Jiang, Dong and Liu, 2018), the impacts of climate change is most evident in developing countries and regions (King and Harrington, 2018). For example, most countries in Africa are particularly vulnerable to climate change because they have fewer resources to cope with climate change. They also have low adaptive capacity (King and Harrington, 2018; Barnard, 2014) as many households in developing countries depend principally on natural resources for their livelihoods and these are the resources that are severely affected by climate change (King and Harrington, 2018; Stringer, Dyer, Reed, Dougill, Twyman and Mkwambisi, 2009).

Kaygusuz (2012) lists specific factors that influence the development and deployment of sustainable energy supplies in developing countries, namely:

> *"Availability, affordability, security, reliability and safety of energy supplies in the energy system;*
> *Environmental friendliness of energy supplies in the energy system;*
> *Planning, design, construction, operation, financing and pricing of energy-suing buildings, industrial processes, transport systems, etc. in end-use sectors;*
> *Social and cultural norms regarding behaviour in end-use sectors;*
> *Access to alternative technologies and energy sources; and*
> *Investment assistance to develop and deploy energy services".*

Government interventions are vital in ensuring that the energy sector promotes sustainable development. In developing countries, lack of access to modern energy services is a major hindrance to social and economic development that needs to be rectified to achieve the UN sustainable development goals (McCollum, *et al.,* 2018). It is worrisome that billions of people have limited access to even the most basic energy services, electricity and clean cooking facilities (Sovacool, Bazilian and Toman, 2016; Kaygusuz, 2012). The majority of households that have to deal with energy poverty, live in rural areas of developing countries, especially in South Asia and Sub-Saharan Africa. In many of the developing countries, women suffer immensely from the hard work and heavy physical burden of collecting, transporting and processing the biomass that is used for cooking and heating purposes in their households. Poverty is an unfortunate, prominent characteristic of resource-poor rural and urban households in developing countries (Sovacool, *et al.*, 2016; Foell, Pachauri, Spreng and Zerriffi, 2011). Many urban households are under-served by inefficient and unreliable electricity systems while those in the rural areas in the Sub-Saharan Africa have no access to off-grid electricity (Rao and Pachauri, 2017; Deichmann, Meister, Murray and Wheeler, 2011). Access to electricity and more affordable fuel are vital for poverty alleviation. These are acknowledged as politically sensitive issues (Gonzalez-Eguino, 2015; Heltberg, 2003). The availability of modern sources of energy is lagging behind in Sub-Saharan Africa, despite a slight increase in the rate of electrification. In this part of Africa, the energy poor not only lacks access to electricity but they also lack clean fuels such as LPG for cooking and other household use (Bouzarovski and Petrova, 2015; Kaygusuz, 2011; Pachauri and Spreng, 2011).

The energy sources used by different income groups in developing countries, differ:

- For **cooking purposes**, low and medium income households use wood, residue and dung, while medium income households may also use charcoal. High-income households use wood, charcoal, LPG and coal.
- For **lighting purposes**, low and medium income households use candles and kerosene, while high-income households use kerosene and electricity.
- For **space heating**, low and medium income households use wood, residues and dung while high-income households use the same, plus coal.
- Low-income households have neither **radio, television** nor **air conditioning** devices, while medium income households may have grid electricity and batteries to power their radios and television sets and may use electric fans for space air cooling. On the other hand, high-income households use grid electricity and batteries for radio and television and use electricity, kerosene and LPG for space air-conditioning (Kaygusuz, 2011).

2.1.4 Climate change and sustainability of global resources

Globally, the impact of climate change differs between income-rich Western developed countries and income-poor Third World developing countries and the associated risks faced by Third World countries is greater than for Western countries (Chirambo, 2018; Lorenzoni and Pidgeon, 2006). Climate change implies multiple diverse challenges that are environmental, economic and social in kind (Chirambo, 2018; Ishaya and Abaje, 2008). Private household electricity consumption has continued to grow globally, despite a public awareness of the problems associated with the use of energy derived from non-renewable resources (Adams and Acheampong, 2019; Gronhoj and Thorgersen, 2011). Hence, there is a call for governments to promote more environmentally sustainable energy expansion at a global level (Chirambo, 2018; Meyer and Odeku, 2009). Fortunately, different stakeholders such as governments, businesses and individuals are increasingly aware of the need to reduce man's environmental footprint. For instance, governments in the UK, Europe, USA and Australia have developed comprehensive policies on environmental issues and climate change. In addition to that, many businesses and individuals have adopted a more socially responsible stand by moving beyond compliance to become involved in pro-environmental consumption behaviours (Clar and Steurer, 2019; Gadenne, Sharma, Kerr and Smith, 2011).

It has been documented that many decisions that are made by different governments need to acknowledge issues of climate change (Clar and Steurer, 2019; Hallegatte, 2009). Governments advocate for energy conservation, product reuse, recycling plus other behaviours that may help to protect and improve the environment (Clar and Steurer, 2019; Goldsmith and Goldsmith, 2011). In the EU, a 20/20/20 campaign exists, that is geared towards obtaining "20% of its overall energy mix from renewable sources, and to reduce primary energy consumption by 20% and also to cut greenhouse gas emissions by at least 20% all of these by 2020" (Carter and Childs, 2018; Skjærseth, Bang and Schreurs, 2013; Ellegard and Palm, 2011). Twenty-seven EU heads of state and government adopted a comprehensive legislation geared at realizing these targets. These include "strengthening the EU Emissions Trading System (ETS); promoting renewable energy sources; adopting differentiated national target for sectors not covered by the Emission Trading System (ETS); and adopting new rules on carbon capture and storage (CCS)". They even compiled rules and regulations aimed at reducing CO_2 emissions based on performance standards for new passenger cars and a directive on fuel quality. The EU has also established several European technology platforms for carbon capture and storage, wind, solar and electricity grids. However, the USA congress failed to pass climate legislation in 2009-2010, despite an alignment of strong policy-change drivers such as the Stern Review of 2006 that highlights that the global economy would suffer negative consequences if they failed to act on global warming. Other factors in this regard included public concern on

climate change, a sharp rise in oil prices as well as improved scientific understanding about climate change (Chong, 2018; Skjærseth, *et al.*, 2013).

Crivits, Paredis, Boulanger, Mutombo, Bauler and Lefin (2010) argue that the issue of sustainability lies with finding a balance between human needs and available resources. Different stakeholders such as leaders in governments, business, neighbourhood associations, or the public at large, play an important role in responding to climate change. They initiate, encourage, direct and endorse the essential cuts in greenhouse gas emissions in order to slow down global warming. Individuals, on the other hand, can develop the maintainable adaptive responses to reduce the impacts of carbon footprints (Boyce, 2018; Wolf and Moser, 2011). Schrader and Thogersen (2011) caution that consumers' choices are the primary cause of unfair conditions for producers and production workers in developing countries, including child labour, unhealthy working conditions and unfair terms of trade. They emphasize that consumers are co-responsible for the consequences of their choices.

The broader issue of climate change and changes in consumption decisions involve growth and development, international economics, political economy, game theory, research and development, regulation, institutions, economic history, public economics and environmental economics (Meckling, 2017; Stern, 2010). The global energy system still needs to overcome major challenges to eventually achieve social, economic and environmental sustainability that are summarised by Hodbod and Adger (2014) as:

> *"The challenge to reduce greenhouse gas emissions from fossil fuels that contribute to climate change at a global scale (with differentiated local impacts), and as the primary source of local air pollution with direct impacts on well-being and ecosystems;*
> *The challenge of energy security through increasing demand and limited supply of fossil fuel products, and price uncertainties;*
> *The challenge of pervasive subsidy of fossil fuels and geopolitical dimensions of the carbon economy;*
> *The challenge of universal access to energy services and energy poverty".*

Sustainability has been a concern with regard to energy consumption as well as subsequent environmental implications for climate change and global warming (Meckling, 2017). Reducing households' energy consumption is therefore considered as crucial to curtail the threat of global warming caused by the climate change. This explains why organisations' mitigation and adaptation agendas have targeted the household sector in an attempt to achieve reduced CO_2 emissions (Apergis, Jebli and Youssef, 2018; Oladokun, Motawa and Banfill, 2012). The debate

on sustainability within the climate debate has become very important, with CO_2 emissions reduction being the highest priority. According to the International Energy Agency (IEA), energy supply and consumption have become clearly unsustainable. Policies in the household sector related to energy consumption depend on consumers' daily choices and household routines. Subsequently, consumers' values and knowledge about how their everyday activities influence energy consumption are important for the development and deployment of efficient and ecologically sustainable energy systems. It is crucial that consumers understand their responsibilities and are willing to bear the responsibilities that are important to create a sustainable society (Steg, Shwom and Dietz, 2018; Ellegard and Palm, 2010). Policies aimed at promoting energy efficiency in the household sector should acknowledge consumers' daily choices and household routines as households are regarded primary in reducing societies' energy consumption (Steg, *et al.*, 2018). Thus, according to Azevedo, Morgan and Lave (2011) public policies that aim to encourage transition towards more sustainable energy systems in response to the challenge of climate change will require more than an increase in the prices of non-green energy sources to encourage households' conservation efforts and their adoption of more efficient technologies.

Climate change is a world-wide phenomenon that requires successful mitigation that can only be achieved through concerted efforts of the governments of both developed and developing countries (Nelson, 2018; Hussein, Hertel and Golub, 2013). Developed countries have targeted the individual consumer as a focal point to tackle environmental problems, considering individuals as both citizens and consumers (Morren and Grinstein, 2016; Barr, Gilg and Shaw, 2011). Hereby, the citizen-consumer is defined as a responsible, socially-aware individual whose actions are morally defensible and who are sometimes prepared to make sacrifices (Morren and Grinstein, 2016; Gabriel and Lang, 1995:175). Generally, policy makers are encouraging consumers to adopt sustainable levels of appropriate behavioural change, making effort to encourage a shift from passive, to active consumers in the wake of global environmental concerns. Social marketing is used to promote behavioural change, whereby conventional marketing techniques are used to promote behaviour for the 'social good' (Barr, *et al.*, 2011). Social marketing is used by both governmental and non-governmental stakeholders (Kennedy, 2015; Corner and Randall, 2011). In this regard, Carrico, Vandenbergh, Stern, Gardner, Dietz and Gilligan (2011), recommend that policy makers should be mindful of different key behavioural principles that might affect consumers' willingness to practise sustainable consumption (Kennedy, 2015), namely:

> *"Price plays an important but limited role, i.e. individual consumers can be induced to change their behaviour even when they are not financially responsible for energy costs;*

Both technology adoption and use are important, i.e. policy makers must target both purchase decisions (efficiency) and product use (curtailment) to maximise the potential for emissions reductions within the household sector;

Economic incentives can be counterproductive, i.e. relying solely on economic incentives and disincentives to change behaviour can lead to motivational crowding;

Decision making is limited by incorrect or incomplete information, i.e. it should not be assumed that consumers make decision on the basis of full and accurate information;

Decision making is limited by our ability to process information, i.e. there is a tendency in the discussion of energy and climate change for consumers to act as it they are applying steep discount rates when making product purchase decisions;

Cognitive costs matter, i.e. consumers often fall prey to a status quo bias in which they revert to the default option due to its convenience, even when that option may be less preferable to the consumer;

Choice depends on the way the options are framed, i.e. even when the expected utility of a set of options is identical, consumers reliably prefer certain choices to others based on how the choices are framed;

People do not always act the way they feel, i.e. consumers may hold strong values to protect the environment on an abstract level, but these values are often overcome by countervailing influences or status;

People often follow the crowd, i.e. consumers generally do not like to be in the minority e.g. learning that one's friends are taking steps to conserve energy, recycle induces many a consumer to do the same;

People strive for consistency, i.e. dissonance is the discomfort that is felt when a person holds contradictory ideas, cognitions or behaviours. To reduce this dissonance, consumers will modify an attitude, belief or behaviour to bring them in line with one other".

The consequences of climate change together with the dwindling of fossil fuel reserves have necessitated the demand for more efficient and renewable energy supplies to reduce the impact that humans have on the environment and to encourage reduced energy consumption. This has motivated mankind to seek alternative sources of energy, which has led to significant deployment of renewable technologies in an attempt to reduce carbon emissions (Stern, Janda, Brown, Steg, Vine and Lutzenhiser, 2016; Rae and Bradley, 2012). Undeniably, human activity and consumption are viewed as integral to climate change as well as its mitigation, especially in the reduction of CO_2 emissions (Stern*, et al.,* 2016; Ellegard and Palm, 2011). All social actors (from households to governments) need to become involved in adopting sustainable

consumption practices whereby they “do more with less” in the wake of climate change (Stern, *et al.,* 2016; Hobson, 2003).

Sustainability is very important in consumption as well as for investment, consumers and policy makers as it encompasses economic, environmental and social aspects (Sheth, Sethia and Srinivas, 2011; Jackson, 2005). The choices and actions that consumers take, impact on the environment as well as on personal and societal well-being. For example, decisions to consume certain products, such as locally produced foods, and to only use services that require less fuel, such as cycling rather than driving, are bound to impact on households’ lifestyles. These decisions will change menus, the way people socialise, entertain, and travel. Thus, consumer behaviour is critical to climate change and the environment (Jackson, 2005). However, even though consumers are encouraged to adopt green consumption of electricity from renewable sources such as wind, solar and biomass, consumers are not necessarily adopting sustainable consumption practices for a variety of reasons. These include: "lack of strong social norms and personal relevance, inconvenience and the uncertainty about the quality of green electricity and lack of accurate information" (Ozaki, 2011). Affluence is the strongest predictor of carbon footprint/ greenhouse gas emissions at both global and household level because affluence enables more frequent travel - whether by vehicle or air, bigger houses, indiscriminate consumption of an array of products and more food wastage. Interestingly, the rich and well-educated are often active participants among advocates for green consumption practices, such as recycling, composting, buying organic food, using re-usable bags when shopping (Groening, Sarkis and Zhu, 2018; Gibson, Head, Gill and Waitt, 2010).

Climate change adaptations also include procedures and activities that aim to enable individuals/ households to deal better with increasingly difficult weather and climatic conditions. Individuals/ households are invited to become involved in activities that are not only beneficial to them, but also for the good of greater humanity, now and in the future (Bengtsson, Alfredsson, Cohen, Lorek and Schroeder, 2018; Tompkins and Eakin, 2011). Consumers’ knowledge of environmental issues is paramount in making more responsible environmental behavioural decisions as consumers with strong pro-environmental beliefs are more inclined to engage in environmental oriented purchasing behaviour. Generally, consumers appreciate the need for suggesting environmental solutions and as such, it is important that both governmental and non-governmental stakeholders to promote renewable energy sources to help preserve the natural environment. Eventually, availabi;ity of renewable energy sources will help to reduce energy use (Bengtsson, *et al.,* 2018; Gadenne, *et al.,* 2011).

According to Gifford, *et al*. (2011), pro-environmental behaviour is likely to occur when individuals have a positive attitude about climate-relevant behaviour, when individuals act

within the norms of their society, and when individuals believe that they have sufficient control over the action (Geiger, Fischer and Shrader, 2018; Gifford, *et al.*, 2011). Citizen-consumers need to behave sustainably when proper technologies, infrastructures and products are provided as the result of strict regulation (Geiger, *et al.,* 2018; Spaargaren, 2011). Essentially, efforts to promote sustainable consumption are aimed at reducing the carbon footprint, to consider the needs of future generations, and to improve the quality of life for the present generation (Geiger, *et al.*, 2018; Huang and Rust, 2011). Climate change on the sustainability agenda of organisations and subsequent efforts to reduce CO_2 emissions, are a high priority (Geiger, *et al.*, 2018; Ellegard and Palm, 2011). Increasingly, the consequences of production and consumption of electricity from non-renewable resources are attracting attention, especially with regard to challenges posed by climate change (Gronhoj and Thorgersen, 2011).

Researchers concur that consumers (the actors) have various roles and responsibilities as users of resources, taxpayers, voters, supporters or detractors of various technologies (Evans, Welch and Swaffield, 2017; Einsiedel, Boyd, Medlock and Ashworth, 2013) and that consumers need to be encouraged to take responsibility on a level where they can make a difference. Sustainability-orientated consumer research have labelled sustainable conscious as so-called green, greener, sustainable, pro-environmental, pro-social, environmentally conscious, altruistic, ecological, ethical or alternative consumers (Evans, *et al.,* 2017; Wells, Ponting and Peattie, 2011; Jackson, 2005).

2.1.5 Climate change and inequality

The impact of climate change can potentially affect every economy of the world, by significantly affecting the quality of the ecosystem on which global systems depend. It is therefore important that governments adapt towards new low-carbon energy economies that are required to mitigate greenhouse gas emissions that threaten national economies and their interests (Longoni and Cagliano, 2018; Adger, 2010). Climate change is however also an issue of inequality with some injustice in the sense that countries that are contributing to greater greenhouse gas (GHG) emissions are not proportionally participating in the fight against the impact of GHG on climate change. The injustice entails obligations for countries (and individuals) that have a high responsibility and/ or capability, versus the rights of countries and individuals) with high vulnerability (Longoni and Cagliano, 2018; Fussel, 2010). In the USA, China and European Union, policies are in place with the aim of decreasing harmful emissions. Elsewhere in the world, policies are implemented to increase the use of renewable energy as part of a drive to curb climate change, and to decrease carbon dioxide footprints (Geiger, *et al.*, 2018; Lund, Ostergaard and Stadler, 2011; Mathiesen, Lund and Karlsson, 2011).

Even though industrialised countries and emerging economies are the largest emitters of carbon dioxide (CO_2) and other GHGs, the effects of climate change are most prevalent in developing countries (Andreoni and Galmarini, 2016; Barnard, 2014). Literature suggests that the poorest countries, such as Malawi that is a developing country, and most vulnerable groups such as children and the elderly, will disproportionately experience the negative effects of climate change. Developing countries continue to be more vulnerable to the impacts of climate change than developed countries. Vulnerability takes different forms, but the ability to withstand disturbances is commonly considered most significant. Usually, increased vulnerability in developing countries have been linked to households' dependence on natural resources, lack of financial resources, poor governance structures, low per capita gross domestic product, high levels of poverty, as well as lack of safety nets to aptly cope with disasters (Andreoni and Galmarini, 2016; Thomas and Twyman, 2005).

In the end, households that are more exposed and sensitive to climatic conditions and those that have poor risk management capacity are the most vulnerable to climate change. Generally, the poorest households are the most at risk, and their wealth and livelihoods are most vulnerable. Sometimes, the vulnerability will differ within a household, depending on the presence of children, women, elderly and disabled persons, which becomes an equity issue (Dumenu and Obeng, 2016; Heltberg, *et al.,* 2009:90). The effects of climate change are eventually experienced at household level, even though the consequences are presented and projected at global, continental or national levels. Generally, governments do not necessarily protect the interests of all citizens equally. Usually, high-risk vulnerable groups are not very well protected (Dumenu and Obeng, 2016; Paavola and Adger, 2006). Inequality is an indisputable dilemma within the issue of climate change: the consequences for vulnerable citizens are dire when the burden that is exerted on the environment is understood. It is hence important that the emitters of greenhouse gasses - particularly in developed countries - accept accountability for the related costs and that compensation is made by the so-called emitters (Mikulewicz, 2018; Adger, 2010). In different societies, communities are differentiated by class, castes, gender, profession, race, ethnicity, age and ability. It is possible to redress inequalities, although the differentiation process in terms of equity still ongoing. Differences affect the distributed opportunities as well as the susceptibilities of communities and the outcomes associated with climate trends and interventions, which are uneven. For instance, it is possible to have vulnerabilities at individual, household and community levels and usually this comes into effect through inter-related local, national, regional and global political-economic interdependences (Mikulewicz, 2018; Marino and Ribot, 2012).

According to Casillas and Kammen (2012), the daily struggle for many consumers in marginalized communities is aggravated by environmental shocks culminating from climate

change. These communities have the largest exposure to climatic change but have the lowest capability to adapt. The situation is worsened by lack of money, low education, limited health care, poor housing, limited security, poor social conditions and lack of political participation (Mikulewicz, 2018; Casillas and Kammen, 2012).

It is important that all countries participate in activities that could help to stabilize atmospheric concentrations of greenhouse gases, attempting to reduce the level of global emissions overall, and to distribute the emission levels among them, elevating equity into being a key element of climate change policies (Wei, Dong, Yan, Chou, Yang and Tian, 2016; Cantore and Padilla, 2010). Developed countries claim that mitigation actions imply an unequitable reduction effort on their part. Excluding developing countries is out of the question because of the trickling of emissions even though developing countries believe that they are not responsible for the current levels of greenhouse gases in the atmosphere and defend their right to increase economic growth (Wei, Dong, *et al.,* 2016; Cantore, 2011:2919).

Eventually, climate change management entails mitigation and adaptation. Mitigation involves slowing down, and possibly halting the effects of climate change, while adaptation involves making changes and allowing national economies to at least partially adjust to the consequences of climate change. Carbon reduction involves the adoption of new and expensive technologies, such as renewable energy sources. Changes to the effects of climate change require private and public resources, for example the use of air conditioning and construction of flood protection systems (Chen, 2016; Osberghaus, Dannenberg, Mennel and Sturm, 2010). Globally, efforts are made to encourage positive change to the household energy situation and to ease energy poverty, which is crucial to meet the UN sustainable development goals (Pachauri and Spreng, 2011; UNDP, 2015), admitting that household energy consumption has contributed severely to climate change (Strengers, 2011).

In developed countries, sustainability is an environmental topic. In developing countries, however, it has to do with issues relating to poverty and equity. Undeniably, energy production and consumption affect sustainability, and energy is a catalyst in the provision of essential basics such as food, clean water, shelter, and health and education services. The sustainable development goals admit that access to energy is essential for sustainable development (Nerini, *et al.,* 2018; Kemmler and Spreng, 2007). The UN sustainable development goal 7 clearly talks about the importance of affordable and clean energy. It mentions the need for cheap energy whereby there is need for investing in solar, wind and thermal power in order to ensure that globally the SDG 7 goal can be achieved by 2030. Energy is an important contributor to climate change as it produces 60% of greenhouse gases (UNDP, 2015). The UN sustainable

development goals (SDG) are aimed at transforming the world and were officially launched in 2016 (UNDP, 2016) (refer to section 1.1.1. for more details).

It is proposed that there is need for incentives to promote sustainable production and consumption, rather than only providing green advice to consumers (Young, Hwang, Mcdonald and Oates, 2010). Lower-carbon economies can be promoted through the adoption of technology, innovation, regulation, investment, financial incentives as well as organizational change and education. However, certain factors may affect consumers' sustainability-related behaviours, for example their demographic characteristics, values, attitudes, knowledge, goals, emotions, and circumstances (Stern, *et al.,* 2016; Wells, Ponting and Peattle, 2011). Particularly, knowledge of environmental issues is linked to positive environmental behaviours (Gadenne, *et al.,* 2011). In a bid to promote sustainable consumption, methods are promoted to change consumers' attitudes, values, behaviours, habits, and practices within societies from a lifestyle with comparatively high greenhouse gas emissions to one with much reduced effects on climate change (Pothitou, Hanna, Chaivatzis, 2016; Stern, *et al.,* 2016; Young and Middlemiss, 2012). Globally, electricity consumption in private households has increased despite an increase in public awareness of the consequences of continued reliance on energy based, non-renewable resources, even in Europe. In modern times, there have been an increase in household appliances in terms of size, capacity and power (Pothitou, *et al.,* 2016; Gronhoj and Thorgersen, 2011), and practically, household energy consumption relates to use of technology (Gram-Hanssen, 2011). Energy behaviours are eventually shaped by both individual and contextual factors (Pothitou, *et al.,* 2016; Lopes, *et al.,* 2012).

The UN declared 2012 as "the international year for sustainable energy for all", aiming to engage governments, businesses and the civil society stakeholders to achieve three goals by 2030. These were: "universal access to modern energy services; reducing global energy intensity by 40%; and increasing renewable energy use globally to 30% of total primary energy supply" (Chirambo, 2018; Inglesi-Lotz and Dogan, 2018; Sovacool, 2012:272). Climate change adaptation may require that actions are taken by the society at large, by individual consumers, groups, as well as governments. Adaptation can be *reactive* in the sense that they respond to past or current events, or may be *anticipatory* because they assess conditions in the future. It can be evident in different ways, such as market exchanges, extension of social networks, through actions of individual consumers, or collective goals of groups or communities. These may be driven by individuals for their own benefit or can be undertaken by governments and civil society bodies to protect their consumers (Chirambo, 2018; Inglesi-Lotz and Dogan, 2018; Adger, *et al.,* 2005; Pelling and High, 2005). Adaptation is then looked at as a process within a system (household, community, group) that is undertaken following a changing shock or stress in order for the system to better cope, manage, or adjust. Adaptation entails adjustments in

systems' behaviour and characteristics that will enhance their ability to cope with the pressure. These adjustments can be autonomous or planned, depending on their spontaneity (Smit and Wandel, 2006). Adaptation is a process, not exclusive to actions and measures that must be taken, but also their consequences. Fundamental societal transformation is required to achieve sustainable development, although vulnerability needs to be contextualized, acknowledging stressors; appreciating differences in values and interests that affect adaptation outcomes; incorporating local knowledge into the adaptation responses; and also considering potential feedbacks between local and global processes. In the end, sustainable adaptation as a way of every day practices should inspire the reduction of greenhouse gas emissions (Sarkodie and Strezov, 2019; Eriksen and Brown, 2011).

2.1.6 Mitigation of climate change at global level

Mathews (2007), propose seven steps to curb global warming, namely:

> *"... creating a new international agency charged with formulating and policing a global carbon pricing regime;*
> *a complementary step involving global monitoring of greenhouse gas emissions utilizing satellite resources;*
> *taking steps to compensate developing countries for preserving rainforest as carbon sinks;*
> *the dismantling of newly created trade barriers holding back global trade in bio fuels;*
> *global promotion of a transition to renewable sources of electricity through facilitation of grid interconnections with independent power producers;*
> *a global moratorium on the building of new coal-fired power stations;*
> *and recycling of carbon revenues to promote uptake of renewable energy sources in developing countries, particularly Brazil, India and China".*

Subsequently, in 2009, the developing countries identified to be involved, included South Africa as an emerging economy (Lau, Lee and Mohamed, 2012).

Adaptation of activities is aimed at taking actions that would assist society to make adjustments to climate change that has already taken place or that are likely to happen considering already prevalent greenhouse gas emissions (Ren, *et al.,* 2011). Developed countries have already embarked on emission reduction commitments. Developing countries, however, are pressurized to do so as well, although they have been resisting such commitments because they believe that they have contributed little to the current concentrations of greenhouse gas in the atmosphere, and because they are poor and already have to cope with low standards of living (Martimort and Straub, 2016; Shalizi and Lecocq, 2009).

There is growing need to accelerate the deployment of new low-carbon technologies and then fast track their global application to stabilize atmospheric greenhouse gas emissions, which would entail appropriate policies for the development and diffusion of such technologies. Most of the environmentally friendly technologies were developed in developed countries, even though they are required to mitigate the greenhouse gas emissions in the fast-growing emerging economies such as Brazil, India, China, South Africa (BRICS). Lack of information is another challenge facing the adoption and diffusion of these technologies. For instance, there is no clear and widely accepted definition of what constitutes a "climate-change-mitigation technology". Furthermore, it is not clear how such technologies are diffused globally (Miyamoto and Takeuchi, 2019; Dechezleprêtre, *et al.,* 2011). While these low-carbon technologies are important to mitigate climate change, there is no clear indication about the value of individual climate change mitigation technologies (Kriegler *et al.,* 2014). Low-carbon technologies and energy-efficiency improvements can help countries and regions to achieve energy security goals by promoting more dependable, resilient and diversified energy portfolios (Miyamoto and Takeuchi, 2019; McCollum *et al.,* 2013).

Challenges are encountered by decision-makers in terms of massive decarbonisation of the world economy that needs a 50-85% reduction of global carbon CO_2 emissions by 2050, nationally and globally whilst also improving the standards of living for consumers. These challenges are evident in developing countries that have benefitted less from the developments that have caused the high greenhouse gas emissions into the atmosphere. This creates a dilemma in terms of striking a balance between satisfaction of the needs of the present generations, while protecting future generations in terms of enjoying a stable and safe climate (Krey, 2018; Ürge-Vorsatz and Herrero, 2012). The cooperation of countries is crucial in the mitigation of the impacts of climate change because of the interdependence among countries. Practically, no one country or group of countries can provide its own remedy, because the impact of the problem is global. It is therefore necessary to organise national plans within regional and international frameworks (Chan, Brandi and Bauer, 2016; Nema, Nema and Roy, 2012) whilst also encouraging cooperation between different levels of governments and the private sector (Chan, Brandi and Bauer, 2016; Broto and Bulkeley, 2013).

Energy efficiency is an essential component in energy and climate change mitigation discourse. Energy efficiency promotes reductions in the greenhouse gas emissions and local environment pollution. Moreover, it reduces investments in energy infrastructures, results in lower fossil fuel dependency and improved consumer well-being. In Europe, energy efficiency practices include refurbishing of walls and roof insulation in residential buildings, improved energy management systems in commercial buildings, equipment replacement in manufacturing industries (using new energy efficient equipment), or changing modes of transport (such as using public transport

or travelling to work in groups instead of travelling individually) (Chan, Brandi and Bauer, 2016; Lopes, *et al.*, 2012). Empirical evidence gathered in Europe established that consumers who are conscious of climate change are more likely to undertake actions to mitigate climate change thereby agreeing to abibe with energy policies and to change future energy consumption patterns. The contrary is true for consumers who are not climate change conscious or consumers who are more concerned about energy availability of the economy that does not require any sacrifices (Wicker and Becken, 2013).

2.2 CLIMATE CHANGE AND HOUSEHOLD ENERGY CONSUMPTION IN SUB-SAHARAN AFRICA

2.2.1 General overview

Sub-Saharan Africa (SSA) is home to 13% of the world's population. The region is very poor with the lowest total Gross Domestic product (GDP) and GDP per capita globally (World Bank; Kebede, Kagochi and Jolly, 2010). Not surprisingly then, SSA is home to countries with the lowest economic and financial development (IMF, 2016; Al-mulali and Sab, 2012). With the exclusion of South Africa, countries in SSA rank last among global regions in the per capita energy consumption (IMF, 2016; Deichmann *et al.,* 2011). According to International Energy Agency (IEA, 2013), 1.3 billion people have no electricity and 2.6 billion people have no provision for clean cooking facilities, and 95% of these people either live in Africa or Asia. This poses a challenge to social and economic development stipulated by the UN sustainable development goals. Provision of energy for all in Africa needs to recognize the multiple sources of energy that are currently used, and also the need for enhancing rural livelihoods - whether based on conventional sources of energy or through promotion of renewable sources of energy (Benedek, Sebestyen and Bartok, 2018; Brew-Hammond and Kemausour, 2009). However, according to the World Energy Outlook (2018), the total number of people without access to electricity in the world fell to below 1 billion in 2017 (Cozzi, Chen, Daly and Koh, 2018).

Most people in SSA are rural agrarian populations with low incomes (Loison, 2015; Sokona in Kebede, Kagochi and Jolly, 2010; Rio+ 5 report, 1995). Statistically, income levels in SSA are lower than in North Africa and South Africa, also indicating a lack of resources coupled with slow economic growth (Loison, 2015). Many SSA countries struggle because of poor infrastructure, poor access to capital, the nature of governance and lack of institutional capacity (Loison, 2015; Karekezi, 2002). SSA as a region is deemed as the most susceptible to the effects of climate change, with over 40% of the population being poor and using energy sources that are eventually detrimental to the environment and the sustainability of natural resources (Loison, 2015; Hertel and Rosch, 2009). As the most of these populations live in rural areas, they spend up to 20% of their monthly income on fuel (Barry, Steyn and Brent, and 2011).

Even though certain development goals that promote manufacturing and agricultural production, health- and education services have materialised, with a subsequent increase in energy use, SSA countries still have the lowest access to electricity in the world (Dagnachew, et al., 2012). Also, some areas only have a five percent electrification level (Dagnachew, Lucas, Hof, Van Vuuren, 2018; Karekezi and Kithyoma, 2002). Most people in Africa live scattered across rural settlements, which generally increases the costs of conventional grid electrification. This is very evident in eastern and southern parts of Africa where the majority of its population reside in dispersed homesteads (Azimoh, Klintenberg, Mbohwa and Wallin, 2017; Karekezi and Kithyoma, 2002). It is still doubtful if countries in the region will be able to meet the energy needs of their people in the foreseeable future. Further to that, it is also doubtful if governments and consumers in the SSA region will be able to accumulate the resources that are required to provide the energy for all their people (Azimoh, Klintenberg, Mbohwa and Wallin, 2017; Brew-Hammond, 2010). In the end, being able to obtain electricity, is a result of availability and affordability. The quality of electricity that is available in these countries is mostly untrustworthy because households and businesses often have to cope without electricity for long periods. The truth is, that the number of consumers that rely on traditional biomass for everyday activities such as cooking, is likely to increase in these regions, because per-capita incomes are not likely to increase to enable consumers to move up the energy ladder (switch from the traditional biomass use to better energy sources), despite increases in electrification rates in some countries (Azimoh, Klintenberg, Mbohwa and Wallin, 2017; Brew-Hammond, 2010). In the end, the issues of “under consumption” and “quality” of energy that is consumed south of the Sahara, are crucial (Sokona in Rio +5 report, 1995).

Households’ continued reliance on fuelwood, charcoal, agricultural residues and animal dung are manifestations of poverty (Sola, Ochieng, Yila and Iiyama, 2016; Kaygusuz, 2012). Some rural households sell fuelwood as a source of income while some poor urban households rely on fuelwood because it is more affordable (Guild and Shackleton, 2018; Hiemstra-van der Horst and Hovorka, 2009). Households in the SSA also use traditional biomass for brick making, tea curing and fish drying (Prasad, 2011). Fossil fuel burning such as coal or gas is responsible for about 70% of the climate change catastrophe (Hancock, 2015; Niemeyer, 2010). Inevitably, there is over dependence and overconsumption of poor quality traditional energy sources such as fuelwood, charcoal and non-woody biomass and an under consumption of high quality modern energy sources such as coal, LPG, natural gas and NRSE.

Energy is a very important catalyst for development at the global, national and local levels (Schoor and Scholtens, 2015; Mohammed, Mustafa and Bashir, 2013). Africa has the lowest electrification rate in the world (Ebhota and Tabakov, 2017; Adkins, Oppelstrup and Modi, 2012; Dasappa, 2011:203) and per capita incomes of most households in the SSA will not increase

high enough to allow households to afford modern forms of energy. Subsequently, continued reliance on traditional biomass energy is inevitable (Masekameni, Kasangana and Makonese, 2017; Chidumayo and Gumbo, 2013; Brew-Hammond: 2010) although biomass use and consumption is very inefficient, unsustainable and causes deforestation (Masekameni, Kasangana and Makonese, 2017; Gwavuya, Abele, Barfuss, Zeller and Muller, 2012). This poses challenges in the drive for clean energy access for the poor as well as efforts to manage climate change (Alstone, Gershenson and Kammen, 2015; Azoumah, Yamegueu, Gininies, Coulibaly and Girard, 2011). Sadly, the demand for fuelwood and charcoal in the SSA is high, and energy from non-renewable sources is reportedly low in these countries (Alstone, Gershenson and Kammen, 2015; Kebede, Kagochi and Holly, 2010). The heavy dependence on fuelwood exacerbates deforestation, that leads to land being left bare (deserts) and increased risk of flooding and environmental degradation (Alstone, Gershenson and Kammen, 2015; Parawira, 2009). North Africa heavily relies on gas and oil; rural parts of South Africa rely on coal; while the rest of SSA depends on biomass for energy (Ouedraogo, 2017; Alstone, Gershenson and Kammen, 2015) .

In SSA, 94% of the rural population use fuelwood, dung and crop residues, while 41 % of urban population use the same. Only 4% of rural households use charcoal while 34% use charcoal; 2% of the population use kerosene while 13% use kerosene in urban areas. Use of LPG and electricity is almost absent in rural areas while in urban areas, 8% use LPG and 4% use electricity (Ouedraogo, 2017; Maes and Verbist, 2012). Charcoal is the main cooking fuel in urban and peri-urban households in SSA (Makonese, Ifegbesan and Rampedi, 2018; Mwampamba, Ghilardi, Sander and Chaix, 2013).

The impact of climate change will be very severe in Africa because of unfavourable direct impact as well as high dependence on rain fed agriculture on top of poor adaptation capacity (Adenle *et al.,* 2017; Collier, Conway and Venables, 2008). Meanwhile, institutions are inefficient in addressing the dilemma: there is an absence of good business models, lack of transparent governance, and no evidence of appropriate legal and regulatory frameworks in the supplying of energy services in the SSA. Current actions are inadequate - both in terms of extent and the speed required to eradicate energy poverty in the region (Aalto, 2016; Bazilian *et al.,* (b) 2012).

Inarguably, energy is instrumental in social economic development (Aalto, 2016; Kedebe, Kagochi and Jolly, 2010; Nkomo, 2007) and therefore there is consensus that energy services in SSA need to be improved (Aalto, 2016; Karekezi, 2002). However, it is somehow doubtful how SSA is going to be able to provide energy for all its people. Governments and their populace will have to mobilise resources to achieve this goal (Adams, et al., 2016; Brew-

Hammond, 2010). It is imperative to ensure that vulnerable consumers in developing countries become energy secure, to fight poverty and for socio-economic development (Adams, et al., 2016; Matsika, Erasmus and Twine, 2013). It is believed that the arrival of electricity in a community improves livelihoods and well-being (Aalto, 2016; Adams, et al., 2016; Kaygusuz, 2011). Attainment of increased development in developing countries requires enormous levels of energy consumption (Adams, et al., 2016; Seberu *et al.,* 2013) amidst barriers exist with regard to energy access. Private sector participants are often more concerned with profit; conservative government officials have competing priorities; development donors have ulterior motives and socio-technical barriers exist (Newell and Bulkeley, 2017; Sovacool, 2012). Furthermore, exploitation and development of renewable energy sources in SSA is lagging behind, because several factors have hampered efforts to expand electricity access in the SSA. These are, for example: inadequate capital investment; lack of technological knowledge on renewable energy development; constricted power generation planning; deficient electricity supply resulting from frequent power system failure and unreliable equipment; low rates of electrification; the high cost of electrical energy generation and high transmission losses (Newell and Bulkeley, 2017; Suberu *et al.,* 2013).

With all intent and purpose, in the fight against poverty, improved energy access for the poorer and marginalised households would make an important difference. It is believed that access to more affordable and appropriate energy resources would bring about positive change in the household sector as well as in industries, and eventually, encourage urban and rural development. Current undependable and very expensive supplies of electricity and modern fuels restrict electricity production, growth and development (Aalto, 2016; Adams, *et al*., 2016; Bazilian *et al*., 2012; Bhattacharyya, 2012; Sokona, Mulugetta and Gujba, 2012). Unfortunately, poverty and poor infrastructure impedes the need for modern services in this region (Gujba, Thorne, Mulugetta, Rai and Sokona, 2012). The adoption of clean energy systems by low-income households and small businesses in developing countries will have some advantages economically, such as reduced energy expenses; reductions in household expenses - especially in health care - because of increased net incomes and savings in time and effort (Aalto, 2016; Adams, *et al*., 2016; Glemarec, 2012). Because of the existing low consumption patterns of modern energy that indicate high levels of poverty (Karekezi, 2002), there is a need for innovative electrification that will also be environmentally viable (Aalto, 2016; Adams, *et al.,* 2016; Karekezi and Kithyoma, 2002). It is believed that access to modern energy services can expand income-generating activities, which in turn can reduce poverty, e.g. providing mechanical power for milling grain, improving illumination for factories and shops, providing heat for processing crops, and enabling refrigeration for preserving products. In many poor countries, energy expenses account for big proportions of household earnings (Sovacool, 2012).

Energy poverty also poses public health consequences, for example, indoor air pollution is associated with diverse health issues such as acute respiratory infections; chronic obstructive pulmonary disease such as bronchitis; lung cancer; asthma; cataracts and tuberculosis (Gonzalez-Eguino, 2015; Sovacool, 2012). Further to that, air pollution also contributes to greenhouse gas concentrations that eventually contributes to climate change (Nadimi and Tokimatsu, 2018; Gwavuya, Abele, Barfuss, Zeller and Muller, 2012). Statistics show that indoor air pollution causes the death of 2.8 million people every year, which is equivalent to the deaths associated with HIV/AIDS. Energy poverty compels households to resort to using even more polluting fuels such as woody biomass and charcoal that are less energy dense. Women play a major role in energy consumption in many countries in the SSA, especially in countries where traditional fuels dominate household energy use. They are involved in the collection, processing and transportation of fuelwood in these biomass-based energy systems (Bouzarovki and Petrova, 2015; Gonzalez-Eguino, 2015; Foell, *et al.*, 2011). The heavy reliance on these fuels causes soil erosion due to land degradation, deforestation and contamination of soil and water resources. In the end, energy, food and water are intertwined issues (Nadimi and Tokimatsu, 2018; Gwavuya *et al*., 2012; Florini and Sovacool, 2011).

Although a cultural dilemma, women need to be liberated from these burdens by making bio fuels more accessible and affordable (Bouzarovki and Petrova, 2015; Gonzalez-Eguino, 2015; Amigun, Musango and Stafford, 2010). It is furthermore concerning that women and children are the most affected by the use of low quality energy sources because women are involved in cooking in enclosures with poor ventilation. Sometimes they carry children on their backs while they are cooking, and therefore, women and children's exposure is higher than that of men (Bouzarovki and Petrova, 2015; Gonzalez-Eguino, 2015; Gwavuya *et al.,* 2012), which also hinders their educational and economic opportunities (Pachauri *et al.,* 2013). Unfortunately, women lack access to important resources, such as financial credit and education, which could give them access to improved clean energy services (Bouzarovki and Petrova, 2015; Gonzalez-Eguino, 2015; Foell, *et al.*, 2011).

Renewable energy resources would provide a solution to the energy crisis in most African countries (Bugaje, 2006) and would improve the general welfare of the poor (Nkomo, 2007). There is consensus that in order for Africa to achieve the sustainable development goals, it needs to widen significantly its access to modern and alternative renewable energy (Ouedraogo, 2017; Mshandete and Parawira, 2009). Over time, there have been drives to provide clean cooking energy for households in developing countries, such as solar, the availability of multifunction thermoelectric cooking stoves, provision of off-grid PV solar community kitchens, and availability of biogas digestors (Johnson and Bryden, 2012). Solar energy is an attractive renewable alternative because it is readily available across the continent,

and its supporting technology is cheaper. It is not limited by supply or price uncertainty, and is eligible for support from bilateral and multilateral establishments that are advancing an increase in low-carbon energy production (Ouedraogo, 2017; Deichmann, Meisner, Murray and Wheeler, 2011). An adequate supply of clean energy is important to raise people's standards of living and to improve the quality and quantity of human capital, in addition to enhancing businesses and the natural environment (Kaygusuz, 2012). It is anticipated that renewable energies, if properly exploited, will provide opportunity for improved access to energy for rural communities (Ouedraogo, 2017; Belward *et al.,* 2011).

2.2.2 Household energy consumption and initiatives

Households are an important target in the attempt to reduce greenhouse gas emissions as they contribute significantly to greenhouse gas emissions in many direct and indirect ways, e.g. through production (cooking, brewing beer etc.), transportation, and disposal of goods and services (Mboumboue and Njomo, 2016; Gifford and Comeau, 2011). Household energy use and consumption are generally related to socio-demographic characteristics of communities, such as income and household size, distinguishing rich, high income households who consume more energy from poor, and lower income households (Mboumboue and Njomo, 2016; Abrahamse and Steg, 2011). Generally, in developed countries, household energy consumption is linked to the possession of appliances and lighting (Mboumboue and Njomo, 2016; Vassileva, Wallin and Dahlquist, 2012). It is debatable whether consumers are really conscious of their energy consumption or not, and whether their consumption and use are habitual and/ or simply irrational (Mboumboue and Njomo, 2016; Pierce, Schiano and Paulos, 2010). In this predicament, it is crucial that the consumer needs to be viewed as agents of change (Spaargaren and Oosterveer, 2010).

Energy use and its consumption as well as the subsequent consequences are dominant themes in the political and economic discourses of most countries because energy issues affect everyone, from households to governments. It is therefore imperative that consumers, service providers and governments cooperate to achieve energy efficiency (Ahlborg, Borang, Jagers and Soderholm, 2015; Gaspar and Antunes, 2011). For instance, member states in the European Union in 2011, designed a proposal for energy efficiency that is aimed at ensuring that government institutions buy only products, buildings and services that meet energy efficiency standards (Ahlborg, et al., 2015; Mills and Schleich, 2012).

Politically, climate change issues are viewed in terms of widening participation and structures, including international climate agreements, in terms of the regulatory systems required for climate change mitigation (Ahlborg, et al., 2015; Barry, Mol and Zito, 2013). For this, the Kyoto Protocol and the European Union's Emissions Trading System are mentioned as regimes for

reducing greenhouse gas emissions (Barry *et al.,* 2013). The European Union has a Climate and Energy package that targets energy efficiency to reduce greenhouse gas emissions and to encouraging widespread use of renewable energy sources. The market in the European Union is using smart-grid technology to mitigate the impact of climate change by managing energy consumption and energy efficiency (Ahlborg, *et al*., 2015; Clastres, 2011).

Energy access is important to address global development agendas such as poverty, inequality, climate change, food security, health and education. Energy is also important in the achieving of the sustainable development goals and unmistakably, energy poverty undermines the achievement of these goals (Hak, Janouskova and Moldan, 2016; Nussbaumer, *et al.*, 2012) since they are impossible to achieve without the availability of adequate and affordable energy (Hak, Janouskova and Moldan, 2016; Sovacool, 2012)

2.2.3 Vulnerability to climate change in SSA

Societies' vulnerability to the impacts of climate change differ. It can be examined in terms of how individuals, groups or communities are able to manage their livelihood and well-being despite external shocks and stresses such as floods, drought, cyclone and heat waves commonly exerted by climate change (Connolly-Boutin and Smit, 2016; Adger and Kelly, 1999).

In discussing ways of adapting to climate variability and change in SSA, Smith (1997) distinguishes *anticipatory* or *reactive* strategies. Anticipatory adaptation involves planning ahead for the coping mechanisms to cope with the consequences of change. Reactive adaptation involves planning and implementing coping mechanisms following the effects of change and after a natural disaster or once gradual climatic changes have already started to have significant impacts. Sometimes, there is no clear demarcation between anticipatory and reactive adaptation because an anticipatory strategy may also be a reactive one (Alvarado. Ibanez and Brummer, 2018). For example, households may decide to diversify their income, or they may move to another area as well as selling of assets. However, Fisher, *et al.,* (2010) argue that rural households in low-income countries may sometimes need to respond to a much broader range of factors, including environmental, societal, political and economic impacts simultaneously. As such, it is almost impossible to evaluate how a single stressor, such as climate change, will impact consumers'/ households' behaviour (Alvarado. Ibanez and Brummer, 2018)..

Low-income households that live near forests use the forests for different reasons, more especially in times of disasters. To begin with, forests are public entities with the local people having free access to them because sometimes government fails to enforce property rights, or traditional regulation of resource-use are weakened (Cronkleton, Artati, Baral, Paudyal,

banjane, Liu, Tu, Putzel, Birhane and Kassa, 2017; Baland and Platteau, 1996). Secondly, it is very easy to access the forest resources financially and physically, and it is humanly possible to do so (Neumann and Hirsch, 2000). Thirdly, different forest products such as timber and fuelwood are usually present and accessible when other income sources are not, for example, when crops fail (Byron and Arnold, 1999; Pattanayak and Sills, 2001). As a result, in tough times, forests “can make the difference between good and bad nutrition, between recovered health and prolonged illness, or between food security and starvation” (Cronkleton, et al., 2017; Angelsen and Wunder, 2003).

In studies conducted in countries other than Malawi, rural households and governments make use of forests to alleviate and abate the effects of climate change, thus to survive. For example, in Senegal, that has experienced droughts since the 1970s, communities practise agroforestry whereby trees serve as windbreaks to control soil erosion, thereby reducing desertification (Quandt, Neufeldt and McCabe, 2019; Oxfam, 2006). In Nigeria, in northeastern Nigeria, that is prone to desertification farming households take care of their trees on farms and forests to maintain biodiversity and to prevent desertification (Abdulhamid, Abubakar and Dawaki, 2017; Mortimore and Adams, 2001). Burkina Faso is another country that is involved in reforestation: they grow fast growing tree species as well as drought resistant trees in order to capture the effects of desertification. This is done on a large scale as part of their National Action Plan for Adaptation (Bayen, Lykke and Thiombiano, 2016; Kalame, et al. 2009). In Kenya and Tanzania, indigenous plant species found in forests are promoted in more than 30% of the strategies used to deal with drought (Odeny, Karanja, Mwachala, Pellikka and Marchant, 2018; Eriksen et al., 2005). Further afield in Peru, forest gathering was also an important strategy to cope with covariate flood shocks, particularly in households with limited physical assets and more adult members (Takasaki et al., 2004). In rural Honduras, young households that did not have assets, resorted to selling different forest products when crops failed in times of natural catastrophes (Mugido and Shackleton, 2017; McSweeney, 2004).

2.2.4 Factors affecting the use of fuelwoods in sub-Saharan Africa (SSA)

According to Falcao (2005), several factors affect the demand and supply of fuelwood and charcoal in Sub-Saharan African namely: population, income, technology, institutions and policies, prices of forests products, substitute products and wood raw material on both the demand and supply sides of wood (Behera and Ali, 2017; Mohammed, et al., 2015). In this particular regard, the state and potential of existing forests influence the growth of the future supply of products and services, while former and existing levels of consumption are influential in terms of future demands for commodities and services. The authors argue that these factors will affect demand for fuelwood differently in different contexts even though population growth and economic growth remain key. Falcao (2005) explains that an understanding of the supply

and demand processes of markets can be used to understand future developments in terms of wood demand and supply. The demand and supply of fuelwood imply that in the case of fuelwood scarcity, alternatives are lacking, making life even more difficult. However, when alternative fuel energy sources are available and affordable, the alternatives are often preferred (Behera and Ali, 2017; Mohammed, et al., 2015).

Generally, there is a direct link between fuelwood consumption and availability of woodland and forests. An economic factor influencing fuelwood consumption is the shrinking forest resources (Bervoets, Boerstler, Dumas-Johansen, Thulstrup and Xia, 2016). For example, household fuelwood consumption in villages in Malawi near wooded areas was found to be up to three times higher than in villages with little or no woodland (Fisher, et al., 2010). Similarly, in Nepal, there is a tendency for people to move to the well-wooded plains, where fuelwood is in abundance and then they consume twice as much as those remaining in the forest-depleted hills (Falcao, 2008). Essentially, therefore, households tend to consume more fuelwood when it is in abundance. Notwithstanding, the consumption of fuelwood depends very much on the availability and price of alternative fuels, and may therefore differ at times (Treiber, Grimsby and Aune, 2015). Uncertainty therefore prevails about households' and countries' fuelwood needs.

2.2.4.1 Population growth

According to Njiti and Kemcha (2003), in 2003, more or less two out of five people worldwide depended on wood or charcoal as a source of domestic energy. They also note that 60 to 90% of the energy consumption of Africans comes from fuelwood and charcoal. Thus, in the savanna zones of Africa, wood is the major source of energy (Iiyama, *et al.,* 2014). It can only be expected that as the population of SSA grows, the dependency on fuelwood and charcoal will also increase. Population growth has historically been a major factor influencing wood consumption and it is not likely that the close relationship between population growth and growth in consumption is likely to change significantly in the near future (Treiber, Grimsby and Aune, 2015; Iiyama *et al.,* 2014; Falcao, 2005:67).

Population growth can therefore serve as a raw indicator of patterns of aggregate energy consumption. The social, economic and technological change brought about by basic changes in population may also affect health, fertility and longevity. Given that Malawi's population continues to grow and that alternative sources of energy such as electricity and fossil fuels remain expensive, and beyond reach of most of the population, it is expected that rural Malawians will continue to depend on fuelwood, exerting even more pressure on Malawi's fuelwood reserves.

2.2.4.2 Economic growth

Economic development influences consumers' desire and willingness to use fuelwood because of the noteworthy propensity to increase the consumption of commercial energy in developing countries that are highly dependent on wood and biomass (Alkon, Harish and Urpelainen, 2016; Falcao, 2005). Energy is a basic need for human survival and is also significant for economic growth and development (Gonzalez-Eguino, 2015). According to IIASA (1998), the world's energy consumption increased threefold in the first fifty years of the 20th century then increased fourfold in the forty years leading to 1990, and it is expected to double or even triple between 1990 and 2050.

Economic growth, especially with the advent of the Industrial Revolution in the 18th and 19th centuries marked the rise of fossil fuels to replace fuelwood, which was the most important source of fuel at the time. The discovery of technology to retrieve, process, transport and use fossil fuels meant that world economies reliance on fuelwood declined. Over a period of 150 years during the 19th and 20th century, the contribution of fuel consumed in today's developed economies has changed from virtually 100% fuelwood and charcoal, to a situation where fuelwood contributes less than two percent (Lindmark and Olsson-Spjut, 2018). However, according to IIASA (2005), in the Third World countries, fuelwood is still the main source of energy, with dependency and consumption being as high as 80% (Karimu, et al., 2018).

Some benefits of economic growth, are the growth in income for citizens that enable them to purchase improved stoves or to gain connection to the electricity grid that may also slightly reduce their dependency on fuelwood (Alemayehu, 2015). Understandably, the cost of fuelwood and charcoal is highest in urban communities compared to the rural areas, mainly because of transport costs (Guild and Shackleton, 2018). Falcao (2005) argues that lower disposable incomes or lack of disposable income tends to slow the rate at which fuelwood and charcoal can be replaced by other fuel sources. In that regard, poor communities such as those in SSA, including Malawi, will continue to depend on fuelwood and charcoal as their main source of energy (Toth*, et al.,* 2019). While the reduction in woodlands and forests due to human activity could increase the cost of fuelwood, economic downturns and growing inflation, will cause the cost of fuelwood in both rural and urban areas to rise even further. At the same time, factors such as increased cost of alternative sources of energy such as electricity and fossil may thus force both rural and urban households to rely even more on fuelwood (Toth, *et al.,* 2019) .

According to IIASA (2005), one characteristic of fuelwood use, is the variation of use in accordance with the total domestic consumption, between as well as within countries (Ram, Bahadur and Shukuya, 2019). Consumption levels also differ among countries where fuelwood constitutes the main source of energy. At the time, IIASA (2005) estimated that in many

countries, the per capita consumption was around one cubic metre per annum. The consumption of industrial wood in many developed countries is incidentally similar to the domestic consumption of fuelwood in developing countries. In Africa, consumption is even higher in countries such as Malawi, Mozambique, Tanzania and Zambia (Falcao, 2005; FAO, 2018).

2.2.4.3 Policies and institutions

According to Falcao (2005), in the SSA countries of Malawi, Mozambique, Tanzania and Zambia, the forestry sector was mainly involved with natural forests and less developed areas. Historically, the sector had a lower priority in society for institutional development. Critical issues such forestry education and local governance of natural and forest resources have thus been lacking. Mostly, government forestry organization is a new phenomenon. In some countries, such organizations are not yet established, or are in very preliminary forms (Ajayi, Akinnifesi and Ajayi, 2016). Unfortunately, many government agencies that are responsible for implementation of forest policy lack the resources to establish or implement the measures. At the time, Solberg (1996) cautioned that in many cases, the legal framework for the implementation of forest policy is weak or do not exist. Currently, Malawi has the national forest policy of 2016 that it is implementing (Government of Malawi, 2016).

Therefore, an important factor that influences the production and consumption of fuelwood and charcoal in SSA, is the existence of energy policy and institutional frameworks. According to Solberg (1996) energy policy can affect forestry and forest products such as paper, forage for livestock, and traditional herbs in different ways (Ajayi, Akinnifesi and Ayjayi, 2016). Economic policy that leads to increased demand for energy can force consumers and industry off alternative sources of energy such as electricity and oil towards fuelwood that can increase the demand and price of fuelwood (Cecelski, *et al.*, 2015). Supply would be affected by transport costs and therefore increase energy costs. According to Falcao (2005:71) the above principle was true in the oil crisis of the mid 1970s as well as the more energy pricing in the former USSR (Melosi, 2017) where they reduced the supply of oil on the market, which resulted in an increased demand for fuelwood in many regions of the former USSR and some Eastern European countries. In the end, an increase in oil price affected the cost of timber from Liberia, which was high due to transport costs.

A policy that is also relevant in the production and consumption of fuelwood, is governments' subsidization of commercial energy, as it could reduce the demand for fuelwood (Li, Chen and Liu, 2019; FAO, 1993) and could serve as a measure to reduce the pressure on the protection of fragile forests in some arid countries, also reducing air pollution (Blum, 2017; Brooks *et al*., 1996). Waste disposal in the urban areas is also related to policy frameworks: often, consumers

are urged to buy and consume only what they need, and to recycle used materials. More importantly, consumers are urged not to use energy wastefully (Frederiks, Stenner and Hobman, 2015; McKendry, 2002).

It is imperative for countries in SSA to develop the appropriate institutional and policy frameworks to govern the critical issues surrounding the acquisition and consumption of fuelwood. The growing demand for fuelwood that is driven by the growth in population, calls for proper institutional frameworks to properly govern diminishing forestry reserves (Sulaiman, *et al.,*2017). As Falcao (2005) argues: "A supply response, improving the strength of the institutional framework, will be increasingly necessary to reduce uncertainty and to ensure an approach to the optimum investment in institutional infrastructure." The foregoing is crucial considering that forest cover is important to sustain the environment and because human beings depend on forests for food, fuel, services and income. Decades ago, Solberg (1996) argued that the needful thing to do is to put in place a policy and institutional framework in every country that enables the preservation of forest reserves and sustainable usage by communities who depend on them (Senganimalunje, Chirwa and Babalola, 2015). This study aims to investigate the existence of such frameworks in Malawi.

2.2.4.2 Fuelwood markets

In Malawi, Mozambique, Tanzania and Zambia, fuelwood and charcoal support a viable local trade. Here, charcoal is a major source of income for many households (Kayambazinthu and Oeba, 2019; Baumert, Luz, Fisher, Vollmer, Ryan, Patenaude, Zorrilla-Miras, Artur, Nhantumbo and Macqueen, 2016). Governments hence need to formulate policies for legal and economic support for small and medium enterprise development. There is also a need to improve efficiency in the production and consumption of charcoal, in order to ensure that this sector does not accelerate deforestation, which requires appropriate policy interventions (Chidumayo, 2019). Research is done to develop more efficient charcoal production methods using improved kilns in a number of countries in Eastern and Southern Africa. Apart from that, there are also efforts to produce charcoal briquettes using waste such as farm refuse, sawdust and woodchips (Neufeldt, Langford, Fuller, Iiyama and Dobie, 2015; Mwampamba, Owen and Pigaht, 2013; Kalumiana 2000). Ideally, these initiatives should be supported through involvement of the private sector.

2.2.5 The energy consumption situation in Malawi, Mozambique, Tanzania and Zambia

According to Falcao (2005), "wood fuel needs refer to the least possible amount of wood fuel necessary regarding the lowest energy estimated to be indispensable for household consumption, artisanal purposes and rural industries, in line with local conditions and the share of wood fuel in their energy supplies" (Cecelski, *et al*., 2015). Charcoal in Malawi,

Mozambique, Tanzania and Zambia is produced from Miombo woodland that are, therefore, very important in the livelihoods of the people (Chidumayo, 2019). Not only does the local population harvest these woodlands for home consumption, they also harvest the woodlands for sale in the urban areas were the fuelwood is used in place of electricity and gas (Chidumayo, 2019).

Luoga *et al.* (2000) explain that the traditional earth kiln method is used to produce most of the charcoal in the aforementioned countries. This inter alia implies locating suitable trees. The process of charcoal production is mainly carried out by men because it is very labour intensive (Chidumayo, 2019). However, according to Jones, Ryan and Fisher (2016), women made a significant contribution in the charcoal production in central Mozambique.

In Mozambique, Malawi, Tanzania and Zambia, electricity and petroleum-based fuels such as paraffin are very expensive, which increases the demand for fuelwood. The situation is even worse in urban areas because of high population growth. Households move on the energy ladder in urban areas from fuelwood at the bottom, through charcoal, kerosene and gas, to electricity at the top as their incomes increase (Kayambazinthu and Oeba, 2019). Charcoal is popular in urban areas because higher income households can afford it: it is preferred for its lightness and because it is non-smoking. It is however hardly used in rural areas because fuelwood is available almost for free (Brouwer and Falcão, 2004:235).

2.3 CLIMATE CHANGE, ENERGY SOURCES AND ENERGY CONSUMPTION IN MALAWI

Malawi's agriculture sector depends on rainfall, which expands its vulnerability to climate change which is characterised by frequent droughts (Chinseu, Stringer and Dougill, 2018). Malawi is also relatively densely populated compared to other low-income countries, with 160 inhabitants per square kilometre, while the other countries average approximately 40 inhabitants per kilometre. Agriculture accounts for one-third of the total economy, half of total export earnings, and provides jobs for two-thirds of the population (Arndt, *et al.*, 2014). Malawi is highly vulnerable to climate change because its eco-systems, food supplies, natural resources and human settlements are sensitive to the projected impacts of fluctuation in the climate that affect eco-systems severely (Chinseu, Stringer and Dougill, 2018). The country's adaptive capacity is limited due to limited financial resources, lower education levels, limited skills, old infrastructure, limited access to resources, and problems related to the stability of institutions as well as management (in)capabilities. In essence, climate change in Malawi is not just an environmental problem. It is also a principal development challenge (Felton and Siachiwena, 2018; Brown, 2011).

2.3.1 Climate variability in Malawi and related initiatives

Malawi provides an important setting for studying household adaptation to climate variability. Globally, Malawi is among the world's twelve most vulnerable countries considering the adverse effects of climate change. Droughts and floods have increased in frequency, intensity and magnitude in the past twenty years, with extremely negative effects on food and water security, water quality, energy resources and sustainable livelihoods of most rural communities (Felton and Siachiwena, 2018; Asfaw, McCarty, Lipper, Arslan, Cattaneo and Kachulu, 2013). For instance, there have been 40 weather-related disasters between 1970 and 2006, which included 16 drought or flood events after 1990. The climatic disasters included intense rainfalls, floods, seasonal droughts, multi-year droughts, dry spells, cold spells, strong winds, thunderstorms, landslides, hailstorms, mudslides and heat waves (Nkomwa, et al., 2014). These weather-related events resulted in chronic food shortages, greater poverty, and deterioration in health conditions (Limuwa, Sitaula, Njaya and Storebakken, 2018; Nangoma, 2007). Flooding in 2001/2 led to famine and an estimated 1000 deaths. Drought in 2005 caused food shortages for more than 4.7 million of the 13 million people in Malawi at the time (Devereux, 2006). Female and child-headed households, together with the elderly and women are the mostly affected by extreme weather events and climate variability because of low capacity to adapt to the adverse impacts of climate change. The situation is complicated by increased poverty and population pressures on limited land and resources, low economic productivity of the land, labour costs and limited capital (Limuwa, Sitaula, Njaya and Storebakken, 2018). Malawi is among the lowest in Human Development Index (HDI): listed as number 163 out of 173 countries in the world (UNDP/ Government of Malawi, 2001). Malawi is also among the poorest of the poor countries in Africa with 65% of its population living below the poverty line and 29% living in extreme poverty (World Bank, 2016; Government of Malawi, 2006). Malawi remains one of the poorest countries in the world despite significant economic and structural reforms because of its heavy dependence on agriculture and vulnerability to external shocks (World Bank, 2018).

Malawi's mean annual temperature increased by 0.9^{o}C during 1960–2006 (McSweeney, New, and Lizcano, 2008) and there is the likelihood of a further 1.1 to 3.0^{o}C additional increase in mean annual temperature by 2060 (Vincent, Mittal and Conway, 2017; McSweeney *et al*., 2008). Increased temperature is usually associated with changes in precipitation. However, rainfall trends are difficult to detect in Malawi because of the effect of the El Nino Southern Oscillation (Botha, Nkoka and Mwumvaneza, 2018). There are both positive and negative changes in model projections for future changes in annual rainfall, with models that assume relatively high carbon emissions consistently predicting increases in the proportion of rainfall that falls during extreme rain events (McSweeney *et al*., 2008). It is estimated that 90% of Malawi's smallholder farmers, who depend on rain to grow crops, including the staple, maize, would be detrimentally affected by the rising temperatures and decline in average rainfall

(Botha, Nkoka and Mwumvaneza, 2018; UNDP, 2007). Local farmers in Malawi are aware of changes in local climate in the past ten years (Fisher, *et al*, 2010), which negatively affects agricultural production and food security (Botha, Nkoka and Mwumvaneza, 2018; Heltberg, Siegel and Jorgensen, 2009).

The ability to adapt to climate variability by rural households has a bearing on future climate variability and change in Malawi. Like other African countries, Malawi is vulnerable to climate change, because the country is drought prone (Maguza-Tembo, Edriss and Mangisoni, 2017; Pauw, Thurlow and Seventer, 2010; Devereux, 2006). Rain-fed agriculture contributes about 40% of gross domestic product in this poor country where the majority of the population is living below the poverty line (World Bank, 2018; Mukherjee and Benson, 2003). Apart from that, technologies for coping with climate variability, such as warning systems and irrigation are limited, while access to information that the population can process is low, and political, social, and economic institutions are ill equipped (World Bank, 2018; Nangoma, 2007;).

Malawi's contribution to global greenhouse gas emission is mainly attributed to agriculture and small livestock ruminants and rice production which are emitters of methane; occasional burning of rainforests and crop residues as well as small industrial and transport components (CO_2 and NOx- emitters). Climate change in Malawi itself, is mainly the result of emissions from elsewhere (Wathore, Mortimer and Grieshop, 2017; Bie, et al., 2013).

Malawi is nevertheless involved in different projects in the wake of climate change. For instance, Malawi was a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) that was hosted in 1992 by the United Nations Conference on Environment and Development. Apart from this, Malawi was also a signatory to the Convention of Biological Diversity (CBD). The National Environmental Action Plan was also developed in 1994 after experiencing the adverse impacts of droughts and floods, essentially caused by climate change (Wathore, Mortimer and Grieshop, 2017; Bie, et al., 2013). The Government of Malawi has adopted two primary strategies to address climate change mitigation and sustainable development, namely that of the National Adaptation Programme of Action (NAPA, 2006) as well as the Malawi Growth and Development Strategy (MGDS) (Stringer, Sallu, Dougill, Wood and Ficklin, 2017; Government of Malawi, 2006). The NAPA is a follow-up to the United Nations Framework Convention on Climate Change (UNFCCC) that advised least developed countries to isolate and analyse important adaptation activities to mitigate extreme effects of climate change among rural communities in vulnerable areas of the country. On the other hand, MGDS is Malawi's medium-term road map for advancing sustainable development (Government of Malawi, 2017; Brown, 2011).

2.3.2 Malawi's forests and forest management

Malawi's forests, just like many other forests in central, southern and eastern Africa are predominately closed, deciduous woodland, known colloquially as miombo. Miombo woodlands are the most common vegetation type in central, southern, and eastern Africa (Ngulube, 1999; WWF, 2019) that provide a wide range of products and services such as grasslands, savannas and shrub lands that are essential to rural communities. Unfortunately, Malawi is losing forest cover at an alarming rate of 2.4% per year; that is likely to affect the usefulness of forest resources as a strategy for adapting to effects of climate variability (Ngwira and Watanabe, 2019). According to Ngulube (1999), most of Malawi forest reserves have natural woodlands dominated mainly by Brachystergia, Julbernadia and Isoberlinia species (FAO, 2009; Ngulube, 1999). Fuelwood collection in the forest reserves is restricted by law (except under co-management arrangements), but despite these restrictions, surrounding communities illegally enter these reserves to derive their livelihoods in the forms of fuelwood, non-timber forest products (NTFP), timber, and poles. Agricultural expansion remains the predominant threat to Malawi's forests (Ngwira and Watanabe, 2019; Government of Malawi, 1998). Smallholder farmers usually clear parts of forests to grow sufficient food, and in many communities, land holding is customary, due to the weakening of traditional control over land allocation (Ngwira and Watanabe, 2019; Government of Malawi, 2016; Government of Malawi, 1998).

Local chiefs control customary forests in Malawi. Unfortunately, most of these forests are degraded due to uncontrolled fires and overexploitation by the local people. However, Village Natural Resource Management Committees (VNRMC) were established to manage and regulate access to these forest areas (Senganimalunje, Chirwa and Babalola, 2015). Jumbe and Angelsen (2011) note that plantation forests in Malawi are the third most important source of energy supplying nearly 20% of the fuelwood (Chitawo, Chimphango and Peterson, 2016; Zalengera et al., 2014; Mauambeta, Chitedze and Mumba, 2010). Usually these plantation forests consist of exotic tree species, most of which were established by the government in the mid-1970s with support from the donor community and the private sector. The government was able to establish 0.5 million ha of softwood plantation (mainly Pinus patula) across the country for pulp, paper and timber, and hardwood species (Eucalyptus species) for fuelwood and poles. Within plantation forests, households also own woodlots/ woodlands and trees outside forests contribute 4.1% of the total fuelwood supply. Of the total area under plantation forests (111,000 ha), only 0.8% is owned by the private sector, mainly to process tea and tobacco. Biomass growing can be used as a tool for generating income among the rural poor, thereby contributing towards poverty alleviation. At the same time, biomass growing would also provide renewable energy indefinitely, concurrently increasing the store for atmospheric carbon, thereby helping to reduce the "greenhouse effect" (Thornley, Gilbert, Shackley and Hammond, 2015; Openshaw, 2010). In the household sector in many developing countries, wood and other biomass are the

main sources of energy and Malawi is no exception (Chitawo, Chimphango and Peterson, 2016; Kambewa and Chiwaula, 2010; Openshaw, 2010; Taulo, et al., 2015).

Forests in Malawi have not yet been used as a resource for reducing the impact of extreme weather events. Sadly, Vision 2020, a long-term government plan that promotes sustainable development and public awareness about climate change issues, does not mention the role of forests. Tree planting schemes to combat deforestation and protect forest resources during extreme weather events are yet to be integrated into the government's adaptation strategies (ActionAid, 2006). It is important to mention that some sections of the National Adaptation Plan of Action (NAPA) of 2006 concern forestry activities. For example, NAPA mentions afforestation and reforestation programs to control siltation, but it ignores the role of forests in minimizing the impact of droughts and floods. The National Forest Policy of 1996 and the National Forestry Program of 2001 of forest conservation policies did not link forests with adaptation to climate change, however the country has now realised the link of forests to climate change adaptation (Baumann, 2016; Ntupanyama and Mughogho, 2013; Kambewa and Utila, 2008).

2.3.3 Household energy consumption in Malawi

Malawi is endowed with different forms of energy that include thermal, coal, hydropower, petroleum, fuelwood and new and renewable resources (Johnston *et al.,* 2018; Taulo, et al., 2015; Government of Malawi, 2003; Government of Malawi, 1993:12). Eighty percent of the people in Malawi live in rural areas where they use biomass energy as the more important source, mostly in its raw form. Ninety-seven percent of rural households use fuelwood and grass for cooking, 1% use charcoal, and another 1% use crop residues that translates into 99% reliance on biomass for cooking in rural areas (Johnston *et al.,* 2018; Taulo, et al., 2015; Kambewa and Chiwaula, 2010). In rural areas, households collect wood free of charge from neighbouring trees, bushes and shrubs for cooking and space heating. Alternatively, they use crop residues when wood is not available or when it is scarce (Gondwe, 2017; Taulo, 2015; Brouwer, Hoorweg and Liere, 1997; Government of Malawi, 1993).

Extensive deforestation and wood scarcity in Malawi is largely because of over reliance on natural resources coupled with unsustainable agricultural practices and population pressures (O'Shaughnessy, Deasy, Kinsella, Doyle and Robinson, 2013). The deforestation also forces some households to resort to the use of agricultural residues and cow dung as sources of energy (Government of Malawi, 1993). Rural areas consume the bulk of household fuelwood while the urban centres consume only 17% of this fuelwood nationally (Gondwe, 2017; Taulo, 2015; Government of Malawi, 1993). Apparently, 43.4% of urban households use charcoal and 41.8% use fuelwood for cooking, while 13.6% households use electricity (Kambewa and Chiwaula, 2010). Major consumers of biomass in Malawi are households, both in rural and

urban areas (Taulo, 2015; Gamula et al., 2013; Kambewa, 2010; Government of Malawi: 1993:29).

Less than 10% of the population in Malawi have access to electricity (Dasappa, 2011). Tariffs for electricity are generally prohibitively high for most households in Malawi, almost making electricity energy unaffordable to the households. Ninety-one percent of the population in Malawi has not been connected to off-grid electricity, with less than 1% of the population having access to modern fuels (Chirambo, 2016; O"Shaughnessy, et al., 2014). The electricity sector is faced with problems such as low levels of consumption, unreliable power supply, high electricity costs and unequal electricity access (Prasad, 2011). Zalengera *et al.,* (2014). There are also added challenges such as: inadequate, expensive, unreliable and inaccessible electricity due to monopolistic structures, under-developed services, poor management, lack of competition and cultural inertia; overdependence on imported commodities, expensive petroleum products; and overdependence on fuelwood largely produced from indigenous forest with aggregate consumption exceeding levels of sustainable fuelwood yields. In addition, the high cost of imported appliances, connection fees, a connection policy that stipulates that electricity will only be connected to houses with tin roof or modern housing material limits the adoption of electrification in both urban and rural areas in Malawi (O'Sullivan and Fitzgerald, 2007). Apart from that, most households in Malawi use fuelwood because they can simply not afford electricity any way (Openshaw, 2010). This thus encourages over-reliance on fuelwood and over-exploitation of natural woodland leading to further deforestation. Women walk long distances looking for fuelwood, instead of devoting their time to more productive work and education. Sometimes households resort to felling fruit tree like mango trees as fuelwood for cooking, lime making, bread baking and brick burning (Rosendal, 2018; Chinangwa, Pullin and Hockley, 2017; Government of Malawi, 1993;).

Solar panels, solar lanterns, and medium powered hand crank generators exist as electricity generating devices that have the potential to provide lighting and phone charging capabilities for off grid rural communities. However, issues such as high capital investment, theft, long term reliability and maintenance have hindered the penetration of these technologies in Malawi so that most households without grid connectivity also lack household electricity from off-grid technologies (Buckland, Frame, Dauenhauer, Eales and Strachan, 2017; O"Shaughnessy, *et al.,* 2014).

Fuelwood remains the main cooking fuel for many households in rural areas. Most rural households collect fuelwood from unfarmed areas within the community and nearby forest reserves and may also use paraffin for lighting. More than 10% of the poorest households in rural areas use fuelwood and grass for lighting. Paraffin is rarely used for cooking across Malawi

because it has become very expensive over the past ten years and is also said to be eight times more expensive that charcoal on an end-use basis. It is however used in rural areas by up to 88.5% of households who have no access or cannot afford electricity (Schuenemann. Msangi and Zeller, 2018; O'Sullivan and Fitzgerald, 2007). In another study, it was found that 89% of rural households use paraffin in lamps, and diesel in generators as a source of lighting energy; 8% use grass and fuelwood, and only 2% use electricity. The situation differs in urban areas where 59% use paraffin and diesel for lighting; 32% use electricity; and 8% use candles (Kambewa and Chiwaula, 2010). Coal is only used by industries. Petroleum products that are sold in the country are imported (Taulo, *et al.* 2015; Openshaw, 2010).

Jumbe and Angelsen (2011) remind that fuelwood and charcoal are important in the rural as well as urban livelihoods in Malawi as other forms of energy are either too expensive or out of reach for most of the population. Unfortunately, according to the Government of Malawi (2006:66), fuelwood production for energy, is one of the main causes of deforestation and environmental degradation. The permanent land conversion for agriculture, settlement and infrastructural development also cause deforestation. Kambewa, *et al.* (2007) explain that charcoal production, which is very important in Malawi, contributes to one-third of Malawi's total deforestation, (Government of Malawi, 2017; Smith, 2017). Where rural communities live close to forest reserves and a major trading area, households heavily depend on forest products for income generation that could be as much as 25% of their total earnings (Senganimalunje, Chirwa and Babalola, 2015; Chilongo, 2014; Jumbe and Angelsen, 2007). Communities in the southern region of Malawi produce charcoal that they sell to urban markets as well as along the road from intensive harvesting from indigenous forests including forest reserves. National Statistical Office (2007) estimates that 54.6% of rural households collect their fuelwood from customary land for free, that makes up 35% of the total fuelwood consumption. This situation is also prevalent in other countries and is not unique to Malawi.

2.3.4 Fuelwood problems in Malawi

In the 1960s, Malawi's forests covered 59% of the total land area of 9.4 million ha. Subsequent to that, the country has lost a significant share of its forest cover reducing to 45% of the land area in 1972, to 25.3% in 1990, and an extra 25% (669,000 ha) by 2008 (Shackleton, Mahonya and Schreckenberg, 2019; Kambewa, *et al*., 2007). The loss has been due to opening of large estates for the growing of cash crops such as tea and tobacco. The government initiated estate-oriented agriculture in the 1970s in order to fuel economic growth. However, the extensive conversion of forestland into estates and farmland resulted in massive land degradation and deforestation. In addition, increasing demands for fuelwood to process flue-cured tobacco added to the on-going deforestation and land degradation. The demands for food and increased agriculture production to sustain the economy has resulted in the increase of land under

agriculture to the extent that now, 70% of land is under intensive or extensive agriculture (Shackleton, *et al.*, 2019).

Generally, Malawi has vast forest resources, although they are not evenly distributed across the country. The Northern Region has 43.7% of the country's forests housing only 13% of the country's population of 13 million people (NSO, 2008), compared to 26.3% in the Central Region with 42% of the population, and 30% in the Southern Region where 45% of the population lives (Zulu, 2010). The abundance and scarcity of wood in the three regions differ. In some areas, people are moving from relying on fuelwood only, to using both fuelwood and charcoal; some household are also using electricity, especially in urban areas. For example, in 2008, urban households consumed 19,076 J of energy of which charcoal accounted for 33% of total consumption, up from 24% in 1994, while fuelwood's share declined from 66% to 56% between 1994 and 2008 (Jumbe and Angelsen, 2011).

According to Arnold *et al*. (2006), in urban areas, people switch from fuelwood to charcoal that is regarded as the “transition” fuel. Nationally, access to electricity has doubled from 4% to 8% since 1994, while urban electricity consumption increased from 6% to 20% over the same period (Taulo, et al., 2015; Zulu, 2010). Nowadays, people have to walk long distances in search of fuelwood because it has increasingly become scarce in most areas. According to Arnold *et al*. (2006), land, money as well as labour affect households' capacity to access fuelwood, while affordability also affects access to alternative sources of energy (Jagger and Perez-Heydrich, 2016; Gamula, *et al.,* 2013).

Another factor related to the use of fuelwood and charcoal in Malawi, is that most of the forest resources (2.3 million ha) are legally protected areas, for example, forest reserves, national parks, catchment areas and wildlife reserves (FAO, 2010). In the past, local communities were not allowed to collect fuelwood or indeed any product from the forest reserves. In a bid to cut pressure on customary forests, in 1996, the Government of Malawi with financial support from the World Bank and the British Government, launched the forest co-management (FCM) program in the Chimaliro forest reserve in the northern region and Liwonde forest reserve in the southern regions, respectively. This was aimed at enhancing rural livelihoods, whereby programme participants were allowed to collect fuelwood and other forest products in exchange for undertaking cultural management practices such as boundary marking, firebreak maintenance, pruning, early burning and patrolling to monitor unauthorized forest extraction (Chinangwa, *et al.*, 2017; Zulu, 2008; Kayambazinthu and Lockie, 2002). Under the project, 210 ha and 1172 ha out of 160,000 ha and 274,000 ha of Chimaliro and Liwonde forest reserves respectively, were demarcated for joint management between the government and surrounding

communities. Although welcomed to save the forests, the nearby population find it difficult to access the forests and have to walk very far to collect the fuelwood they need on a daily basis.

2.4 REASONS FOR MALAWI HOUSEHOLDS' ENERGY CONSUMPTION PRACTICES

Energy plays a crucial role in development at household level and has an important influence on production because the cost of energy influences the prices of goods and services that are consumed and produced. Most African countries struggle with the provision of adequate, reasonably priced, efficient and consistent high-quality energy services for their countries (Jagger and Prez-Heydrich, 2016; Kees and Feldman, 2011; Barry, *et al.*, 2011; Amigun, Sigamoney and Blottnitz, 2006).

Households are important in terms of their contribution to the emission of greenhouse gases in SSA, and by extension to global warming (Dubois, *et al.,* 2019; Abrahamse, Steg, Vlek and Rothengatter, 2005). Households contribute to greenhouse gas emissions through everyday energy-related behaviours such as their choice of fuel, that is affected by location, financial circumstances and household preferences (Ekholm, *et al.,* 2010), as well as services such as transport services (Gadenne, *et al.,* 2011). Households use energy directly or indirectly, i.e. directly for lighting, heating space etc., and indirectly in the manufacturing of different goods and services, the transportation of goods and services, as well as the disposal of goods and services that are consumed by households (Dubois, *et al.,* 2019; Wei, Liu, Fan and Wu, 2007; Poortinga, *et al.,* 2004).

According to Consumer Lifestyle Approach (CLA), households' consumption behaviour is affected by multiple factors, including contextual influences, for eample, cultural background, social consumption attitude and available technology. Apart from the external variables, consumption is also influenced by internal psychological variables, such as people's attitudes, personal preference and their consumption motives (Chirambo, 2016; Wei, *et al.,* 2007). Households' consumption behaviour is also affected by norms and attitudes that are difficult to change (Gadenne, *et al.,* 2011).

Eventually, households' energy use is a result of the social structure, and on a practical level, the amount of energy consumed by a household, is greatly influenced by heating demand, use of energy-intensive appliances, types and frequency of use of appliances, occupancy work patterns, standards of living, comfort expectations and cultural habits (Yohanis, 2012:654; Gibson, *et al.,* 2010). Availability and income determine the kind of energy a household uses (Gram-Hanssen, 2011, Kaygusuz, 2011; Bailis, *et al.*, 2003; Karekezi and Kithyoma, 2002). Furthermore, the location of a household, whether rural or urban, as well as housing type also

affect the types of energy that households use (Waitt, *et al., 2012*; Ekholm, *et al.*, 2010). Energy consumption will be affected by the construction quality (insulation, energy efficiency systems and construction materials) of housing types, as well as physical attributes (housing type and size) of a housing structure (Estiri, 2014; Estiri, Gabriel, Hopward, and Wang, 2013). Households' total energy consumption eventually differs between and among households because of differences in disposable income/ expenditure, with a strong correlation between energy consumption and income/ expenditure. Lifestyle patterns generally affect households' energy consumption and use (Schuenemann, *et al.,* 2018; Raty and Carlsson-Kanyama, 2010). Generally, households' energy consumption tends to increase when their income increases, due to affordability. Sadly, improved standards of living are inclined to negatively affect households' environmental impacts because households then inadvertantly buy more materials/ appliances and subsequently produce more CO_2 emissions (Tukker, *et al.,* 2010).

There has been increased interest in households' energy consumption to encourage changes that would reduce energy consumption, while also contemplating cultural and social changes that may encourage households to be more energy inefficient (Gram-Hanssen, 2011). It is important to note that cultural values shape households' economic decisions and usually, households' preferences and behaviours develop from existing norms and beliefs (Bisaga and Parikh, 2018; Gibson, *et al.,* 2010). Over time, there have been calls on all stakeholders, from governments to individuals to reduce their energy consumption practices and to adopt more sustainable practices such as more efficient use of available resources (Hobson, 2003). This was due to a call to mitigate the global climate change through revised behavioural pratices (Bisaga and Parikh, 2018; Borgstede, *et al.,* 2013; Mideksa and Kallbekken, 2010). Eventually though, pro-environmental behaviour culminates from values that go beyond self-interest (Poortinga, Steg and Vlek, 2004).

Some personality and perceptual characteristics are associated with consumers' energy saving behaviours, for example, the perception that certain energy saving measures may imply reduced comfort; how people personalize concern for environmental and energy-related issues; the cost associated with energy saving behaviour - especially relating to the extent to which individuals are aware that they may make significant savings by conserving energy; whether people realise that they have a responsibility to save energy; normative influences on behaviour, relating to their significant others such as family and friends who might encourage energy saving; as well as self-presentation - specifically the extent to which individuals perform behaviours in ways that they could make a positive impression on significant others (Cecelski, *et al.*, 2015; Barr, Gilg and Ford, 2005). Sometimes, consumers fail to reduce their energy consumption simply because of lack of adequate knowledge to effectively amend existing practices, not prioritising the issue, as well a s high costs associated with energy savings.

Alternatively, it could be merely a matter of a lack of practical alternatives (Cecelski, *et al.,* 2015; Steg, 2008). Generally, physical, social, cultural and institutional contexts shape and constrain consumers' choices with regard to energy consumption (Owens and Driffill, 2008). Undeniably, the high cost of modern energy sources are pertinent constraints in terms of households' fuel preferences in many developing countries (Ouedraogo, 2006). Unfortunately, eco-friendly alternatives are perceived to be more expensive and this often impedes pro-environment decision-making on the part of the consumer (Sonnenberg, Erasmus, and Schreuder, 2014).

In a study in Beijing in China, the researchers Wang *et al.* (2011) found that factors such as economic benefits; governmental policies and propaganda influence households' energy saving behaviour. For example, energy saving behaviour that is not going to cause any inconvenience, are embraced more easily. This particular study revealed that the amount of knowledge related to climate change did not contribute to households' electricity saving behaviour, indicating that other issues such as convenience may be more important. Notwithstanding, many still propagate the significance of information in promoting energy saving (Frederiks, *et al.*, 2015). For example, in a study by Ek and Soderholm (2010), factors such as environmental information and social exchange were indeed found to be very important in electricity-saving behaviour (Hori, Kondo, Nogata and Ben, 2013). Smilarly, another study concluded that environmental consciousness will encourage consumers to adapt their behaviour (Gram-Hanssen, 2011).

2.5 CONCLUDING REMARKS PERTAINING TO THE CHALLENGES OF SUSTAINABILITY IN SSA

In many African countries, such as Malawi, households' dependence on biomass for their energy needs, has had devastating consequences, such as increased air pollution and greenhouse gas emissions, as well as other negative consequences including unfortunate health related issues (Kaygusuz, 2011). Energy insecurity in general, is a major challenge in developing countries. Unfortunately, lack of access to modern energy sources is currently jeopardising economic and social development in SSA, which accentuates the need for households to gain access to modern energy services so that the UN sustainable development goals (SDGs) could be achieved (Kaygusuz, 2012; UNDP, 2015). Inescapably, financing complicates the switch to modern energy sources such as renewable energy as it is expensive, and mostly unaffordable for the majority (Bouzarovski and Petrova, 2015).

It should be noted that important related constructs such as knowledge, awareness and consciousness are explicated and attended to in chapter 3 when discussing the relevant theoretical perspectives.

CHAPTER 3

THEORETICAL PERSPECTIVE

This chapter presents the theoretical perspective used to organize the theoretical content of the research, to refine the research methodology, as well as to organize and structure the findings

3.1 INTRODUCTION

Structuration theory served as the theoretical perspective for this study because it allowed the researcher to frame rural Malawi households' energy consumption practices in terms of their demographic and socio-economic context to gain a better understanding of the complex and often hidden processes that influence attempts to enact sustainable lifestyles at household level. Lifestyles can be socially, culturally and historically contextualized and reflect how consumers wish to be/ live, and to be seen by others based on social class, income, age, gender, ethnicity and related behaviours (Nye and Burgess, 2008). In principal, structuration theory as developed by Anthony Giddens (1984), is a social theory that attempts to understand the relationship between the activities of knowledgeable human actors (households, in this instance) and the structuring of social systems - including the socio political structures that households are confined to - that culminate in terms of particular, distinguishable social practices that are reproduced over time (Hobson, 2003; Giddens, 1984).

Structuration theory thus proposes the study of consumers'/ households' behaviour and underlying reasons for behavioural conduct, interests and motives at a particular time and space within the context of social practices that are shared with others. Households were investigated in terms of their consumption of different sources of energy in the wake of climate change. Malawi households were subsequently viewed in a specific context, acknowledging the resources available to them, in the reproduction of social practices (Spaargaren and Van Vliet, 2000). It is important to acknowledge that the social practices model that was developed by Spaargaren and Van Vliet relies on the structuration theory, which allowed the researcher some acknowledgement and engagement with the 'cultural politics of consumption' (Hobson, 2003). According to structuration theory, it is important to realize that climate change mitigation will not merely realize from a change in individuals' attitudes, but also requires acknowledgement of the input and contribution of different role players in the greater world. It is hence necessary to understand the agency (human action) and structure (social institutions) that constitutes the framework for human (households') action. It was furthermore necessary to give credit to the shared responsibility between consumers and their micro and macro environments that form a

collective of their system of provision (Jackson, 2005). These systems of provision provide rules and regulations for households' social actions. Structuration theory offers a practical stance because it offers a sociological context approach in which both agents and structure share responsibility. It allows the study of the social life of agents in terms of social practices that progress and change over time. Both **structure** and **agency** are organised in a mutually dependent duality requiring an understanding of micro-level activities and macro-level influences of the social life of agents. In this particular case, providing the relationship between the household and their social structure as stipulated by the structure (systems of provision) (Gauntlett, 2008:99).

In this study, structuration theory refers to the society and the rules and regulations in accordance which households operate on a daily basis. In principle, households are locked in by particular social norms (Giddens, 1984).

3.2 STRUCTURATION THEORY

The following sections present the assumptions of structuration theory as well as a discussion of the relevance of households' knowledge concerning sustainable consumption practices.

3.2.1 Assumptions of structuration theory

In terms of structuration theory, an individual's/ household's behaviour is studied in the context of social practices that transpire in a particular time and space, that represent the so-called rules and underlying reasons that are shared with others in the particular society (Giddens, 1984).

Theoretically, rules and resources constitute the **structures** that are involved in the reproduction of social practices (Spaargaren and Van Vliet, 2000). Structure hence refers to the rules and resources in a specific context, that stems from social practices, specifically the "the structuring properties that allow for the binding/ integration of time and space in social systems". Structures are believed to be the so-called media that enable the actors/ households to act and exist *internally* within agents as memory traces, as well as *externally* as the manifestations of social actions and/ or the product of agents' past actions (e.g. in terms of pollution, or deforestation) (Giddens, 1984). Three kinds of structure are relevant in a social system, namely *signification* (where meaning is assigned to practice); *legitimation* (consisting of the normative perspectives that are embedded as societal norms and values); and *domination* (i.e. how power is applied, particularly in the control and allocation of resources) (Giddens, 1984). Structure can influence or limit the choices and opportunities of households, and it can be enabling or constraining the general behavior of agents (Giddens, 1984).

Agents refer to the groups or individuals, for example the households, who rely on the existing structures to perform social actions (in this instance, household energy consumption practices) through embedded memory, i.e. memory traces that provide the vehicle for agents' social actions. According to Giddens' structuration theory, agents are important because they possess free will and knowledge as role players. Three types of memory traces are distinguished, namely: *domination* (power); *signification* (meaning); and legitimization (*norms*). It is important to understand that an agent is knowledgeable (Kaspersen, 2000:22). Households draw on "stocks of knowledge" to make sense of manifestations and to apply the knowledge in their daily activities. Agents furthermore rely on this knowledge and routinely "**reflexively monitor**" not only their daily practices, but also the contexts and settings surrounding them (Giddens, 1984).

Structuration theory also distinguishes a **social cycle** that is sanctioned by agents as well as structure to become part of a **duality**, **modality,** and **interaction** within relevant social systems. The duality of structure (that examines the structure), refers to the dual character of the rules and resources that are involved in the production, reproduction and transformation of social systems that comprise of sets of social practices that apply at a particular time and space. Agency and structure are interdependent, intertwined and very dependent on each other, while social structure is both the medium and outcome of social action (Rose and Scheepers, 2001). **Modality,** in this case, is the means by which structures are translated into actions. **Interaction** refers to agents' activity within the social system, in a particular space and time, that culminates as some form of routine, which is fundamental to establish social order and social systems' reproduction (Giddens, 1984). Actors/ households are obliged, in their actions, acknowledge the rules and available resources (in this study, for example, the available energy sources). Eventually, the actors'/ households' actions (e.g. energy consumption practices) endorse and reinforce the structure (Spaargaren and Van Vliet, 2000). Eventually, an understanding of consumption is necessary to encourage behavioural change, as consumption forms part of social practices and also positions consumers (households) as carriers of those practices (Strengers, 2010).

Duality of structure is very important for the mitigation of unsustainable consumer behavior in the sense that combating climate change will not only be the result of change of attitudes of individuals, but will essentially require the input and contribution of all the role players within the greater society. According to structuration theory, duality of structure evolves and is reproduced over time and space (Giddens, 1984).

Giddens argues (1984) that an individual's autonomy (independence) is influenced by a prevailing structure, while the structures are maintained and adapted simultaneously through the **agency**. Structuration theory further assumes that social action cannot be explained entirely

by either the structure or the agency alone. Neither can it be done by a micro-, nor a macro-focus only, as actors (households) generally operate within a particular context (e.g. rural Malawi) with prevailing rules that are produced by the existing social structure. These structures are secure when actors act in a compliant manner.

Generally, agents are able to rationalize the grounds for their social action, even though they may not be aware of the consequences of their action (for example explain why they use wood for fuel, not necessarily understanding pollution and deforestation in terms of the consequences for global warming). There is interaction between agents and structure as well as reflexive action. This is referred to as **reflexive monitoring** that ocurs at two levels of consciousness, namely *practical*- and *discursive* consciousness. Discursively, agents can give reasons for, and can rationalize their behavioural practices. They can thus linguistically reflect about the rules and resources that are involved in social interaction and can reflexively monitor their own social behaviour as well as that of others at the level of practical consciousness. Reflexive monitoring deals with the agents' conscious effort or deliberate ability to alter social structure (Giddens, 1984, in Macintosh and Scapens, 1990:458).

Jackson (2005) identifies three conditions that indicate that energy consumption mostly constitutes habitual behavior: it is believed that decisions taken in everyday energy consumption are likely to be considered as having *less important consequences* than other decisions; the *low complexity of decisions related to everyday energy consumption* does not require a lot of cognitive effort; and the *constraints of society* tend to encourage existing habits and routines. Therefore, it is probably idealistic to expect consumers to be capable to control their consumption of energy (Marechal and Lazaric, 2012).

3.2.2 The relevance of knowledge

Giddens' structuration theory follows a sociological-contextual approach in determining the role of consumers' knowledge in how they understand daily activities. This theory assumes that consumers, as agents of change, rely on their knowledge of a phenomenon and then **reflexively monitor** their own behaviour within a particular context (such as rural Malawi) and surroundings to better understand their behavior, and to enable them to explain and discuss the phenomenon. It is also proposed that society provides structure with rules and regulations that consumers abide by on daily basis (Marx-Pienaar and Erasmus, 2014).

It is suggested that an improvement of consumers' level of knowledge of climate change and subsequent change of consumption practices, has the potential to mitigate climate change (Marx-Pienaar and Erasmus, 2014). The authors assert that in terms of consumers' knowledge, much can still be done to educate consumers about climate change and ways and means to

amend unsustainable consumption practices, such as when consumers worldwide emulate the lifestyles and consumption patterns of more affluent societies in which success and status are often associated with extravagance and waste (Marx-Pienaar and Erasmus, 2014). Unsustainable consumption practices are typical when consumers do not have the relevant facts concerning environmental degradation, or when they have limited access to relevant information and appropriate action strategies. Ideally, consumers need to possess both explicit (factual) and tacit (implied) knowledge about their consumption practices, i.e. factual information and underlying know-how and skills on how to mitigate climate change (Marx-Pienaar and Erasmus, 2014).

To clarify human beings' activities in daily life, Giddens (1984) distinguishes three levels of experience in the daily lives of individuals (agents): the *unconscious*, *practical consciousness* and *discursive consciousness* as explained in Table 3.1.

TABLE 3.1: THE THREE LEVELS OF EXPERIENCE IN THE DAILY LIVES OF INDIVIDUALS

Level of consciousness	Explanation
Unconsciousness	This concept is derived from Freud to outline that we are not fully in control of, and what is beyond our immediate intentions.
Practical consciousness	Actors know implicitly how to operate in the contexts of social life, which entails tacit knowledge.
Discursive consciousness	When possessing this type of knowledge, individuals can describe and express in verbal terms what they are doing.

Source: Adapted from Giddens (1986:7, 49)

Firstly, the agent's ability to apply knowledge of everyday activities is bound by the unconscious (Giddens 1986:282) that strongly connects with one's basic security system whereby anxiety may control or repress an individual's intention or motivation to act (Giddens, 1986:49). Intentions or motivations on the unconscious level are elevated to the level of consciousness, that can then be distinguished as practical- and discursive consciousness.

3.2.2.1 Practical consciousness

The environmental impact of consumers' energy related actions are not immediately "visible" (Marechal, 2010:1108). Environmentally significant behaviour is hence not so much the result of discrete, reasoned action, as it is a result of the rather inconspicuous routines of everyday life, and the practical skills and knowledge that are required to perform them. Simply stated, it is the knowledge for getting on in everyday life that allows routine actions that are repeated more or less automatically. Most people's/ consumers' conventional, routine or habitual activities that are done without intentionally thinking about how to do it, and why it is done, is associated with one's practical consciousness. This particular study involved rural Malawi households that have become acquainted with consuming certain energy sources, in a particular way, over time, and

neither they, nor society has necessarily ever questioned these consumption practices, even though they were unsustainable.

Practical consciousness is the knowledge that an agent (household) applies to perform everyday tasks in life and mostly, such knowledge is hardly noticed (Nye and Burgess, 2008). Reflexive monitoring affects the agents' ability to monitor their actions in settings within particular contexts - almost without thinking about it, thus routinization of behavior. Households' routine practices imply the application of hidden knowledge that enable them to perform activities without contemplating them all the time. Consumers' practical consciousness change over time, and does not require discursive consciousness (that involves facts) to change (Scott, Bakker and Quist, 2012). However, it is important to know that practical consciousness is critical for households to function, in the sense that it is the practical consciousness that exibits consumer behavior in terms of habits and their routine of daily life. It is possible that households' practical consciousness may be unsustainable but has been shaped through societal rules and regulations, through their socialization. Households may for example have bcome used to using fuelwood, because society has never questioned it before. It can thus be said that households are locked in by structures because there are no alternatives in terms of more sustainable practices for them to choose from. In order to mitigate unsustainable consumption behavior, attention then shifts to discursive consciousness (Karspeesen, 2000:31).

3.2.2.2 Discursive consciousness

In contrast, discursive consciousness entails a connection between routine behavior and the justifications or reasons for doing things in a particular way. Discursive consciousness involves a consideration of the contextual processes that are involved in questioning/ reasoning particular practices. It is about the discursive processes that are evoked when consumers contemplate their consumption practices and how that might impact the outcomes. Discursive consciousness focuses on 'how", and the forms of knowledge that consumers possess, therefore questioning the processes when consumers reconsider their consumption practices (Hobson, 2003). In essence, discursive consciousness reflects a person's ability to verbally express knowledge about a phenomenon, i.e. to explain it, and includes ideas and cognitions that consumers can reflect on. In this particular study, discursive consciousness is about questioning the previously unquestioned practices of consumers (in this case household energy consumption practices), based on facts about the environment and sustainable consumption, which is necessary to start changing certain habits. It is about relating one's practical knowledge (how to) to discursive consciousness (why to) that could result from a concern about climate change or environmental issues (Bartiaux, 2008).

It is critical to know that the boundary between discursive and practical consciousness is permeable in the sense that there is an interchange of information that highlights reflexive monitoring (Giddens, 1984). Consumers are often not aware of the amount of energy that they utilize every day. When they then acquire factual information to explain it to them, their behavior is more likely to change (Bartiaux, 2008). However, households that are better informed about climate change issues and renewable energies are not necessarily acting in an environmentally friendlier way, because more knowledge on a subject is not always enough to spur energy-sounder practices. New practices have to become acceptable within people's social environment, for example, among friends, colleagues, neighbours, family members and the media to ensure shared, and social support for the changes.

Discursive consciousness focuses on how and what forms of knowledge consumers have. It is about examining the processes that occur when consumers reconsider their consumption practices (Hobson, 2003). Further to that, it is not only the process of having the "unquestioned questioned" that creates positive behavioural change, but also the forms of knowledge represented in the questioning process. Discursive awareness is part of consumers' discursive consciousness, not necessarily altering what they know and do, but becoming part of continuous understanding and debate concerning lifestyles and values. It is fundamental to the ways that consumers deal with socially complex information, by inter alia becoming engaged in debates, contests, and positioning certain information or a proposition within the knowledge they already possess. Discursive consciousness shows that, notwithstanding public behavioural inertia, constructive, discursive processes are taking place that acknowledge individual consumption, but which also affects the uncertainties and social implications of knowledge and practices. Practices that are part of consumers' practical and discursive awareness hence become part of an iterative process of questioning and reconsidering information (Hobson, 2003:106, 107). For this study, discursive consciousness would represent the way in which households are able to reflect on, and question their energy consumption practices, while their practical consciousness would refer to their almost automatic/ thoughtless use of different sources of energy, because that is what they are used to do.

It has been argued that when practical routines are discursively bundled together within everyday living, they form a lifestyle, which is a more or less integrated set of practices that a consumer adopts - not only because such practices fulfil utilitarian needs, but because they give material form to a particular narrative of self-identity (Hobson, 2003:96). Essentially, communication between agents and structure could also assist in mitigating unsustaibale household energy consumption (Spaargaren, 2006).

3.2.2.3 Conclusion

According to Giddens (1984), social structures are “works in progress” and the practices of households cannot simply be reduced to routine acts. Rather, they constitute daily habits and practices that constantly create and recreate social ordering (Hobson, 2003:103-104). Routine practices reflect the “concealed” knowledge of actors (consumers/ households), i.e. their *practical consciousness*. This type of knowledge enables a consumer/ household to continue with daily life without having to consciously make new decisions every time: for example, cooking food in a specific way without contemplating the way they cook. On the other hand, the awareness with which individuals think and talk about certain practices or phenomena, is known as *discursive consciousness,* that implies a body of understanding that develops on an on-going basis to shape ideas that are anchored in factual knowledge (Hobson, 2003), e.g. to consider alternative sources of energy when cooking for a specific reason.

The shift from practical consciousness to discursive consciousness appears to be socially shaped and is not just an issue of transferring knowledge to consumers as the individual agents and then expecting matters to change (Bartiaux, 2008). The boundary between practical- and discursive consciousness changes over time, with increased experience and exposure. It is also permeable, which allows reflexive monitoring (Hobson, 2003; Giddens, 1984). The nature of practical and discursive consciousness explain that new information is not simply added into a current lifestyle to achieve changes, but that social support is crucial to enable change. In the end, “everyone is on the lookout for approval, admiration and love in the eyes of the others” and would make changes provided that they are supported (Gram-Hanssen, Bartiaux, Jensen, Cantaert, 2007). Practical consciousness requires little confidence or skill, while discursive consciousness requires more profound changes to habits and lifestyles that require more extensive engagement. Because behavioural change programmes question the appropriateness of a focus on the individual, the WWF (2008, in Moloney *et al.,* 2010) recommends framing campaigns around intrinsic values such as social norms and community involvement that acknowledge the relevance of social norms in shaping behaviour. Ultimately, the technical, social, economic and political aspects related to energy consumption need to be appreciated to understand how the collective or social context shape and frame consumers’ daily actions.

In the climate change debate, there is consensus that changes in human actions and behaviour are necessary for the transition to becoming “low carbon communities”. By implication, this would require an understanding of community practices and subsequent emissions, which this study aimed to achieve, and attending to available technologies and infrastructures by institutions associated with the communities. It is therefore about a comprehensive socio-technical framework that considers both individual psychological factors and the systems,

standards and norms in accordance which consumers generally operate (Moloney, Horne and Fien, 2010). Jackson (2005) is of the opinion that consumer behaviour is key to the impact that society has on the environment, which elevantes the relevance of social practices in this debate. This hence brings into the discussion the norms and values that shape consumers' practices, infrastructure, institutional arrangements and systems of governance, which should be well understood to inform appropriate policies and strategies that might encourage low carbon practices.

All behavioural change models involve an integration of internal and external variables. Internal variables are the micro-sociological aspects that influence and shape what ever goes on inside a consumer's mind e.g. awareness, knowledge, values, attitudes, behaviour, rational thought processes, emotional states and entrenched habits. Internal variables vary among individuals, and even within an individual, depending on the life stage and context. On the other hand, external variables are located in the physical, and social environments in which a person lives, and often, a consumer has limited or no control over these influences (Moloney, *et al*., 2010).

3.2.3 The system of provision

Household energy use, together with water consumption and waste generation are the three areas of household activity that are particularly important for the environment. Therefore, it is important to understand how the systems of provision work in relation to household energy acquisition and use in rural areas. Generally, the systems of provision are the interface between social practices and technologies that households script and structure: they create a notion of convenience (or not) and what is considered conventional in a society (or not) (Nye and Burgess, 2008).

Within the system of provision, consumption is an active process where human agents (households) follow certain lifestyles with associated consumption and practices. The so-called systems of provision entail a holistic positioning of consumers' consumption in relation to processes of production, distribution, access, as well as the nature and influence of the conditions under which the provision of goods and services occur. The prevailing systems of provision in a particular context could enable or limit households' consumption of energy sources, for example encourage or restrict use of fuelwood and charcoal. Usually, the state (government) plays an important role in the systems of provision (Bayliss, Fine and Robertson, 2013). In this study, th Government of Malawi was represented by the District Agriculture and Development Officers (DADO) as well as extension workers of the Government's Department of Forestry in the districts of Balaka and Phalombe, who have the authority to support or impede sustainable consumption behavior (Organization for Economic Co-operation and Development (OECD, 2002). For example, Government of Malawi, through its Department of Forestry

restricts the consumption of charcoal and also controls the felling of trees from government forests.

3.2.4 The relevance of lifestyle

Lifestyle can be defined as a "more or less integrated set of practices, which an individual embraces, not only because such practices fulfill utilitarian needs, but because they give material form to a particular narrative of self-identity" (Giddens, 1991:81 cited in Middlemiss, 2011). Generally, lifestyle (the way people live) includes factors such as shared attitudes, activities and behaviours that are contextual to a particular group. Lifestyle is particular to individual or household decisions, including their acquisition and consumption behavior. Lifestyle is also described in terms of consumers' psychographic characteristics that consist of, and is measured by, their activities, interests and opinions (Schiffman and Kanuk, 2010:84). Lifestyle therefore evolves around households' consumption patterns that reflect their choices of, for example, how much time and money is spent on certain products and services (Schiffman and Kanuk, 2010:84; Solomon, 2004:198). For the purpose of this study, this denotes interests, opinions, behaviours and behavioural orientations of different households in the selected geographic areas in Malawi, with respect to their acquisition and consumption of fuelwood and charcoal. On a practical level, the lifestyles of the human agents interact with structures in the systems of provision to create specific social practices. In this study, it mattered to what extent households and communities consider government policies, community rules and regulations and how they affect the acquisition of energy sources at household and community level.

Lifestyle can be culturally and historically contextualized and culminates when practical routines are discursively integrated with everyday living and is influenced by the different social practices of a household (Figure 3.1). Lifestyle is furthermore contextual, in the sense that it relates to time and space. In this particular case, the researcher looked at how much money was spent on energy sources (mostly fuelwood and charcoal) by households in selected parts in Malawi, including how much time and effort were devoted to collecting fuelwood and other energy sources for the household in a rural community. Structuration theory posits the understanding of environmentally responsible behaviour as a duality, i.e. as the choices of households with the surrounding infrastructure, considering social norms and systems (Nye and Burgess, 2008:33) and allows some reflexivity on the part of the consumer in which the individual positions the self against knowledge about something (for example, environmental impacts of everyday living) and the lifestyles of others who are living in similar ways (Nye and Burgess, 2008:89).

3.2.5 The relevance of human agency

Agency refers to “the action of individuals and groups” (King 2005:215) or “their capacity of doing” (Giddens 1986:9). To understand society, it is necessary to consider the actions of human beings in society, which is not a physical entity that acts while ignoring its members. In society, there are various individuals of which some are more knowledgeable and capable to explain their actions (Giddens, 1985;62). Avruch (1998:5) explains that people’s actions (in society) can hence result in the transformation or reproduction of the social and economic structure because the joint action of its members will culminate as a force that cannot be ignored. In his earlier writings, Giddens (1983:62) explains that structure and agency are interdependent, as the structure provides its members (agents) with resources and rules. Resources provide them the possibility of actions, while rules are guidelines as to how actions should be performed (Giddens, 1986:xxxi, 25). Therefore, structure has both the role of guiding agents in terms of certain actions and enabling them to act. In the end, however, agents can explain their actions, based on the fact that human beings have the capabilities to act in specific, chosen ways with self-consciousness. The can also reflect, have particular intentions and can act with purpose (Weber, in Morrison, 2004:276). As agents, human beings have the ability to acquire knowledge that can be used in the production and reproduction of everyday activities in their society (Giddens 1986:22) and are unconsciously motivated to act in particular ways. Agents recursively continue their actions through this process, reflexively monitoring their actions with particular intentions and possessing a particular level of knowledge (Giddens, 1983:56, 1986:5).

Structuration theory (Giddens, 1986) posits that social practices across space and time are interdependent and that human agency and social structure act as enablers for one another.

3.3 RESEARCH PROBLEM

Malawi is among the poorest countries in Africa. Due to high costs of electricity and the fact that relatively expensive electrical appliances are required when homes obtain access to electricity, Malawi’s rural households largely depend on natural woodland and forest resources for fuelwood for daily use and as a source of income (Jumbe and Angelsen, 2011). Unfortunately, the growing consumption of fuelwood at household level in the country now exceeds the supply of fuelwood and subsequently exerts immense pressure on forests and woodlands around the villages and communities, resulting in alarming rates of deforestation (Currier and Lewis, 2015; Smith *et al.*, 2015; Bandyopadhyay, *et al.,* 2011;). This has detrimental consequences for the environment in terms of the sustainability of natural resources, and ultimately, for climate change (Shackleton *et al*., 2001). Additional causes of overexploitation of woodland and forestry resources, are open access to forest areas, high levels of poverty, weak management and lack

of coordination between local and traditional governance i local woodlands and forests. Consequently, Malawi is losing up to 2.8% of its forests annually. For example, earlier statistics show that 13% of the country's land surface forest cover was lost between 1990 and 2005, principally due to demand for fuelwood (Stringer, *et al.,* 2012; FAO, 2010). This phenomenon is not unique to Malawi in Southern Africa, as even more economically advanced countries such as South Africa experience similar problems (Maphiri, 2009; Prasad and Visagie, 2005) due to poor communities' over-reliance on fuelwood as an energy source. The predicament is, that fuelwood consumption has become an integral aspect within the Malawi rural social context and it is unfortunately not clear how informed households are about the consequences of their fuelwood consumption, and how willing households and communities are to adapt their current fuelwood consumption practices. What complicates matters further, is that change will entail effort to be made in terms of a higher order need, namely to save global resources for the sake of the future of our planet. Without empirical evidence of consumers' behavioural practices, ability and/ or willingness to make sacrifices or adapt, it would be difficult to convince government to elevate concern about climate change to the top of their agenda, and to encourage and enablehouseholds' access to alternative energy sources that would halt deforestation.

Studies in other developing countries that have accounted for household wealth, income and location, concluded that households depend differently on forests and agroforestry for fuelwood supply (Ashton *et al.,* 2011; Baland *et al.,* 2010; Jumbe and Angelsen 2011). An analysis of the energy consumption patterns of households in Malawi will enable context specific recommendations to households on how to sustainably use fuelwood in the light of dwindling forests and woodlots with an empathetic understanding of practical challenges in relation to households' energy needs. Findings will furthermore provide evidence of the role of consumers' knowledge of the consequences of their fuelwood consumption practices and the probability that they could adopt alternative energy sources in the near future.

3.4 RESEARCH AIM AND OBJECTIVES

The study focused on households in selected rural areas in the southern part of Malawi, namely Balaka and Phalombe. The research aimed to generate empirical evidence of households' energy consumption as a consequence of their way of life (lifestyle) and the systems of provisions as largely determined by Government policies through the Department of Forestry and Ministry of Agriculture DADO (district and agriculture development office) and traditional leadership. The study envisaged a contribution towards initiatives that may encourage sustainable household energy consumption behavior amidst expressed concern about deforestation in the country and irrevocable consequences in terms of climate change, by

gathering evidence of households' practical- and discursive consciousness concerning their energy consumption as pre-requisites to facilitate and promote behavioural change. The study aimed to indicate the potential contribution of households within selected communities in reducing their own carbon emissions that are potentially detrimental to the future health of the planet, and to instigate policies that would serve the cause.

The following research objectives directed the research design:

Objective 1: To investigate and discuss specific aspects of households' lifestyles specifically relating to their consumption of sources of energy for daily use, i.e.:

1.1 types of energy used for different activities.
1.2 origin of the different energy sources and related implications.
1.3 involvement and habits of household members in the collection of fuelwood and charcoal for different activities and occasions.
1.4 time (hours) spent on collecting fuelwood and charcoal by households.
1.5 money spent on energy for the household.

Objective 2: To investigate and discuss heads of households' practical consciousness about climate change and sustainable consumption practices in terms of:

2.1 its manifestation in the sources of energy used for different activities, and
2.2 their demonstration of thoughtful practices when using energy sources.

Objective 3: To examine and discuss households' *discursive consciousness* of climate change with regard to their consumption of different energy sources, specifically their ability to explain their choice of energy sources.

Objective 4: To explore and discuss the role and interaction of systems of provision (i.e. government, non-governmental organizations) in these areas in terms of households' and communities' consumption of energy sources.

3.5 CONCEPTUAL FRAMEWORK FOR THE STUDY

The conceptual framework for the study as presented in Figure 3.1 shows the interrelationship between agents and systems of provision. It indicates how the agents (households) function in view of the structure that is provided by the systems of provision with regard to households' consumption of energy sources.

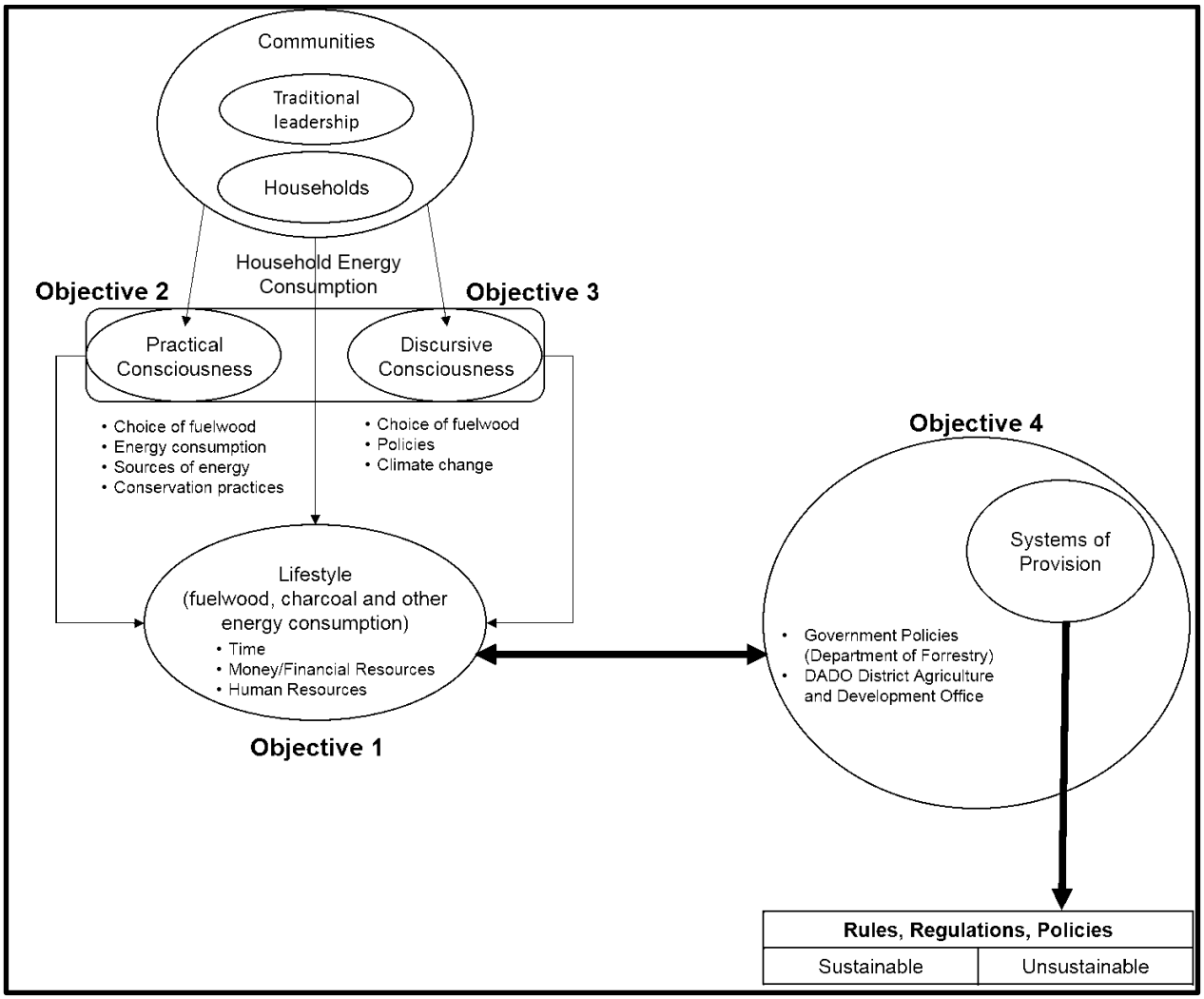

FIGURE 3.1: CONCEPTUAL FRAMEWORK: RURAL MALAWI HOUSEHOLDS' FUELWOOD ACQUISITION AND CONSUMPTION AS PART OF THEIR PREVAILING LIFESTYLES

This study was framed in accordance with Giddens' (1984) structuration theory, aiming to investigate households' (agents") energy consumption practices as part of their lifestyles, to comprehend their existing consumption of energy sources, as well as to assess households' (decision makers') environmental knowledge as an indication of their discursive consciousness about broader environmental issues. The study had a vested interest in the structures within which households' energy consumption practices are framed. The 'model of consumption' propagated by Spaargaren and Van Vliet (2000) guided the conceptual framework that is based

on Anthony Giddens' structuration theory. It illustrates that households' fuelwood and charcoal acquisition and consumption in rural areas in Malawi are studied within the notion of duality of structure. The notion of duality of structure (Giddens, 1984) advocates that two perspectives need to be evaluated when investigating household energy consumption, i.e. the household (agent) and the systems of provision (government and non-governmental organizations). The systems of provision provide pertinent rules and structure that affect the consumption of different energy sources by agents (Rose and Scheepers, 2001). Unavoidably, households are continuously performing certain actions that are deemed socially acceptable within the established systems of provision.

The conceptual framework (Figure 3.1) indicates that the lifestyle of households as the agents (explored through Objective 1) operate with two kinds of consciousness (investigated in Objectives 1 and 2 respectively), i.e. *practical consciousness* and *discursive consciousness*. Practical consciousness refers to the capability whereby the households (agents) maintain their everyday household energy consumption activities without justification or explanation (Giddens, 1984; Jackson, 2005). Secondly, discursive consciousness deals with the agents' reflexive ability to consciously explain and reason about their motivation and intentions relating to household energy consumption practices (Lyytinen and Ngwenyama, 1992). Agents generally reflexively monitor their consumption practices. Structuration theory assumes, for example, that for certain behavioural patterns to change, it would be crucial for the agent to elevate routine behaviours from the level of practical consciousness to a level of discursive consciousness that requires explicit knowledge about a phenomenon. Explicit knowledge of climate change and sustainability issues, for example, would (hopefully) influence households' lifestyle and their pro-environmental practices (Kollmuss and Agyeman, 2002).

It was imperative to also study the systems of provision in these areas, as propagated by the government and non-governmental organizations that facilitate initiatives and formulate policies that affect these households, particularly referring to different energy sources. The study therefore investigated households (as agents) within specific communities with established leadership on the one hand, and government and non-governmental organizations on the other hand (as the prevailing systems of provision) that affect households' energy consumption practices. Within the systems of provision perspective, i.e. acknowledging that government and non-governmental organizations are the authorities in the areas, it is indisputable that households' energy consumption behaviour is guided by certain rules, regulations and policies, irrespective of whether prevailing energy consumption behaviour is sustainable or not. Literature also confirms that households' (agents') energy consumption practices and their subsequent energy demands are affected by the prevailing structures in a socio-cultural context (Bartiaux, 2007). The inclusion of the structure and systems of provisions is necessary in

contextualizing the duality of structure as assumed within the structuration theory. However, with all intents and purposes, the household as an agent constitutes the main focus of enquiry.

CHAPTER 4

RESEARCH DESIGN AND METHODOLOGY

This chapter presents the research design and the methodology that was used to execute in three phases, using quantitative as well as qualitative techniques to gather the data

4.1 RESEARCH DESIGN

It was decided that a mixed method approach would provide a more complete and comprehensive understanding of the context in which Malawi households operate and that it would minimise the possibility for interpretation biases that could be made by the researcher when relying on a single method. Mixed method research is becoming more popular in social science research as a means to achieve a broader insight as it allows for the use of both inductive and deductive reasoning, while also increasing the validity of the findings (O'Leary, 2013). Furthermore, using a multi-method approach increases the researcher's confidence, because it offers more than one way to investigate a particular situation and opportunity to verify the findings (Flick, 2015; O'Leary, 2013).

The study adopted a pragmatic approach, i.e. an explicitly value-oriented research approach. Pragmatism provides a set of assumptions about knowledge and inquiry that reinforces the mixed method approach. It distinguishes the approach from purely positivism in a quantitative approach and purely interpretivism or constructism in a qualitative approach, thus a fusion of approaches. It also provides a basis for using mixed method approach as a "third alternative" (Schoonenboom and Johnson, 2017; Denscombe, 2008:5-7; Johnson and Onwuegbuzie, 2004). Pragmatism asserts that there is a single "real world" and that individuals have their own unique interpretations of this reality. It offers inter-subjectivity that captures this duality. Pragmatists treat issues of inter-subjectivity as a key element of social life. There is an understanding that results can be very specific to a context, or that it could be more general implications that also apply to other contexts, thus the transferability of findings to other, similar contexts (Schoonenboom and Johnson, 2017; Morgan, 2007:71-72). Pragmatism emphasizes abduction, inter-subjectivity and transferability, and creates new opportunities for contemplating methodological issues in social sciences. While maintaining the distinctions between induction and deduction, subjectivity and objectivity or context and generability that a combination of qualitative and quantitative research brings, pragmatic research offers an effective alternative with emphasis on abductive-intersubjective-transferable aspects of research (Morgan, 2007:73). Abductive reasoning implies that a researcher switches between induction and deduction in a

sequential manner whereby the deductive results obtained in the quantitative approach, for example served as inputs in the inductive results that were obtained from the qualitative approach (phase 2).

Mixed method research is designed ensuring that “objectives, scope and the nature of inquiry are consistent across methods and across paradigms” (Johnson and Onwuegbuzie, 2004) and as such, it is inclusive, pluralistic and complementary (Creswell, 2014:11). Mixed method research recognizes that both quantitative and qualitative research is important and useful to supplement one another while it aims to draw from the strengths of both quantitative and qualitative methods and to minimize the weaknesses of both. It is used to link the division between quantitative and qualitative research. Mixed method research is superior to depending on mono-method research to reach conclusions (Johnson and Onwuegbuzie, 2004). By nature, mixing of methodologies is also seen as a profound form of triangulation (Olsen, 2004:3) as the emphasis is on what methods and techniques will produce the most useful findings in relation to the research problem. Mixed method research produces numerical values that are statistically analyzed, as well as narratives and dialogue that can facilitate the capturing of a range of perspectives to strengthen the research outcomes and interpretation (Flick, 2015; O’Leary, 2013). Both types of research involve safeguards in their respective inquiries to minimize bias and to increase trustworthiness of the research (Johnson and Onwuegbuzie, 2004).

In this study, data was collected sequentially, beginning with quantitative data collection followed by qualitative data collection (Creswell and Clark, 2011:40-41; Johnson and Onwuegbuzie, 2004). In the first phase of the study, quantitative data was collected using a baseline survey, while qualitative data was collected using focus group discussions and by means of key informant interviews (Creswell and Clark, 2011:5-6). The content of the inquiry was informed by the data obtained in the first phase. Hence, in this multi-method research inquiry, the quantitative and qualitative data were collected and analyzed in sequential phases to allow a more comprehensive approach to addressing the research problem than any single method could provide on its own (Creswell, 2014:4; Creswell and Clark, 2011:2,3).

4.2 METHODOLOGY

4.2.1 The research plan and research phases

This research study was exploratory and explanatory in kind (Creswell, 2014:220). Data collection entailed three phases, namely:

Phase one: Household survey, targeting women heading their households, or their proxies
Phase two: Focus group discussions with selected women who also took part in phase 1

Phase three: Key informant interviews with government district agriculture development officers (DADO), forestry officers and village leadership, as well as representatives of Non-Governmental Organizations (Concern Universal in Balaka and MEET in Phalombe) working in the two areas.

The quantitative results (phase 1) were used to inform the type of participants to be purposefully involved in the qualitative phase during the focus group discussions (phase 2), as well as the themes and the type of questions that needed to be asked during the qualitative phases, therefore during focus group discussions with participants (phase 2), as well as during key informant interviews with government officials and traditional leadership (phase 3) (Creswell, 2014:224; Creswell and Clark, 2011:6). In an explanatory sequential mixed-method, quantitative and qualitative data collections are integrated and are not interpreted independently from each other (Creswell and Clark, 2011:185). The research plan and phases of the research are summarized in Figure 4.1.

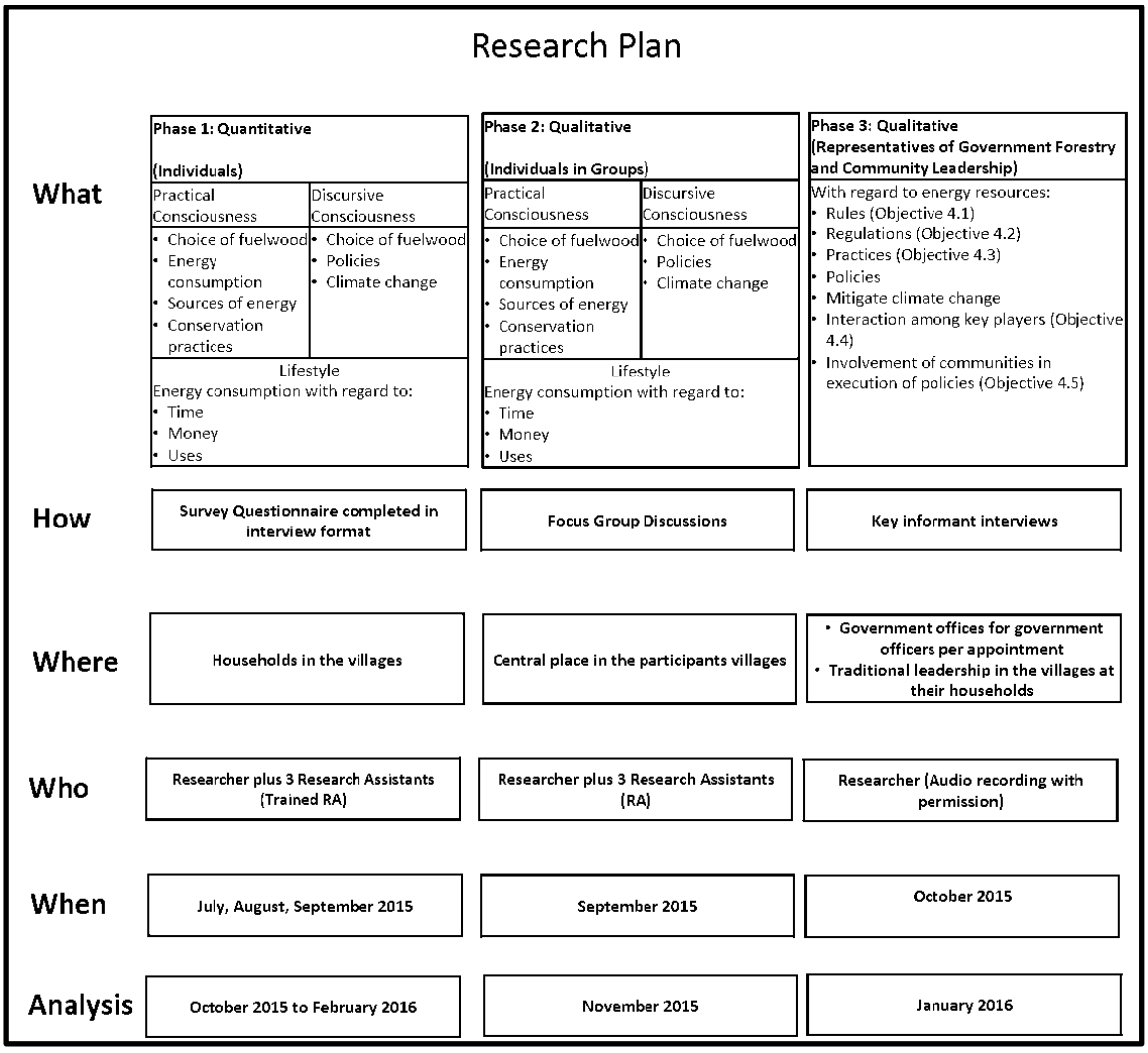

FIGURE 4.1: RESEARCH PLAN

4.2.2 The study sites (population)

Households were recruited in two rural areas in Balaka and Phalombe districts in the southern region of Malawi. These two districts are among the six districts of Malawi dubbed the “sunspot” districts because they are most hit by increasing temperatures and declining rainfall.

It is important to note that Balaka and Phalombe were already identified as climate change hotspots in Malawi as part of the larger CABMACC project (Capacity Building for Managing Climate Change in Malawi) that ran from June 2013 to June 2018. This project was funded by the Royal Norwegian government and Government of Malawi at LUANAR (Lilongwe University of Agriculture and Natural Resources), where the researcher is employed. The researcher is a beneficiary to the project as an academic member of staff at LUANAR. The project was aimed at enhancing capacity of the University (LUANAR), among other aims. The CABMACC project had identified Manjanja village in Rivirivi EPA (Extension planning area) in Balaka district and Khamula village in Kasongo EPA in Phalombe district, which explains their inclusion in this research project. Phalombe district is also prone to floods where rainfall is decreasing each year, and fuelwood is becoming scarcer as people turn to forests to augment income and offset the effects of the drought (CABMACC validation exercise report, 2013).

4.2.3 Data collection

In the mixed-method approach, data collection entails different interrelated steps, including sampling, gaining the relevant permissions, collecting-, recording and administering the data (Creswell and Clark, 2011:171).

Data collection in phase 1 (the quantitative data) was done through completion of questionnaires in interview format, which was to be augmented by the qualitative data collected during subsequent stages. This entailed focus group discussions involving purposefully selected participants (in phase 2), as well as key informant interviews involving government officers, village leadership and representatives from non-governmental organizations (Concern Universal and MEET) involved in the two areas (phase 3). The participants involved in the focus group discussions were drawn from the same participants used in the baseline survey because the whole idea was to follow up the quantitative results in addition to exploring the results more in-depth (Creswell, 2014:224). However, the sample size for the qualitative data collection was smaller (Creswell and Clark, 2011:181).

4.2.3.1 First phase: Quantitative data collected by means of a survey

4.2.3.1.1 Questionnaire development

A questionnaire was developed to investigate households’ acquisition of fuelwood; sources of fuelwood, use of resources such as human-, time- and money spent on the acquisition of

energy sources for the household. It also collected data on the influence of systems of provision on household decision-making regarding the acquisition and use of fuelwood and charcoal.

Bogdan and Biklen (1998) explain that quantitative research allows the researcher to familiarize him/ herself with the problem or concept that is investigaed, and perhaps generate hypotheses to be tested. In this paradigm: (1) the emphasis is on facts and causes of behaviour, (2) the information is presented numerically, to be quantified and summarized, (3) the mathematical process is the norm for analysing the numeric data, and (4) the final result is expressed in statistical terminologies (Charles, 1995). Thus, the questionnaire made provision for questions that attempted to discover facts and causes of households' lifestyles, and their energy consumption practices. Ordinal-type scales were used for sections B and C, based on the fact that such data was readily amenable to be coded and statistically analysed (Glesne and Peshkin, 1992).

As Winter (2000) recommends, the questionnaire attempted to fragment and delimit phenomena into measurable or common categories that could be applied to all the subjects or wider and similar situations. The questionnaire was developed to capture the varying perspectives and experiences of households by means of specific and predetermined response categories to which numbers were assigned (Patton, 2001:14). In this respect, the questionnaire provided a standardized guide based on constructs that were well defined in literature. In short, everything possible was done to ensure that the questionnaire measured what it was supposed to measure and that the predetermined procedure would work properly.

The questionnaire (Addendum A) comprised of closed-ended questions to collect numerical data and was divided into:

Section A: Demographic information
Section B: Lifestyle inquiry
Section C1: Environmental knowledge as an indication of households' discursive consciousness
Section C2: Households' practical consciousness

4.2.3.1.2 Population and sampling process

Rural communities in Malawi reside in villages or a group of villages that are part of an informal, but officially recognized administrative structure of the traditional leadership (chieftaincy) system. These organise and influence people's social, cultural, political and economic aspects, and therefore villages are important research entities (Kutengule, 2000:58). However, even with the presence of these structures, there are other structures that play an important role in village

development, such as the Village Development Committees (VDCs) in order to target beneficiaries. The VDCs emerged out of the national decentralization policy that was introduced in the 1990s to promote local governance and development management. They were framed around traditional leadership structure, and as such, they play a very important role in managing community assets such as forests (more specifically the Village Natural Resource Management Committees) (Stringer, *et al.*, 2012). In order to to facilitate proper implementation of development, the jurisdiction of each VDC in Malawi is divided into zones, each comprising 15 to 120 households. The zones constitute neighbouring villages and also serve as central place for VDC project meetings. The villages are also organized like hamlets that comprise related individuals or individuals who know each other fairly well. For this reason, the focus group discussions were held at zone level, since that is the highest level that the participants are deemed fairly able to know and discuss every household in the villages.

Following a preliminary visit to the areas, a list of households in the communities was compiled. The preliminary visit to Phalombe and Balaka showed that the two communities chosen, comprised of between 272 and 280 households respectively. The basic assumption in research is that the sample being studied should be representative of the larger population of interest from which the unit of inquiry is sampled (Lenth, 2001). In livelihoods research, a household is recommended as the basic unit of inquiry (Ellis, 2000; Seaman, Clarke, Boudreau and Holt, 2000). A household, in the Malawi context, is described as a social unit that comprises a person or group of persons generally bound by ties of kinship who live together under a single roof or within a single compound and who share the same household head and eat from the same pot (Casley and Kumar 1988:6). Variants of this description exist. For example, Kutengule (2000) describes the household in rural livelihoods of Malawi as 'banja', which includes spouses (parents), their children, other kin and even workers who live with them, since all these groups are regarded as 'children' in the Malawian kinship systems. Nevertheless, the membership and terminology related to households in Malawi are matters of practice in different socio-cultural contexts that are known by various terms, such as banja la (the family of) or khomo la (the home of) or nyumba ya (the house of). It may not necessarily comprise parents as heads, since orphans and other vulnerable children (OVC) are increasingly known to head households. It is not uncommon now to find households being categorized as 'male headed', 'female headed', 'elderly headed' or 'child headed'.

Different approaches are used to select valid samples, and sample size may not necessarily be the main issue. The goal is to design a study that captures parameters and dimensions of interest. While a sample can be too small for statistical generalization, it could still be valid for constructing useful conclusions. Often, flexible research designs yield better research results (Sandelowski, 2000; Lenth, 2001). Nevertheless, for most practical purposes, a '30-10 rule' is

recommended, which requires the sample size to be a minimum of 30 units or 10 per cent of population of interest, whichever is greater, and where a complete population of interest is known (Grinnell, 2001). For this study, the researcher employed random sampling whereby the researcher recruited the participants from the already identified villages. The researcher and the research assistants moved from door to door in search of women to be included in the survey. Every second house was considered. If the women of selected houses were not available, the adjacent house was considered (Creswell, 2014:158). Extending the minimum recommendations of the '30-10 rule', 231 households of the total of 552 households in the Phalombe and Balaka districts were sampled from lists of households in the two areas for the survey.

4.2.3.1.3 Training of the research assistants:

Prior to the data collection exercise, one-week training was provided to the research assistants (RAs) – all teachers - to orientate them in terms of the research objectives, the research design, data collection methodologies as well as the ethical issues that had to be considered (sensitivity, confidentiality etc.). The research assistants were trained so that the questionnaire would be administered consistently, each time (Creswell and Clark, 2011:179).

4.2.3.1.4 Pre-test

Part of the training of the research assistants included a pre-test of the baseline questionnaire in a nearby village. The pre-test was used to refine the questionnaire and to map out field logistics before conducting the fully-fledged baseline survey. The participants chosen for this pre-test were similar to those in the study (Creswell and Clark, 2011:189). At the same time, the researcher monitored the RAs' mode of conduct to ensure that the completion of the questionnaires was done correctly and that the assistants did not interfere with respondents' answers. The completion of a questionnaire took approximately 80 minutes to complete because the respondents needed to understand the quistions. Most of the respondents did not go further than primary school (Table 5.5, formal education level of respondents): 88.7% of respondents had only completed 10 years or less of formal schooling. The research assistants completed the questionnaires on behalf of the respondents without interfering with respondents' answers to the questions. It was important to make sure that questionnaires were usable (Creswell and Clark, 2011:189). The research assistants were trained by the researcher during which she discussed the process, the questions, problems that may be encountered and how to resolve concerns. Because the RAs were trained beforehand, all the completed questionnaires were usable and retainable. Respondents also indicated that the process was acceptable and not intimidating.

4.2.3.1.5 Data collection

The researcher and three RAs implemented the baseline survey that entailed completion of the structured questionnaire in interview format, involving responsible heads of households (mostly females) or their proxies. It was expected that the household survey phase would take three months maximum to complete (one and a half month in each of the two districts, Balaka and Phalombe). The researcher personally supervised and monitored the data collection by the RAs, but to ensure quality work, the payment of the RAs was tagged to each properly completed, checked and approved questionnaire. All three RAs worked together to complete questionnaire administration in one village before moving to another. It was expected that six questionnaires would be administered per day. All the household level interviews (completion of questionnaires) were held at respondents' houses/ homes. At the end of every day, the questionnaires were coded and entered into SPSS by the researcher and one data entry assistant who was engaged throughout the data collection period.

4.2.3.2 Second phase: Qualitative data: Focus group discussions

Realising that data gathered from the quantitative research (phase 1) might be too general and not explanatory, two qualitative phases were added to gain a clearer interpretation of the quantitative data (Flick, 2015; O'Leary, 2013). The aim of phase 2 was to triangulate the findings in the quantitative phase. The same concepts used in the quantitative approach were used in the qualitative approach to enable a comparison of the two datasets and for them to be merged (Creswell and Clark, 2011:184). In the second phase, focus group discussions were held to discuss various aspects related to fuelwood acquisition and use in households and in communities. The focus group discussions were held during November, 2015.

- *Sampling procedure*

The focus group discussions were held with individuals selected from phase 1, to provide an in-depth view and more detail about their responses in the questionnaires. The researcher worked hand in hand with the government extension workers as well as the village leadership to make sure that women who took part in discussions had taken part in the quantitative phase of the study. Care was taken to ensure that the women who took part in the focus group discussions, also took part in the survey. As a matter of fact, the village headman was requested to organize a group of women who also took part in the survey for participation in the focus group discussions. Every group comprised of 8 to12 participants and the focus group discussions were held at a central place within each village. Because the participants in these focus groups had also participated in the survey, they were familiar with the purpose of the study and had a reasonable expectation of the type of questions that would be asked (Creswell, 2014:220; Creswell and Clark 2011:185).

The researcher arranged four focus groups for discussions in the two districts: two each in Balaka and in Phalombe. The focus group discussions offered some form of triangulation to the quantitative stage, i.e. the survey.

- *The discussion procedure*

The researcher made sure that seating arrangement was comfortable in order to encourage participation. At the beginning of the discussions, permission was sought from the participants to record the discussions as the recordings were meant to ensure accuracy of the transcription of the discussions. The researcher handled the focus group discussions personally while RAs assisted with the logistics, such as seating arrangement, refreshments and recording of the discussions. The researcher prompted participants to encourage discussion of certain topics based on the outcomes of the data collected in phase 1 (see Addendum B for the interview schedule). Each focus group discussion took approximately two hours to complete. Refreshments and drinks were served to participants at the end as a token of appreciation for their participation.

- *Transcription of the recordings*

The researcher transcribed the recordings immediately after the focus group discussions, and before another focus group discussion was held (See Addenda P, Q, R, S for the transcriptions).

4.2.3.3 Third phase: Qualitative data: Key informant interviews

In the subsequent qualitative phase, key informant interviews were also conducted in the two research sites.

- *Sampling procedure*

Purposive sampling was used to select participants for the key informant interviews, i.e. a non-probability sampling procedure was used that involved a deliberate recruitment of willing participants based on the information required (Neuman, 2006). In this study, the researcher conducted eight key informant interviews at district and community levels with willing district forestry officers (DO) and the district agriculture and development officers (DADO) for the two districts. Key informant interviews were also conducted with traditional leadership (chiefs) in both districts. In Balaka, the group village headman, chief Manjanja, was interviewed. In Phalombe, chief Khamula was interviewed. Other relevant stakeholders were also consulted in these areas, namely the non-governmental organizations working in these areas: Concern Universal in Balaka, and Malawi Environmental Endowment Trust (MEET) in Phalombe. Concern Universal was involved in a project that dealt with sustainable energy use in this area

(promoting the adopting and use of energy saving cook stove, locally known as Chitetezo Mbaula) while MEET was involved in funding reforestation in Phalombe district.

- *The discussion procedure*

Four key informant interviews were conducted per district. These in-depth interviews were held to gain a deeper understanding of the situation in these districts; fuelwood energy programmes implementation processes and their impacts on poverty and reduction of vulnerability. Discussions were guided by pre-formulated prompts. The same concepts used in the quantitative approach were used in the qualitative phases in order that the two databases could be compared or merged (Creswell and Clark, 2011:184). Addenda C, D, E, F, and G present the interview schedules. Interviews took approximately two hours to complete. Yet again, discussions were recorded with permission of the participants.

- *Transcription of the recordings*

The researcher transcribed the recordings immediately after the interviews, and before conducting another interview that are presented in the respective addenda (Addenda H [MEET]; I [Concern Universal]; J [DADO Phalombe]; K [DADO representative in Balaka]; L [Chief Khamula in Phalombe]; M [Chief Manjanja in Balaka]; N [Forestry officer in Phalombe]; O [Forestry officer in Balaka].

4.3 DATA ANALYSIS

In keeping with the mixed-methods approach, data were analysed separately, i.e. quantitative data were analysed using the relevant statistical methods, while the qualitative data were analysed by means of the relevant qualitalitative methods. Before commencing with the following phase, the results of the former phase was used to inform the inquiry of the next, i.e. phase 1 results were used to direct phase 2; phases 1 and 2 were used to direct phase 3. However, quantitative and qualitative methods may involve similar steps of preparing data for analysis, exploring the data, analyzing the data, representing the analysis, interpreting the analysis and validating the data and interpretation (Creswell and Clark, 2011:203, 204).

4.3.1 Quantitative data: Phase 1

It was expected that data collection for the quantitative survey would take two to three months. Data entry was an on-going exercise during this period. Questionnaires were completed and entered into computer software SPSS (Statistical Package for Social Sciences). The data was firstly processed by means of descriptive statistics to summarise the data, e.g. demographic characteristics; to quantify the amount of resources (energy, time, money) used per household per week/ month, and to sketch a lifestyle scenario. Percentages, means and standard

deviations were calculated wherever relevant. In terms of section C of the questionnaire, exploratory factor analysis (EFA) was used to factorise the battery of items pertaining to consumers' discursive- (Question 35) and practical consciousness (Question 36), respectively. Cronbach 's Alpha coefficients were calculated to verify the internal consistency of the factors that were identified, where after means, and standard deviations and the percentage of variance in the data were calculated for discussion of the relevance of the different factors that were identified in order to address the objectives that were formulated for the study (Colman and Pulford, 2006).

4.3.2 Qualitative data: Phases 2 and 3

The data sets were transcribed verbatim by the researcher and crosschecked with the assistance of RAs. The transcriptions of the two sets of data were then subjected to content analysis, using open coding to identify important constructs: the codes were then divided into themes (Creswell and Clark, 2011:205). Open coding puts data into categories. Essentially, during open coding, the researcher read through the data several times and then created tentative labels for the chunks of data that were summarized. These words and associated concepts were then grouped into structures, followed by axial coding whereby the concept structures were broadened and concepts were refined in more detail. Axial coding puts the data back together by making connections between the categories and sub-categories (Scott and Garner, 2013:95).

The operationalization of the constructs is presented in Table 4.1 in accordance with the objectives of the study.

TABLE 4.1: OPERATIONALISATION OF CONSTRUCTS

OBJECTIVE	CONCEPTS	DIMENSIONS	SCALE ITEMS /INTERVIEW SCHEDULE	MEASUREMENT/ ANALYSIS
PHASE 1: QUANTITATIVE DATA: SURVEY				
PHASE 2: QUALITATIVE DATA: FOCUS GROUP DISCUSSIONS				
Objective 1: To investigate and discuss specific aspects of households' lifestyles specifically relating to their consumption of sources of energy for daily use, i.e.: 1.1 Types of energy used for different activities 1.2 Origin of the different energy sources and related implications 1.3 Involvement and habits of household members in the collection of fuelwood and charcoal for different activities and occasions 1.4 Time (hours) spent on collecting fuelwood and charcoal by households 1.5 Money spent on energy for the household	Lifestyle	Energy sources Origin of energy sources Human resources Time Money	Scale Items used in the World Bank Third Malawi Integrated Household survey, 2013 adapted for this study, including: walking distance; how many household members are involved in the collection of fuelwood; household expenses per week	Questionnaire: Question 11 – Question 34 Descriptive statistics including frequencies, means, standard deviations.
Objective 2: To investigate and discuss heads of households' practical consciousness about climate change and sustainable consumption practices in terms of 2.1 its manifestation in the sources of energy used for different activities, and 2.2 their demonstration of thoughtful practices when using energy sources	Practical consciousness Agents	Choice of fuelwood Energy consumption Sources of energy Conservation practices	Statements were developed to test the respondents practical consciousness manifesting in actual practices with options of: Never Sometimes Frequently Always Qualitative data:Interview schedule Self-developed prompts inspired by Bezuidenhoudt (2015) Type of energy used; why the energy is used	Questionnaire: Section C2: Question 36.1-36.25 **Descriptive statistics** including frequencies, means, standard deviations **Inferential statistics:** exploratory factor analysis Cronbach's Alpha % Variance in the data **Focus group discussions** **Content Analysis (Qualitative data)** Open coding to identify themes and relevant constructs Axial coding to organize the data

Objective 3: To explore and discuss households' and communities' discursive consciousness of climate change with regard to: 3.1 their consumption of different energy sources, 3.2 their ability to explain their choice of energy sources	Discursive Consciousness Agents	Choice of fuelwood Climate change Conservation practices Energy consumption Sources of energy	Statements were developed about climate change to test respondents' environmental knowledge as an indication of their discursive consciousness, with options of: True False Don't know Interview schedule Self-developed prompts, including items extracted from Bezuidenhoudt (2015) and Marx-Pienaar (2014) Type of energy used; why the energy is used	Questionnaire: Section C: Question 35.1 -35.12 **Descriptive statistics** including frequencies, means, standard deviations **Inferential statistics:** exploratory factor analysis Cronbach's Alpha % Variance in the data **Focus group discussions** **Content Analysis (Qualitative data)** Open coding to identify themes and relevant constructs Axial coding to organize the data
PHASE 3: QUALITATIVE DATA: KEY INFORMANT INTERVIEWS				
Objective 4: To explore and discuss the role and interaction of systems of provision (i.e. government, non-governmental organizations) in these areas in terms of households' and communities' consumption of energy sources	Systems of Provision	Rules Regulations Policies	Interview schedule Self-developed	Content analysis Open coding to identify themes and relevant constructs Axial coding to organize the data

4.4 ENHANCING THE QUALITY OF DATA

Throughout the research, effort was made to eliminate error, to increase the validity and reliability of all procedures throughout the research process thereby ensuring that the results are truthful, also not being influenced by researcher's bias. This is of utmost importance in terms of opportunity to replicate the study elsewhere later on. Honesty was also maintained throughout the research process to enhance the quality of the data and the findings (Creswell and Clark, 2011; Creswell, 2010; Mouton, 1996)

4.4.1 Phase 1: Quantitative research

During the quantitative component of the study, the researcher paid attention to issues of validity and reliability, inter alia through triangulation, as explained in the following section.

4.4.1.1 Validity

Validity is about ensuring that the research results remain consistent (Maree, 2007:37). The traditional criteria for validity are rooted in a positivist tradition, and to an extent, positivism has been defined by a systematic theory of validity. Within the positivist terminology, validity resided amongst, and was the result and culmination of other empirical conceptions such as the relevance of universal laws, evidence, objectivity, truth, actuality, deduction, reason, fact and mathematical data (Winter, 2000). Joppe (2000:1) explains that, in quantitative research, "validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit 'the bull's eye' of your research object?" Being able to fulfill the objective of the research. Researchers generally determine validity by asking a series of related questions. They would also seek answers in the research of others.

In this study, the researcher took several precautions to enhance the validity of the research. A pre-test was done in another area prior to the baseline survey to ensure that the research tool was valid, easy to complete, and understandable. This pre-test was necessary to ensure that the concepts were clear. It entailed administration of the questionnaire to 10 women in a neighbouring village. This process was useful to clarify any vagueness in terminology as well as in the instructions. Secondly, the pre-test was done to ensure that procedures for administering the questionnaire were relevant and executable. In view of the above, the researcher sought the assistance of three research assistants (RAs), who were trained teachers, during the data collection period.

4.4.1.2 Reliability

Another way of ensuring the quality of data, is to investigate the issue of repeatability of the study. Joppe (2000:1) describes reliability as the extent to which results of an investigation will be consistent over time, and be an accurate representation of the total population under study, thus indicating that a study is reliable if it can be reproduced later on using a similar methodology. The idea of replicability or repeatability of results or observations is therefore of concern. (Kirk and Miller,1986:41-42; Neuman, 2014; Creswell and Creswell, 2018**)** specify three types of reliability that relate to: the degree to which a measurement, given repeatedly, remains the same; the stability of a measurement over time; and the similarity of measurements within a given time period. Drawing from these recommendations, the researcher made sure that the methods used in this research were clear, properly planned and as replicable as possible. The foregoing sections explain the procedures used in the administration of the questionnaire. Further, the questionnaire (see Addendum A) is available for anyone who may wish to inspect it, and/ or use it in the future. The researcher ensured that the questionnaire and the procedures for administering the questionnaire are indisputable in terms of repeatability.

Triangulation was also used in this research to ensure good quality data and to enhance the validity and reliability of the findings. Mathison (1988:13) explains that "Triangulation has raised an important methodological issue in naturalistic and qualitative approaches to evaluation [in order to] control bias and establishing valid propositions because traditional scientific techniques are incompatible with this alternate epistemology." Triangulation is relevant when different sources and participants are used in the data collection process as a "cross check" of the information that is collected (Babbie, 2016; Creswell and Clark, 2011:211). The qualitative data that was gathered in phases 2 to verify the validity of the quantitative data that was generated in phase 1 while the qualitative data gathered in the phase 3 of the research, allowed the researcher to gain understanding into the system of provision. Focus group discussions were held with selected women from the community, and key informant interviews were held with traditional leaders and government officials to triangulate the quantitative data. Furthermore, government policy documents were used to understand the phenomena of fuelwood acquisition and use, and its effects on the forests and woodlands.

4.4.2 Phase 2 and 3: Qualitative research

In qualitative research, different constructs are used to indicate how potential error is attended to in the research.

4.4.2.1 Credibility/Authenticity

Credibility in qualitative research involves establishing that the results are credible or believable from the perspective of the participant in the research. This inter alia involved taking the findings

back to the participants or RAs for confirmation, congruence, validation and approval (Kumar, 2018; Kumar, 2011: 185). Triangulation of different methods within the qualitative paradigm were used to collect information: focus group discussions and key informant interviews were conducted to verify information. The subject was adequately identified and described for each phase. Cross checks were done to ensure a match between research participants' views and researcher's reconstruction and representation of them (De Vos, et al,, 2014: 419-420). However, before the focus group discussions for phase 2, discussion sessions were arranged with women in another area to evaluate the clarity of the prompts on the checklist (Creswell and Clark, 2011:189).

4.4.2.2 Transferability

The researcher made sure that the findings of the qualitative component can be transferred to another case, for example, another district by carefully selecting the districts and involving two districts in the study rather than only focusing on one. Triangulation of the various sources of data (quantitative and qualitative, also involving two districts and the actual decision makers in households) were used to improve the study's usefulness for other settings. Other researchers would therefore be able to follow and replicate the study because it is thoroughly and extensively described as recommended (De Vos *et al.,* 2014:420; Kumar, 2011:185).

4.4.2.3 Dependability

The researcher ensured that that the qualitative data was documented logically, also checking it without interfering with anything, thus presenting all the narratives exactly as they were transcribed (De Vos *et al.,* 2014: 420,421). The qualitative data anlysis allowed the researcher an understanding of the research objectives as revealed by the patterns and themes in the data (De Vos et al., 2014).

4.5 ETHICS

Ethical implications are especially relevant when human subjects are the focus of a scientific investigation as was the case with this research (Maree, 2007:306; Leedy and Ormrod, 2005:101; Welman, et al.,, 2005: 181, 201). Essentially, researchers are obliged to protect the research participants, to develop mutual trust , to promote integrity of the research, and to safeguard against misconduct and form of rudeness (Creswell, 2014: 92). Usually within the social sciences, concern mainly revolves around psychological/ emotional harm (Strydom in De Vos *et al* 2005:58). In this regard, the nature of this study did not require of any participant to endure unusual stress, embarrassment or loss of self-esteem. For example, it was made clear that if a respondent decided that they no longer wished to participate at any stage in the project, their wishes would be respected, without any negative consequences. This however, did not

occur in any of the stages. Anonymity was also preserved for all participants throughout the data collection, only using codes to specify participants' contributions during interviews (Leedy, Ormond and Johnson, 2019; Kumar, 2018; Maree, 2007:306; Welman et al., 2005:153). Following the recommendations of Creswell (2014: 96), an informed consent form was presented to legally and psychologically competent research participants with the following information:

- Identification of the researcher
- Identification of the sponsoring institution
- Identification of the purpose of the study
- Identification of the benefits for participating
- Identification of the level and type of participant involvement
- Notation of possible risks to the participants
- Guarantee of confidentially to the participant
- Assurance that the participant can withdraw at any time
- Provision of names of persons to contact if questions arise

In conforming to the participants' right to privacy, no oral or written report or publication of the findings will be presented in a manner that may lead to the identification of any particular individual, their responses or behaviour (Leedy, Ormond and Johnson, 2019; Creswell, 2014:92; Maree, 2007:307; Leedy and Ormrod, 2005:101). Complete and honest accounts of the research findings will be presented with full acknowledgment and recognition of the thoughts, ideas and other intellectual property of external parties (Leedy and Ormrod, 2005:102). The researcher obtained the necessary permission from relevant authorities and selected a neutral site for discussions to prevent any form of bias or confusion (Creswell, 2014:96). Participants were treated with respect and thanked for their willingness to participate, sharing fairly sensitive information (for example their financial situation) as well as clearly disclosing the purpose of the research (Creswell and Clark, 2011:179). The proposed research was also submitted for approval to the University of Pretoria's Ethics Committee before data collection commenced.

CHAPTER 5

RESULTS AND DISCUSSIONS

This chapter presents the demographic characteristics of the sample followed by an integration of the results obtained in the different phases of investigation, presented in accordance with the objectives of the study, and interpreted against the backdrop of existing literature

5.1 INTRODUCTION

This study employed a pragmatic worldview in the sense that it employed mixed methods of data collection. It used quantitative methods as well as qualitative methods. A survey was used to collect the quantitative data. The quantitative data pertaining to the research objectives were analysed using descriptive and inferential statistics. Specific research objectives as well as the theoretical perspective guided the presentation of the results as well as the interpretation of the findings in terms of relevant literature. The qualitative methods, including focus group discussions and key informant interviews, were conducted to add more depth and insight to the quantitative results. These methods therefore complemented and triangulated each other, specifically with regard to the Malawian households' lifestyles and energy consumption. The survey and focus group discussions targeted the rural households in the research sites, while the key informant interviews were conducted with other stakeholders who are also working closely with the issues of fuelwood and other energy sources at these sites. These stakeholders included government officers such as DADO (District Agriculture and Development Officers), and forestry officers based in the communities of both Balaka and Phalombe districts. Further to that, during the data collection, it was found that there are non-governmental organisations based in these areas to promote sustainable energy. The researcher therefore interviewed officers from these organisations as well. For Balaka, the researcher had a key informant interview with an officer from Concern Universal, which is a non-governmental organization that was working on issues of sustainable energy in that area, while an officer from MEET (Malawi Environment Endowment Trust) was interviewed for the Phalombe district. The researcher therefore used both quantitative and qualitative data to make sense of households' point of view. The key informant interviews offered further insight with specific reference to the systems of provision and support for households to embrace more sustainable energy consumption practices within the targeted geographical context of the study. In adopting a pragmatic approach, the research was conducted within the social contexts of the units of analysis (Creswell, 2009:11).

5.2 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

As an overview of the demographic characteristics of the sample, it is worth noting that in July, 2019, the Malawi population was at 19,763,839 according to the United Nations estimates, of which the largest portion is located in the southern region of the country where the research was conducted. The results that are presented, refer to the areas under study (Balaka and Phalombe) Literature indicates that different households have different energy needs (Stoppok, Jess, Freitag and Alber, 2018; Schuenemann, *et al.,* 2018; Guta, 2014) The findings of this study are typical of scenarios that are prevalent in Third World countries. Malawi is primarily rural. Balaka and Phalombe districts are rural, and households in these two districts rely on fuelwood as a primary source of their households' energy needs. As a nation, the population growth has been increasing rapidly, exerting more pressure on the natural resources (Ndovi and Miao, 2019; Komarek and Msangi, 2018). Solid fuels such as fuelwood are more accessible and more affordable to the rural communities than grid electricity that is supplied by ESCOM, despite efforts to encourage the use of electricity through the hydro power initiatives. Currently, electricity in these areas is restricted to certain, small shops simply because households cannot afford it and because most of the homes in rural areas are not suitable for the installation of electricity.

Willing respondents, principally women (as the main decision makers when it comes to energy consumption in the home), were recruited for the study. The study was conducted in two phases. During the first phase, a questionnaire was administered to women or their proxies in their respective households: a total of 251 usable questionnaires were retrieved for both districts. During the second phase, focus group discussions were conducted with groups comprising of eight to ten women who had previously taken part in the survey. The selection of the women for the focus groups was purposive. There were four focus groups in total, comprising two groups per district.

Furthermore, the researcher also held key informant interviews with government officers working in the area during the third phase of the study. For instance, the researcher had key informant interviews with district agriculture and development officers (DADO) or their representatives in the two districts. These district and agriculture development officers were based at the district headquarters. They managed different agriculture and development projects at district level. The researcher also held key informant interviews with government forestry extension officers in the two areas who work in the communities. In Malawi, government, through its decentralization programmes, has divided districts that are distinguished in terms of smaller areas where government projects are managed at grassroots level. These smaller areas are called EPAs (extension planning areas). It was important that

the researcher held key informant interviews with government forestry extension officers that are resident in the communities, at the local level, to obtain deeper insight pertaining to the extension planning areas (EPAs) in both Balaka and Phalombe. The researcher interviewed a government forestry extension officer in Rivirivi EPA in Balaka and another government forestry extension officer in Kasongo EPA in Phalombe.

Key informant interviews were also held with representatives of non-governmental organizations (Concern Universal in Balaka and MEET [Malawi Environment Endowment Trust] in Phalombe) who are working in the two areas. (Please note that Concern Universal changed its name to United Purpose in February, 2017). Key informant interviews were also held with the village leadership (chiefs) in these areas. In Balaka district, the researcher interviewed Chief Manjanja, and while in Phalombe, the researcher interviewed Chief Khamula.

These focus group discussions and key informant interviews were done to triangulate the findings of the survey as well as to provide in-depth understanding of the issues surrounding energy use and consumption in these areas in the wake of climate change. Based on the assumptions of structuration theory, it is imperative to understand both agents and structure. In this study, the households were seen as the "agents" and the government and non-governmental organisations were viewed as the "structures" that affect households' energy consumption practices in these sites. Policies formulated by the government influence the energy consumption patterns of these households. The non-governmental organisations also follow rules and regulations that are promoted and advanced by the government. These rules and resources constitute the structures that are relevant in the production of social practices surrounding the households' energy consumption behavior and practices (Spaargaren, 2003; Spaargaren and Van Vliet, 2007; Middlemiss, 2011). This particular study allowed the researcher to study the relationship and interdependence between the household and their existing social systems, i.e. interaction between agency and structure as stipulated by Anthony Giddens' structuration theory (Middlemiss, 2011). It was therefore important to understand views from both sides, i.e. agents and structure to abide with the notion of duality of structure in which the agent and structure are interdependent and intertwined, which is useful when analysing household energy consumption practices (Shove, 2003; Giddens, 1984), which was the focus of this study.

In terms of households (which represent the agent's viewpoint), demographic variables that were relevant to this study, included gender, age, level of education, marital status, household size, household income as well as current employment status. These demographic characteristics encompassed some of the most common demographic variables that are used in research. A nominal scale was used to code the data for gender, level of education,

approximate total monthly household income and population group. Simply put, a nominal scale is a hierarchy of precision on which a variable can be assessed. The variables measured, differ in terms of quality rather than quantity; further to that each variable is specifically assigned to accurately identify the items being measured (Salkind, 2012:111).

The following section presents specific demographic characteristics of the household sample that was used for the quantitative component of the study. These were households in both Balaka and Phalombe districts. The researcher and the research assistants interviewed heads of households or their proxies for the survey. The demographic characteristics presented are those of the respondents who took part in the survey and who formed the sample. Some of the respondents later on also took part in the subsequent focus group discussions.

5.2.1 Area of residence

Information regarding area of residence of the respondents is presented in Table 5.1.

TABLE 5.1: AREA OF RESIDENCE OF RESPONDENTS (N=231)

District	Frequency	Percent
Balaka	118	51.1
Phalombe	113	48.9
Total	231	100

The respresentation of respondents in the two districts was almost equal.

5.2.2 Gender

Gender is one of the most vital factors in consumer behaviour studies. In this particular case, the study included mostly females because they are largely involved in the consumption of energy at household level and were better able to share the households' experiences in this regard. Generally, women are responsible for, and involved in cooking as a practice that significantly influences energy consumption in Malawi. Women are also potential agents of change as they are considered the main agents of socialization in the home, through the upbringing of the children and providing an example that is later on imitated by the offspring in the home. Information regarding the gender of the respondents is presented in the Table 5.2.

TABLE 5.2: GENDER OF RESPONDENTS (N=231)

	Frequency	Percent
Male	6	2.6
Female	225	97.4
Total	231	100

The study targeted rural Malawian households, who were all Black. Females dominated the sample as the study intentionally targeted the decision makers in households. The men who

took part in the survey were the proxy to the females in their respective households where females were not present at the point of investigation and when the men indicated that they were willing to participate and knowledgeable about energy consumption practices in their households.

5.2.3 Age

The study did not discriminate in terms of age provided participants were knowledgeable about energy use and consumption at household level. The respondents indicated their age by responding to an open question requesting their birthdays. Eventually, respondents as young as 15 years, to others as old as 85 years took part in the survey. Age information of respondents is indicated in the Table 5.3.

TABLE 5.3: AGE DISTRIBUTION OF RESPONDENTS ACROSS THE TWO DISTRICTS (N=231)

District name	Minimum	Maximum	Mean	n	Std. Deviation
Balaka	15	85	36.9	118	15.7
Phalombe	16	81	36.6	112	15.8
Total	15	85	36.8	230	15.7

The mean age for the two districts is similar. The mean age indicates that the majority of respondents were quite experienced in the acquisition and use of energy resource as they were more than thirty years of age and were therefore, more than competent to make valid contributions to the study, despite some of the respondents being young. However, it was assumed that exposure to household practices would have given the younger respondents enough experience to contribute.

5.2.4 Marital status

Marital status as an attribute was included in the study because sometimes households are disadvantaged based on who is heading the households and whether there is support of more than one adult figure in the home. Female-headed households as well as child headed households are generally economically disadvantaged. The marital status of respondents was important in this study as it could affect the households' purchasing behaviour and disposable income. Information regarding respondents' marital status is presented in the Table 5.4.

TABLE 5.4: MARITAL STATUS OF RESPONDENTS (N=231)

Marital Status		Frequency	Percent %
Valid	Single	7	3.0
	Separated	36	15.6
	Divorced	2	0.9
	Widowed	34	14.7
	Married/Couple	150	64.9
	Missing	2	0.9
	Total	231	100

The majority of the respondents were married (64.9%), while only a few were single (3%). Marital status is important because the assumption is that a household with both spouses would have two adults jointly contribute to their household's resources, such as finding piecework and working together on the family garden. Furthermore, the assumption is that married couples could jointly assist to resolve matters related to energy needs unlike when the respondent is single, separated, or divorced and only one person has the responsibility for household income and household decisions such as choice of energy sources.

5.2.5 Education level

Consumers' level of education influences their perceptions and the ability to share information in a study of this kind. In this study, level of education was acknowledged and the questionnaire was translated from English to the local language, i.e. Chichewa that is spoken by a large portion of the population, to facilitate ease of completion of the questions. The researcher worked with a language specialist to ensure lexical equivalence whereby the English questionnaire was translated into Chichewa and back into English again. This was done to make sure that the questions were clearly understood by the repondents. This translation was also important to make sure that the Chichewa questionnaire was asking the right questions as initially intended with the English questionnaire.

It is important to note that during the one-party rule in Malawi (from 1964 to 1993), Chichewa was once the national language. Chichewa and English were the only languages used in official communications, in radio as well as print media. Chichewa is spoken by a large section of Malawians. Although Chichewa is still spoken by large section of the society, other languages *inter alia* Chitumbuka, Chiyao, Chisena, Chilhomwe, Chitonga etc. have been introduced in radio and print media after the multi-party dispensation in 1994. Due to financial and time constraints, this study only translated the questionnaire into Chichewa, as it remained the one language that all of the respondents were familiar with and which they could relate to.

The questionnaire was administered by the researcher and trained research assistants to ensure that the questionnaires would be completed thoroughly and that the responses would be usable. Literacy levels in rural areas in Malawi are generally low (UNESCO Institute of

Statistics, 2016). The respondents' formal level of education information is indicated in Table 5.5.

TABLE 5.5: FORMAL EDUCATION LEVEL OF RESPONDENTS (N=231)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Standard 8 or lower	205	88.7	88.7	88.7
	Form 2 or lower	9	3.9	3.9	92.6
	Form 4 or lower	7	3.0	3.0	95.7
	Diploma or certificate	1	0.4	0.4	96.1
	No schooling	9	3.9	3.9	100
	Total	231	100	100	

Most of the respondents who took part in this study had only reached up to Standard 8 (up to 10 years of schooling) (88.7%). Studies done elsewhere, report that education level of household members generally affects energy choice in the sense that education improves income, thereby improving access to cleaner energy sources, and affordability of alternative energy sources. Further than that, education level, also determines individuals' knowledge about energy sources. For example, in India, when the level of education of the household head was higher, the household's search for clean and efficient sources of energy improved. Generally, education level is a very important attribute in households' choice of energy for cooking in developing countries such as Malawi (Rahut, *et al.,* 2016).

5.2.6 Monthly household income

Generally, education level may be related to household income, as it is assumed that the higher the person's formal education is, the higher their occupational status and by extension, the higher their income. It is imperative to note that the study considered the joint income of the household, i.e. considering the income of all household members. It is therefore possible that the response will show a higher income despite the education level being not so high. The household incomes in these study areas included the money that they earned from casual labour, small business as well as remittances from relatives who stayed in town. The questionnaire had an open-ended question that inquired about the households' monthly income that is presented in Table 5.6.

TABLE 5.6: MONTHLY HOUSEHOLD INCOME (N=231)

District name	Minimum (MK)	Maximum (MK)	Mean (MK)
Balaka	1 000	30 000	15 500
Phalombe	500	80 000	40 250

At the time when the data was collected, the exchange rate was 42 MK (Malawi Kwacha) to 1 ZAR (South African Rand). An average monthy income of 15 500MK in Balaka equates to

approximately 516 MK per household per day, which was around R12 per day (ZAR), which is well below below 2 USD per day per person. This confirms the low income levels of the households: although the incomes in Phalombe were higher, it was nevertheless low as the number of people were not even considered in these figures. Malawi is a very poor country with 50% of its population living below 2 USD per person per day (Benfica, *et al.,* 2018; Zalengera *et al*., 2014), which is approximately R32 per day (ZAR). Poverty is therefore very rampant in Malawi. Some households have no constant source of income. Household income is an important characteristic in influencing consumer needs and wants because it is a determinant of households' lifestyles, living standards and spending power (Schiffman and Kanuk 2010:80). Information regarding respondents' employment status is presented in Table 5.7.

TABLE 5.7: EMPLOYMENT STATUS OF RESPONDENTS (N=231)

Employment status	Frequency	Percent
Employed full time	8	3.5
Employed part time	84	36.4
Own Business	52	22.5
Not employed	87	37.7
Total	231	100

Slightly over one third of the respondents were unemployed (37.7%) at the time, while a similar percentage was employed part-time (36.4%) such as being engaged in seasonal jobs, for example offering casual labour to farmers. Some of the households rely on remittances from extended families in order to survive although those remittances are usually not much because family members could also be struggling financially due to the rising cost of living in the country (Andersson, 2011). Household income is an important attribute in the householdds' choice of different sources of energy. Literature indicates that as the wealth and income of households improves, such households will stop using "dirty" sources of energy such as fuelwood and adopt more advanced and possibly cleaner energy sources such as electricity (Rahut, Behera and Ali, 2016 b).

5.2.7 Household size

The number of household members is important because the number has a bearing on the dependence ratio of the households and helps to clarify the income levels as well as the poverty levels of the households. Dependence ratio examines the number of household members who are either too young to work or too old to work against those who are within the productive age. Generally, the more dependents are present in a household, whether young or old, the rifer the poverty. In both study areas, the average number of household members was 4.6. The number of household members is important because it can help identify household energy consumption needs. For example, households with more members also need more fuelwood for cooking. According to Rahut *et al.* (2016), household size has a positive correlation on the collection of

fuelwood, because it increases labour for collection of fuelwood and increases the demand for fuelwood. Information regarding the minimum and maximum number of household members in the sample is presented in the Table 5.8.

TABLE 5.8: NUMBER OF HOUSEHOLD MEMBERS (N=231)

District name	Minimum	Maximum	Average
Balaka	2	11	6.5
Phalombe	2	11	6.5
Total	2	11	6.5

5.2.8 Household focus group sample

The groups comprised of eight to twelve women each, to ensure that the researcher was able to control the discussions and that each participant was given the opportunity to voice her opinion. The women were allowed to discuss issues related to household energy consumption as the topic at hand (Kumar, 2011:128). Thereafter, the focus group discussions were analyzed qualitatively (Creswell and Clark, 2011:71, 72), which allowed the researcher to gain deeper meaning and understanding of the topic at hand and delved into the "why" and "how" of household energy consumption practices in these two areas.

5.3 HOUSEHOLDS' LIFESTYLES (Objective 1)

Objective 1: To investigate and discuss specific aspects of households' lifestyles specifically relating to their consumption of sources of energy for daily use

Essentially, lifestyle includes how households live and embrace their daily routines. In this particular study, it may include their attitudes and practices regarding, for example, the way they cook, heat spaces and water, and how they produce light in their homes. Inevitably, cultural factors and technological development are some of the environmental factors that may affect households' energy consumption behavior. Contextually, the attitudes and beliefs within the household may also affect their consumption behavior, as well as household size, housing type, income and location (Bin and Dowlatabadi, 2005). The influencing factors could therefore be internal to the agent, or external in kind, as provided and influenced by the structures in the systems of provision (Giddens, 1984). At household level, the lifestyle practices of rural Malawi women entail that they are primarily responsible for fuelwood collection, which is overburdening in terms of their family and household responsibilities. The time used to collect fuelwood could for example rather be used for childcare, education, or for paid work (Smith, Fischer, Hallett, Homans, Smith, Abdul-Salam, Emmerling and Phimister, 2015). It was therefore important to study the lifestyle of these households in order to examine their everyday living and to check whether households (as agents) actually contemplate/ "reflexively monitor" their household

energy consumption behavior. Reflexive monitoring refer to agents' ability to monitor their routine behavior (such as household energy consumption practices) within the context and the setting that they find themselves in (Mathieu, 2009; Nye and Burgess, 2008).

The lifestyles of these households are also influenced by their practical consciousness. Practical consciousness affects the way in which routine tasks are performed, thus their habits, because of regular and continued set of practices - that in this case, affects their energy consumption behavior (Marx-Pienaar and Erasmus, 2014). In this particular study, practical consciousness was investigated in terms of the stock of knowledge that households have concerning their energy consumption (Getu and Mulinge, 2013). However, the effects of climate change could create ontological insecurity among households because encountering these effects, such as flooding, may disturb the norms of households' social activities and practices (Haugaard, 1997).

The first objective of the study was therefore to investigate and discuss aspects of households' lifestyles that specifically relate to the sources of energy that are consumed by households for daily use, in terms of types of energy used for different activities; origin of the different energy sources and related implications; involvement and habits of household members in the collection of fuelwood and charcoal that are used; time (hours) spent on collecting fuelwood and charcoal by household members, and money spent on sources of energy. The following section presents the results of the inquiry.

5.3.1 Types of energy sources used for different activities

Households' lifestyles influence, and are influenced by the type of energy sources that they use to facilitate their lives and practices in the home environment. Table 5.9 indicates the different energy sources that were identified by respondents for various activities in their homes and distinguishes energy sources that are free, and those that households have to pay for. The sources are listed alphabetically.

TABLE 5.9: ENERGY SOURCES USED IN THE TWO DISTRICTS FOR DIFFERENT ACTIVITIES

	Lighting %			Cooking %			Space heating %			Water heating %			Beer brewing %		
	B	P	Av	B	P	Av	B	P	Av	B	P	Av	B	P	Av
Energy sources that are free															
Collected fuelwood	3.4	7.8	5.6	98.2	94.8	96.5	80.8	27	53.9	94.2	40.0	67.1	0	2.6	1.3
Crop residue							12.4	52	32.2	4.8	46.0	25.4			
Grass	0	1.8	0.9												
Energy sources that are paid for															
Battery	96.2	76.2	86.2												
Candles															
Charcoal				4.4	0	2.2	8.6	0	4.3	5.8	0	2.9			
Electricity															
Gas															
Paraffin	2.6	1.8	2.2												
Purchased fuelwood			0	1.8	3.4	2.6	0	1	0.5	0	1	0.5			
Other	0	10.4	5.2				4.8	17.4	11.1	1	11.4	6.2	51.1	47.6	49.35
% of Total	51.1	48.9	50	51.3	48.7	50	51.9	48.1	50	51.1	48.9	50	51.1	48.9	50

Key: B=Balaka; P=Phalombe

Lighting: This study found that for lighting, **batteries,** an energy source that they have to pay for, is the predominant form of energy used in both districts. On average, almost 90% of the households rely on batteries for lighting. Batteries, however, can be recharged with available solar energy and do not necessarily cost that much. The results from this study correspond with other empirical research done in other parts of the sub-Saharan Africa. For example, in remote and poor areas in the sub-Saharan Africa, households spend money on dry-cell batteries that are used for powering torches that are used for lighting (Grimm, Munyehirwe, Peters and Sievert, 2017).

Cooking: For cooking purposes, collected fuelwood, which they do not pay for, is used by more than 95% households across the sample. Purchased fuelwood and charcoal is used as an exception by less than five percent of households. Dependence on fuelwood is indicative of households being trapped in poverty. Similarly, the study by Rahut *et al.* (2016) reported that 95.6% of households in Malawi use **solid fuels** for cooking, which include fuelwood, charcoal as well as crop residues. This does not discriminate the use of specific types of energy for specific end uses and therefore it is not possible to deduce conscious thought about energy consumption practices from existing literature, although recent. This investigation was specifically focused on gaining an understanding of reasons for consumers' choice of energy sources, their knowledge about climate change and their practical and discursive consciousness concerning the issue.

Use of fuelwood and other solid fuels in poorly ventilated rooms/ kitchens are a leading cause of respiratory health problems. According to the World Health Organization (WHO 2014), 4.3 million deaths that occurred in 2012 were attributed to household air pollution that was a result

of combustion of biomass and coal (Burke and Dundas, 2015; Guta, 2014). Household air pollution is associated with conditions such as stroke, ischemic heart disease, chronic obstructive pulmonary disease, respiratory infections, lung cancer and tuberculosis. Women and children are exposed daily to pollution from indoor cooking smoke. It is reported that this exposure is associated with acute respiratory illnesses, chronic obstructive lung disease, low birth weights, lung cancer and eye infections among women and children (Rahut, Behera and Ali, 2016a). Heavy reliance on fuelwood leads to increased greenhouse gas emission, deforestation, and health problems from indoor air pollution as well as reduction in capacity to mitigate climate change (Rahut, *et al.*, 2016b). Deforestation severly affects the environment in the sense that there is loss in biodiversity, soil erosion, eco-system degradation as well as global warming i.e. climate change. In addition, combustion of biomass contributes locally to outdoor pollution (particulates) and globally leads to methane, black carbon scales (Burke and Dundas, 2015).

Space heating: Major differences exist between the two districts in terms of space heating: limited use of collected fuelwood in Phalombe (less than 30% compared to more than 80% in Balaka), is due to larger deforestation in the area and the subsequent dilemma that wood is not freely available to collect any more. As indicated previously, deforestation affects the environment severely. Also, combustion of biomass contributes to local outdoor pollution (particulates) and globally leads to production of methane and black carbon scales in the air (Burke and Dundas, 2015). Instead of using fuelwood, many households in Malawi as well as households elsewhere in Sub-Saharan Africa typically also use crop residue for space heating, as they do not have to pay for it (Dasappa, 2011).

Water heating: Differences in the two districts' use of fuelwood for water heating (Balaka: 94.2% versus Phalombe: 40.0%) can be explained in the same way as for space heating, i.e. Phalombe is heavily deforested. Again, crop residues such as maize stalks, pigeon pea, and tobacco stems are also used. While, charcoal is sometimes used, it is expensive and only used as an exception by a few households. Refer to figure 5.1 below showing how a bag of charcoal is transported.

FIGURE 5.1: A BAG OF CHARCOAL

Beer brewing: Beer brewing was included in the investigation since beer brewing is generally part of people's socialization in these areas. Alternative energy sources such as empty sacks or tyres are often used for beer brewing. Therefore, use of energy sources differ for different activities, which indicate some form of thought (discursive consciousness) about which is the best or the most convenient or the easiest to access. Energy sources that are used less frequently are those that households have to pay for, such as purchased fuel wood and gas.

As shown in Table 5.9, candles are not used by these households because they have to be bought constantly and these households are mostly poor, living below the poverty line (Devereux, 2015). Table 5.6 shows that the households included in this survey earned between MK500 to MK30,000 (Balaka) and MK1000 to MK80,000 (Phalombe) per month. At an exchange rate of $1 = MK570 in October/ November, 2015 during the time of data collection, this was well below the poverty line and therefore it is understandable that households would avoid energy sources that they had to pay for. Rather, households needed this money to meet other needs such as to buy food and other basic commodities for their survival.

5.3.2 Qualitative insight pertaining to the types of energy sources used for different activities

The qualitative phase of the study allowed the researcher to gain a deeper understanding of various findings that was obtained from the quantitative analysis. As an example, a prominent

theme that emerged from the focus group discussions (in both the Balaka and Phalombe districts) was households' use of various energy sources for different daily activities in their homes. The sources of energy that were identified included fuelwood, charcoal, dry cell batteries, solar energy and crop residues, which essentially confirms the specific types of energy sources identified during the quantitative phase (survey). The focus group discussions revealed that each of these energy sources were used for specific household practices as follows:

Fuelwood was often used for cooking as exemplified in the following verbatim quote: (FG1) "*We use Nsangu trees for cooking"* Furthermore, the amount of fuelwood that was used for cooking purposes were not always considered: (FG4) *"We just cook regardless of how long it will stay on the fire…".* In some instances, fuelwood was also used for the purpose of heating bath water: (FG4*) "Others heat their water for bathing while others do not".* Some households also mentioned fuelwood as a primary source of energy for space heating: (FG1) *"We use fuelwood. We sit around the open fires".* Other practices that relied on fuelwood as a primary source of energy included brick baking, brewing beer, and lighting: (FG4) *"Blue gum trees are also used for baking/ burning bricks". (FG1) "Yes,* [we use fuelwood for] *local beer such as kachasu* [i.e. local spirit] *and masese* [i.e. opaque beer]*".* In response to the researcher's question pertaining to what they use for lighting, some participants (e.g. FG3) immediately responded *"…fuelwood"*. The aforementioned identification of fuelwood as a primary source of energy and its end uses also correspond with the findings of a study conducted by Brouwer, Hoorweg and Van Liere (1997), who administered a survey questionnaire to assess strategies used by rural households to cope with decreasing fuelwood availability in Malawi. The findings of Brouwer *et al.* (1997) concluded that Malawian households primarily used fuelwood for cooking purposes, space heating and the heating of bath water. In this particular study, during both the quantitative and qualitative phase, respondents indicated that they use fuelwood for different practices such as cooking, lighting, space heating, bath water heating, beer brewing, lighting as well as brick baking (this came out in the focus group discussion, i.e. the qualitative phase) and clearly confirmed an over-reliance of households on fuelwood for different household practices.

A second or alternative source of energy identified in the focus group discussions, was the burning of **crop residues** such as maize stalks, pigeon pea stalks, tobacco stems or sunflower stalks. During the quantitative phase, respondents indicated that they use crop residues for cooking [16.5%]; lighting [2.6%]; space heating [24.1%] and heating bath water [19.6%]. These results are substantiated by the focus group discussions during which participants indicated the following: (FG3) *"We grow sunflower and then after harvesting the seeds, we use the sunflower stalks as fuelwood".* These crop residues were burned to generate space heating: (FG1) *"We*

use maize stalks for warming up our bodies. We also use other crop residues... pigeon pea stalks, other crop residues". Crop residues are also used for cooking. (FG2) *"We use stalks from maize, pigeon peas, tobacco stems and cotton* [for cooking]*"*. In addition to the above, crop residues were burned to accomplish the task of brewing beer: (FG4) *"Others brew sweet beer* ["thobwa"] *using fuelwood obtained from the fields"*. Crop residues could then also be used for heating bath water: (FG3) *"We collect maize stalks, which we use for heating bath water"*. (FG4) "*If we need to heat water as well, we make sure that we collect more stalks"*. The aforementioned identification of crop residues as a source of energy correspond with the findings of a study done by Liu, Lucas and Shen (2007) in Tibet; Mohammed, Mokhtar, Bashir and Saidur (2012) in Ghana, as well as Guta (2014) in Ethiopia.

Charcoal also came to the fore as topic of discussion during the focus group sessions. Participants explained that charcoal is occasionally used as an alternative source of energy to accomplish day-to-day household tasks such as cooking: ([FG3] "*We use charcoal sometimes for cooking"* and for heating bath water [FG2]. Some [e.g. FG1] noted that *"….it cooks faster than fuelwood*".

The focus group discussions also provided more insight into the use of **solar energy**. For example, solar energy was deemed an acceptable source of energy for heating bath water: (FG1*) "By putting the water in the sun. Then the husbands agree to bath in such water because the water is at least warm"*. (FG2) *"We put the water in the sun".* In addition to heating bath water, solar energy is also used for lighting and powering television sets as well as charging electrical devices: (FG1) *"Solar energy is used for lighting the homes".* (FG2) *"You can also watch television using energy generated from solar panels"*. (FG1) *"Solar energy is used for charging cellphones and batteries"*.

Paraffin was mentioned as another source of energy, specifically for lighting: (FG1) *"We use paraffin lamps".*

Dry cell batteries are also at times used for lighting: (FG2) *"Others keep the torch on because of the children, especially when there is a nursing mother. Others do not keep the torches on at night when they are sleeping. Children are scared of darkness. Sometimes other parents keep the torch on in order to see crawling insects that might bite their children".*

Although the survey indicated limited use of **candles**, focus group participants referred to the use of candles, specifically in terms of lighting (FG1) *"Sometimes we use candles for lighting".*

In a survey conducted by Van Gevelt, Holzeis, Jones and Safdar (2016) among Rwandan households, the researchers found that households used paraffin lamps as well as candles, dry cell battery lamps and torches for lighting practices.

As can be gathered from the aforementioned, the focus group analysis essentially triangulated the findings of the quantitative phase in terms of the variety of energy sources used for particular household activities, but also provided deeper insight into certain aspects such as the use of solar energy to heat bath water.

5.3.3 Origin of the energy sources

This following section presents findings related to sources of the energy discussed in the preceding sections.

5.3.3.1 Fuelwood

Respondents indicated that fuelwood is a crucial source of energy for most households in both Balaka and Phalombe, as 85.7% used no other source of energy other than the fuelwood that they collect from the surrounding environment. Only 1.3% of the sample purchased all their wood, and around 2.5% purchased some wood, but less than half of what they needed. Negative aspects that are associated with fuelwood consumption, include environmental, social, and economic and public health issues. In the Sub-Saharan Africa, there is lack of access to clean energy because of extreme poverty. Dependence on fuelwood is typical of households that are trapped in poverty. In rural areas across the Sub-Saharan Africa, households devote considerable time to collect fuelwood, thereby displacing schooling and other productive activities (Burke and Dundas, 2015).

Sadly, theft is also an issue in the availability of energy as the following focus group comments indicate: (FG 2) "*Therefore, after harvest, the stalks are transferred to the households for safekeeping..... The transferring of stalks is to protect them from theft."* (FG4) *"Others steal fuelwood due to the unavailability of trees".*

Sources: Four prominent sources were indicated for wood, namely 28.4% was collected from a community woodlot; 28% collected wood from their own woodlot; 22.6% from unfarmed areas in the community and 18.9% from *kumunda* and *kudimba*, i.e. pieces of land where they grow different crops including maize that is the staple food for the country. Apart from that, they also have vegetable gardens. Households plant trees in and/ or around their gardens. Sometimes they harvest these trees for cooking. For instance, participants reported that (FG1 "*we use nsangu [faidherbia albida] trees for cooking*"; FG4 "*we use blue gum trees. These trees are from*

our fields and around our homes". Refer to figure 5.2 of an example of a woodlot in the study site:

FIGURE 5.2: A TYPICAL WOODLOT IN THE STUDY SITE

Frequency: The majority of the survey sample (57.1%) collected wood weekly, although 32.5% collected wood daily. Less than five percent collected wood less frequently, for example fortnightly (3.5%) or monthly (2.2%) and when required (4.8%). The amount collected varied from one bundle at a time (65.8%) to two bundles (16.0%). Very few collected three bundles of wood at a time (4.3%), which could be due to the number of people assisting to collect and carry the wood the distance that they have to walk to fetch the wood. Table 5.10 indicates the number of bundles of collected fuelwood that are used per month by households in the two districts.

TABLE 5.10: NUMBER OF BUNDLES OF COLLECTED FUEL WOOD

Number of bundles	Balaka		Phalombe	
	Frequency	**Percent (%)**	**Frequency**	**Percent (%)**
Two bundles	17	14.4	15	13.3
Three bundles	11	9.3	20	17.7
Four bundles	53	44.9	34	30.1
Other (incl. 5, 6,7, 8, 9, 10)	36	30.5	36	31.9
Missing	1	0.8	8	7.1
Total	118	51.1`	113	48.9

5.3.3.2 Crop residues and grass

Access to modern energy sources is a challenge for most households in the sub-Saharan Africa, and Malawi is no exception. Crop residues were used as a source of energy in both Balaka and Phalombe. Crop residues from maize, pigeon peas, cotton, tobacco etc. are used for cooking and heating. Usually, the crop residues were obtained from the households' gardens and accessible pieces of land. Households in these rural areas also indicated that they sometimes use grass for cooking and lighting. Generally, households resort to using crop residues for cooking due to lack of economic capability to acquire modern fuels such as electricity and liquefied petroleum gas (Karimu, 2015).

5.3.3.3 Batteries

Households buy dry cell batteries from the shops to use for powering torches as sources of lighting. These batteries are sold between MK50 and MK300. Because these households are poor, they have come up with ways of prolonging the use of the batteries, such as leaving them in the sun so that they can be recharged before they are disposed of. Usually the batteries are disposed of when they can no longer be recharged nor power the torches. The torches are bought from shops, but in some instances they can also be made by the younger boys in the households in order to save money.

5.3.3.4 Candles

The households reported that they are sometimes unable to afford candles for lighting in their homes. This is alluded to in section 5.3.1 whereby candles are not commonly used because households cannot afford to continuously purchase candles. It is reported that 65% of Malawians live below the poverty line (World Bank, 2018). According to the quantitative results, the households did not indicate the use of candles for lighting. They indicated that they use torch bulbs/ solar, fuelwood, paraffin, charcoal and crop residues for for the purpose. However, during the focus group discussions, the women indicated that they (FG 1) "sometimes use candles" for lighting. (FG 2): "Candles" when asked what they use for lighting apart from paraffin lamps and torches. It is important to note that the women indicated that they use candles occasionally and not all the time.

5.3.3.5 Charcoal

Charcoal is used by only a few households in these two districts because it is expensive. It is a vital source of energy that is highly commercialized in the sub-Saharan Africa (Neufeldt, *et al.,* 2015). In Malawi, charcoal is produced unsustainably by chopping down trees for the purpose.

5.3.3.6 Gas

Gas as a source of energy is intermittently available in Malawi. However, it is virtually unknown in the rural areas. The use of gas is restricted to the urban areas were vendors package and sell it to the urban middle class. Gas is considered expensive and out of reach of the rural population including the respondents in this study.

5.3.3.7 Paraffin

Paraffin is used for lighting requirements in some households in Malawi (Taulo, *et al.,* 2015; Dauenhauer, 2015). In this study, 2.6% of the households used paraffin for lighting. Paraffin is a carbon-based source of energy (Eales, *et al.,* 2017). Unfortunately, paraffin is relatively costly and is also a dirty source of energy with serious health effects such as respiratory irritation, irritation of the eyes and skin (Dauenhauer, 2015).

5.3.3.8 Electricity

Access to electricity is considered fundamental for economic development and poverty reduction by international governance and funding organizations such as World Bank and UNDP (Schafer, Kebir and Neumann, 2011). All the 231 respondents in the survey indicated that they have no electricity in their households. However, 9.1% indicated that their villages do have access to electricity provided by ESCOM (Electricity Supply Corporation of Malawi), which is supplied to small businesses in their areas, for example maize mills and grocery shops. However, the households did not have electricity because it is apparently too expensive (99.1 %). Moreover, the construction of the homes were not appropriate/ suitable for electrical wiring.

Different factors cause households not to use electricity and other modern energy fuels for cooking, *inter alia,* electricity is expensive in Sub-Saharan Africa; poverty; lack of access; as well as the erratic nature of power supply. Apart from that, low cost of fuelwood and lack of available alternatives also cause households to rather use the inferior sources of energy. Households in Sub-Saharan Africa find that fuelwood is cheaper, affordable and more easily available compared to electricity. There are abundant renewable sources of energy in different countries in Eastern and Southern Africa, such as solar, wind power, geothermal and hydropower. However, these countries have to date failed to make good use of such renewable energy sources (Ifegresan, Rampedi and Annegarn, 2016; Rahut, Behera and Ali, 2016 b). Table 5.11 indicates whether the village has access to electricity provided by ESCOM, while Table 5.12 provides reasons for not having electricity in their households.

TABLE 5.11: RESPONDENTS WHOSE VILLAGES HAVE ACCESS TO ELECTRICITY PROVIDED BY ESCOM

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	21	9.1	9.1	9.1
	No	210	90.9	90.9	100
	Total	231	100	100	

TABLE 5.12: REASONS WHY HOUSEHOLDS DO NOT HAVE ELECTRICITY

		Frequency	Percent
Valid	Connection/wiring fee unaffordable	220	95.2
	Dwelling inappropriate for connection	1	0.4
	Other	1	0.4
	Total	222	96.1
	Missing	9	3.9
	Total	231	100

5.3.4 Qualitative insight pertaining to the availability of different energy sources

From the survey results, it became apparent that very few households have access to electricity. The focus group discussions also offered an opportunity to the respondents to narrate their experiences and views on this particular topic. For example, on the issue of grid electricity, respondents commented: (FG 3) *"Because we don't have electricity in our area. If we had electricity available, we would be using it for lighting".* A topic that in fact repeatedly emerged in all the focus group discussions was the availability of energy sources. Household members explained that their choice of energy sources was mostly governed by the accessibility of specific types of energy. For example, grid electricity is unavailable in many rural areas: (FG3) *"We don't have electricity in Khamula village."* In fact, it is estimated that electricity is used by only 8% of the population, nationally. Sometimes the supply is also intermittent and very unreliable because of power outages. On the other hand, this electricity is also very expensive, therefore, unaffordable to most households (Zalengera *et al.,* 2014).

While the availability and access to ESCOM electricity remains a major concern, focus group participants also noted that although fuelwood is still available in certain areas, it is becoming scarcer. (FG 3) *"If the household is using fuelwood, it means that they have bought the fuelwood from Phalombe boma. Sometimes we do not know where the fuelwood comes from".* Literature shows that Malawi is an important case study in terms of its high rate of deforestation. Malawi is among countries in the sub-Saharan Africa where deforestation is the highest. It is estimated that the country loses 2.8% forest cover per annum. This translates into 164, 500 ha to 460,600 ha of annual average forest loss in Malawi (Mapulanga and Naito, 2018). It is because of this deforestation that some parts of Malawi experience fuelwood scarcity (Jagger and Jumbe, 2016). On the issue of fuelwood becoming scarcer, the respondents indicated: (FG 1) *"It is now difficult because we have to travel long distances. People have cleared trees from their field".* (FG 3) *"We buy from vendors from Mozambique who bring charcoal here.*

[Because…] No, we don't have enough trees". Although this statement was made by women from the Phalombe district (which is situated along the border with Mozambique), both Balaka and Phalombe are among the areas in Malawi that are highly deforested. In fact, as many as 80% of rural households in Malawi rely heavily on fuelwood (Bandyopadhyay, *et al.,* 2011). One of the reasons why Malawi is experiencing deforestation, is because of a high population growth resulting in excessive pressure being exerted on forest resources. Communities are constantly accused of clearing forests, hence leading to deforestation (Wiyo, *et al.,* 2015). Altogether, biomass scarcity in Malawi leads to significantly lower household welfare - more especially for the rural poor (Bandyopadhyay, *et al.,* 2011).

The focus group discussions also highlighted that the lack of a particular energy sources sometimes influences the use of alternative sources or a combination of energy sources for specific purposes. The following comments from focus groups are illustrative: (FG 1) *"Things are different. If fuelwood is not available, households use crop residues such as maize stalks for cooking".* (FG 4) *"The cooking will depend on the available stalks or fuelwood. For example, beans require a lot of stalks. This means that we have to monitor the fire closely in order to maintain the cooking".* (FG 4) *"……sadly the stalks do not heat up for a longer period as compared to fuelwood".* Other studies revealed similar results pertaining to the practice of combining energy sources when there is limited access and/ or availability of one particular source. Liu, *et al.* (2007) used a questionnaire to gather data about energy patterns of rural households in Tibet. They found that in rural areas in Tibet, cattle dung is used in combination with solar energy and fuelwood (55%). Mohammed, *et al.* (2012) obtained their data from analysis of FAO database of the United Nations, using secondary data collected in Ghana and found that biomass is the main renewable energy source in that country. Mohammed, *et al.* (2012), used nationwide data and a literature review on decentralized electricity generation using biomass conversion technologies. They reported that unsubsidized energy running on imported fuel was beyond reach of the rural populations. The same can be said of the rural households in Malawi as supported by the following verbatim: (FG3) *"Khamula village is far from Nyezelera. It would require people with money to apply for electricity with ESCOM to extend the power line to supply electricity to our area".*

Mohammed *et al.* (2012) further emphasized promotion of the use of renewable energy as well as the need for encouraging utilization of other types of biomass for electricity and heat supply to reduce pressure on the demand for biomass. The latter exerts increased pressure on wood obtained from forest areas. Use of renewable energy would enhance growth of natural forests thereby increasing potential to mitigate undesirable emissions. On the other hand, a literature review of Guta (2014) on household biomass energy use and energy substitution in Ethiopia concluded that 94% of households use fuelwood for cooking and combine it with crop residues

and cattle dung. This researcher found that fuelwood use declined as fuelwood became scarcer and then concluded that concerted effort was needed to compile a policy whereby rural livelihoods' living standards could be improved and afforestation be encouraged to increase biomass supply. Apparently, according to this report (Guta, 2014), households in Ethiopia consumed multiple fuels that were either complementary or substitutes depending on cultural preferences, lifestyle and intended purpose.

In this study, the focus group participants also commented that seasonal changes influence availability and use of particular energy sources as the following comments testify: (FG 3) *"Sometimes we use sacks for cooking……because fuelwood and maize stalks are not available during rainy season".* (FG 2) *"These stalks are specially used for space heating in cold season during the months of June, July and August".* (FG 3) *"Therefore, after harvesting the stalks are transferred to the households for safe keeping. The stalks have to be transferred while they are still fresh….The dry stalks are then kept at a secure place in the household. Getting them out in the rainy season".* The practice of collecting stalks is similar to what Rawat, Joshi and Joshi (2000) found in the Central Himalayas where communities were collecting fuelwood for drying as well as for future use. They found that fuelwood is mainly accumulated in the Indian Central Himalayas in the winter months of December to February when agricultural activities are minimal. This is similar to the Malawi situation in which fuelwood is piled near or within the households in the form of twigs and branches of trees. Fuelwood and crop residues are collected soon after harvesting, during the months of March to May. Refer to figure 5.3 that shows fuelwood stockpiling in the study area:

FIGURE 5.3: FUELWOOD STOCKPILING IN THE STUDY AREA

In addition to the above, the households in these two areas also seem to be making use of some simple technologies related to energy consumption. Technology (implemented by especially the younger generation) influences availability and use of particular energy sources. For example, the households talked about the use of torches for lighting their homes. Focus group participants noted the following: (FG 2*) "Paraffin is no longer available that is why we are using the torches. Adoption of new method is because paraffin is not available. This new method was taught to us by the younger generation. Children do this. If the child is away then maintenance of these bulbs becomes a problem".*

Refer to figure 5.4 below of a torch made locally by children to produce light in their homes.

FIGURE 5.4: A LOCALLY MADE TORCH USED TO PRODUCE LIGHT IN THEIR HOMES

The subsequent section explains the involvement of household members in fuelwood collection.

5.4 INVOLVEMENT OF HOUSEHOLD MEMBERS IN COLLECTING FUELWOOD AS THE MAIN SOURCE OF ENERGY

A discussion of the involvement of household members in terms of fuelwood collection also entails the time devoted to the task by different family members.

5.4.1 Time consumed by wood collection

Table 5.13 indicates the time used to collect fuelwood away from the home in both districts.

TABLE 5.13: TIME REQUIRED FOR COLLECTING FUELWOOD

Time	Frequency	Percent
Less than one hour	94	40.7
One hour	60	26.0
Two hours	52	22.5
Other specify	19	8.2
Missing	6	2.6
Total	231	100

More than 80% of the sample could collect fuelwood within two hours, although only 40.7% could do so within an hour, while close to 10% took longer. Therefore, the collection of fuelwood is a time-consuming process that can be described as wasted time in terms of family socialization and optimal use of time.

5.4.2 Households' habits concerning fuelwood collection

For this study, habits refer to the frequent role of different family members in acquiring the different energy sources, for example collecting fuelwood as well as the frequency of fuelwood collection. These habits form part of the households' practical consciousness because it guides their conventional and habitual activities such as collecting fuelwood; cooking processes as well as use of crop residues when there is a shortage of fuelwood. Usually, households simply perform these practices with little or no deliberation and therefore it forms part of their practical consciousness (Nye and Burgess, 2008; Giddens, 1984).

Involvement of household members*:* The study found that the tedious task of wood collection is performed 93.5% of the time by women who are also the nurturers in the families. Children are involved to a lesser extent (5.2%) but men's involvement is minimal. Many households in sub-Saharan Africa spend a substantial amount of time on chores such as fuelwood collection (DeGraff, Levison and Dungumaro, 2017) with evidence that the women (93.5%) in both Balaka and Phalombe were mainly involved in the time-consuming activities of fuelwood collection for their households. These households used four or more bundles of fuelwood for cooking per month (68.9%) and also used fuelwood for space heating, and to heat water for bathing. This corresponds with results from studies done elsewhere that indicated that women spend a lot of time collecting fuelwood for their households, unlike being involved in economic activities such as small business and education that could improve the quality of their lives (Scheurlen, 2015).

Another unfortunate consequence of fuelwood scarcity, is that it further increases the effort required to collect fuelwood by the same women who are also involved in the nurturing of children and who often miss out on business opportunities because they simply do not have any time left. It has also been found that households are often forced to switch to foods that they can cook faster due to the scarcity of fuelwood (Guta, 2014).

In terms of households' fuelwood collection habits, four prominent sources of fuelwood were indicated in the quantitative survey, namely: a community woodlot; their own woodlot; unfarmed areas in the community, and from *kumunda* and *kudimba.* The latter are pieces of land where they grow different crops including maize that is the staple food for the country. Apart from that, they also have vegetable gardens where they grow trees sometimes. Generally, these pieces of land are used for subsistence farming. Therefore, various sources are used to collect fuelwood from, depending on accessibility and convenience.

5.5 MONEY SPENT ON ENERGY SOURCES PER MONTH

The following section indicates how much money households spend on energy sources for their households.

5.5.1 Fuelwood

As presented in Table 5.14, households spend as much as MK5000 (ZAR 119) per month to buy fuelwood for cooking, while money is generally very limited in most rural areas in Malawi.

TABLE 5.14: MONEY SPENT ON FUELWOOD BY HOUSEHOLDS PER MONTH

District	Minimum (MK)	Maximum	Mean	N	Std. Deviation
Balaka	200	5000	1957	14	1708
Phalombe	100	5000	1423	13	1320
Total	100	5000	1700	27	1529

5.5.2 Charcoal

Table 5.15 indicates that the amount of money spent on charcoal by households in Balaka (n=25) ranged from MK500 to a maximum of MK3000 (ZAR 71) per month. Respondents in Phalombe, reported that they cannot afford to use charcoal for cooking because it is too expensive.

TABLE 5.15: AMOUNT OF MONEY SPENT ON CHARCOAL

District name	Minimum	Maximum	Mean	N	Std. Deviation
Balaka	500	3000	1420	25	785.3
Total	500	3000	1420	25	785.3

5.5.3 Qualitative insight pertaining to the affordability of energy sources

The affordability of energy sources was also a major issue that came to the fore in the focus group discussions. For example, households complained about lack of electricity in their area, which was mainly related to its affordability. This meant that the households in these villages could not afford electricity, as noted: (FG 3) *"Khamula village is far from Nyezelera. It would require people with money to apply for electricity with ESCOM to extend the power line to*

supply electricity to our area." (FG 2): *"If the electricity is supplied some households would be able to afford the electricity. It depends on individuals. It costs a lot of money…."*

Further to that, affordability of dry cell batteries, bulbs and torches also affected their consumption. The respondents indicated that they cannot afford the torches. This was supported by the following focus group comments: (FG 1) *"A torch (flashlight) costs MK1000. But it also depends on the size. It can cost from MK1000 to 1200".* (FG 4) *"MK70 to 120 for batteries. The price depends on the distributors. MK500 to 700 for the torches".* (FG 2) *"Charging a cellphone costs between MK30 and 50".* As of October 2015, when the study was conducted, ZAR1 was equivalent to MK42. (As of February, 2019, the Malawi kwacha was then being exchanged at 54 to ZAR1). Thus, affordability was problematic, even for basic necessities like torches (flashlights) for lighting. Respondents also talked about the affordability of charcoal indicating that: (FG 1) *"We do not use charcoal because of lack of money. We cannot afford charcoal….because we just do not have the money".* (FG 2) *"A bag of charcoal is sold between MK1000 and 1500. Most expensive is MK3000 during rainy season".*

In this regard, Mensha and Adu (2015), established similar results in Ghana whereby the use of different sources of energy was also an issue of affordability. They found that the higher the household income, the higher the probability of being able to afford modern and cleaner sources of energy. This was the case in urban areas; where households with higher incomes could afford modern fuels. On the other hand, in rural areas, households relied on fuelwood for cooking because supply of modern energy sources such as LPG and electricity are very problematic. These modern fuels are not easily accessible in rural areas. Similar conclusions are drawn from the study conducted by Rahut, *et al.,* (2017) in Ethiopia, Tanzania and Malawi where the researchers used data from living standard measurement study from the three countries to investigate factors that affect households' use of renewable and clean energy sources (World Bank's living standard measurement study/ LSMs): for Ethiopia, they used socioeconomic survey (ESS) 2013; for Malawi, they used data obtained from integrated household panel survey 2013; and for Tanzania, they used national panel survey that was done between 2012 and 2013.

To add to the issue of affordability, some household members also mentioned selling energy sources to generate income. These are households that have Nsangu (faidherbia albida) trees that are sold as fuelwood according to the following comments: (FG 1) "*Individuals cut down trees for sale. They need some money for different family needs*". (FG 1) *"Some households sell the tree (Nsangu [faidherbia albida]) because of domestic problems e.g. hunger".* Some households are also involved in selling charcoal as can be noted from the following focus group discussions: (FG 1) *"…they produce some charcoal from trees in other villages. Charcoal is*

produced in another area…in our area; producing charcoal does not happen a lot. But there are other particular areas where charcoal production takes place".

The following section reflects on the second objective of the study that aimed to understand households' practical consciousness associated with sustainable consumption. It was important to understand households' thought process as they consume different energy sources in the wake of climate change. The aim was to investigate households' consumption practices with regard to their choice of energy sources.

5.6 CONSUMERS' PRACTICAL CONSCIOUSNESS OF CLIMATE CHANGE AND SUSTAINABLE ENERGY CONSUMPTION PRACTICES (Objective 2)

Objective 2: To investigate and discuss heads of households' practical consciousness about climate change in terms of thoughtful energy consumption practices.

For the purpose of this study, practical consciousness about sustainable consumption practices that are highly important in the advent of climate change, refers to the knowledge concerning sustainable consumption practices that households demonstrate in their everyday energy household activities. This encompasses the tacit knowledge that actors (households) possess, thus the taken-for-granted knowledge that enables households to cope with everyday social life (Giddens, 1984). Household members are for example socialized about how to use different sources of energy, and how to cook food, not necessarily understanding why, but practically doing things "right" (showing responsible choices and conduct in the use of energy sources) because this is what they have become accustomed to doing.

5.6.1 The EFA procedure to investigate respondents' practical consciousness of sustainable consumption practices

Consumers' practical consciousness was investigated through a battery of questions (items) presented in Section C2 of the questionnaire. The relevant data were subjected to exploratory factor analysis (EFA) to distinguish pertinent factors/ dimensions of the phenomenon. The dimensions were expected to distinguish respondents' practical consciousness in its manifestation in the sources of energy used for specific activities, as well as their demonstration of thoughtful practices when using energy sources. The EFA procedure is subsequently reported after presentation of Table 5.16 that presents the EFA outcomes. The Statistical Package for Social Sciences (SPSS) was employed to perform the statistical analysis. The extraction method used, was Principal Component Analysis (PCA), with Oblimin Rotation, using Kaiser Normalization.

The respective Cronbach's Alpha values of the five factors that were extracted (0.69; 0.62; 0.53; 0.66; 0.70) could not be improved despite several attempts to manipulate the factors (reducing and increasing the number of factors between three and eight factors based on the Scree plot and an Eigen value >1). Based on the best Cronbach's Alpha values and factors that made sense, it was decided that this final outcome illustrated acceptable internal consistency within the factors (Field and Miles, 2010:583), considering the context in which the study was done, thus admitting the low educational levels of the respondents, as well as the complexity of the topic of investigation that may have contributed to the difficulty of the questions. This may have jeopardised more satisfactory reliability outcomes.

The percentage variance explained amounted to 56.31%, which is held to be an acceptable percentage in terms of explaining variance in data (Beavers, Lounsbury, Richards, Huck, Skolits and Esquivel, 2013). Standard deviations were small, indicating small fluctuation in the responses, thus strong consensus about the answers to the questions (Salkind, 2014:237-238). The EFA structure matrix is presented in Table 5.16.

TABLE 5.16: STRUCTURE MATRIX FOR CONSUMERS' PRACTICAL CONSCIOUSNESS REGARDING SUSTAINABLE HOUSEHOLD ENERGY CONSUMPTION PRACTICES

	Factor				
	1	2	3	4	5
Do you change cooking methods in order to save energy?	.778	-.010	.163	-.284	-.419
Do you shift to food that takes less time to cook in order to save energy?	.757	-.015	.194	-.153	-.205
Do you closely tend and mange fire to reduce fuelwood consumption?	.547	-.257	-.194	-.411	-.491
Do you cook fewer meals in a day in order to save energy?	.492	-.160	.259	-.483	-.297
Do you cover pots with lids when cooking?	.468	.104	-.328	.330	.159
Do you save fuelwood by extinguishing the fire when finishing cooking?	.454	.098	-.320	-.299	-.105
Do you use energy saving cook stove?	.098	.828	-.010	-.167	-.319
Do you use a three-stone fireplace for cooking?	-.253	.734	.145	-.087	-.126
Do you save charcoal by extinguishing the charcoal when finishing cooking?	.276	.495	-.136	-.196	-.484
Do you add more fuelwood to the fire than what is required for cooking?	.131	.463	-.185	.065	.153
Do you bath in cold water in order to save energy?	-.173	-.152	.711	-.237	.109
Do you heat water in the sun in order to save energy?	.031	-.022	.651	.174	.053
Do you reduce water heating in order to save energy?	.292	.026	.592	-.172	-.323
Do you switch off lamps when no one is in the room?	.347	.040	-.133	-.769	-.328
Do you switch off lamps when going to bed?	.157	.153	-.140	-.745	-.125
Do you save energy by opening window coverings to allow natural light into the house to reduce the use of artificial light?	.223	-.192	.065	-.601	-.458
Do you soak food such as beans to reduce cooking time?	-.069	.065	.212	-.498	.076
Do you chop off/cut natural trees for cooking?	.290	.305	-.098	-.082	-.835
Do you chop off/cut plantation/forest trees for cooking?	.085	-.002	.108	-.087	-.817
Do you plant trees to counter deforestation?	.207	.312	-.056	-.366	-.511
Mean	**2.58**	**2.53**	**2.49**	**2.49**	**3.13**
Standard deviation	**.57**	**.44**	**.66**	**.86**	**.54**
% Variance explained	**21.95**	**11.11**	**9.07**	**8.06**	**6.12**
Cronbach's Alpha	**.69**	**.62**	**.53**	**.66**	**.70**

The five factors were labelled in accordance with their content, namely:

Factor 1: Food preparation practices (6 items).
Factor 2: Cooking systems (4 items).
Factor 3: Water heating practices (3 items).
Factor 4: Energy saving practices (4 items).
Factor 5: Fuelwood consumption practices (3 items).

Respondents indicated their answers on a four increment Ordinal-type scale **(**Always=4; frequently=3; Sometimes=2; Never=1). For the purpose of the interpretations of the means (M) that were calculated for the respective factors, and the subsequent discussions (in 5.4.2), the following applied:

M>3.5≤4: Highly conscious
M⩾3<3.5: Fairly conscious
M≥2.5<3.5: Moderately conscious
M≥2<2.5: Weak (low) consciousness
M<2: Very weak (low) consciousness

Consumers' practical consciousness of sustainable consumption practices

Consumers' practical consciousness of sustainable consumption practices as demonstrated through the sources of energy used for different activities as well as the optimisation of

resources during use, was interpreted based on the means that were calculated for the different dimensions/ factors identified through EFA. Table 5.16 presents the results, which reveals that for factors 1, 2, 3, and 4, a moderate consciousness of sustainable practices is evident, while factor 5 suggests a manifestation of fairly (above average) conscious measures to curb wasteful practices in terms of fuelwood consumption for different activities.

Therefore, households' practices reflect a moderate consciousness of what sustainable practices imply, in terms of how they *generally prepare food* (Factor 1: cooking methods used, the amount of food cooked, covering of pots; the *cooking systems* used; Factor 2: using an energy saving stove, efforts to save charcoal after use, limiting the size of the fire; *water heating practices;* Factor 3: rather bathing in cold water and heating water in the sun in order to save energy, and a general demonstration of *energy saving practices;* Factor 4: switching off lamps when no one is in the room and when going to bed, as well as opening window coverings to allow natural light into the house to reduce the use of artificial light. Results suggest that households are fairly (above average) conscious about sustainable practices when it concerns their *fuelwood consumption practices* (Factor 5).

Therefore, consumers'/ households' practical consciousness of sustainable household practices - based on how they operate and the decisions that they make with regard to the use of energy sources in their homes - suggest some level of responsible/ sustainable behaviour, although not remarkable in demonstrating recommendable practices. Many respondents (52.8%) for example, indicated that they always switch off lamps in the room when no one is in. Further to that, 64.1% of respondents indicated that they switch off lamps when going to bed, while 30.7% indicated that they save energy by always opening window coverings to allow natural light into the house to reduce the use of artificial light. These households used crude lamps and torches that provide artificial light to their homes. These torches were made locally or bought from local traders. The torches /lamps were powered by the batteries. As many as 58% of the respondents also indicated that they closely tend and manage fires in order to reduce fuelwood consumption, while 82.7 % indicated that they never cook together in a "shared pot" to reduce individual household fuelwood consumption. In other countries, however, communities practice communal cooking whereby households cook together in one pot in order to reduce fuelwood consumption.

5.6.2 Qualitative insight pertaining to households' practical consciousness of sustainable consumption practices

From the focus group discussions, it also became apparent that households have devised several ways in which to conserve energy bearing in mind that the fuelwood is becoming scarcer. Some of the key informant interviews also offered some perspective on the issues of

energy conservation in the study areas. The conservation/ mitigating practices mentioned by household members to counter the implications of using fuelwood included (1) attempting to minimizing wastage of the fuelwood as the following comments indicate: FG2: "*We pour water over fire after cooking in order to save fuelwood so that we can use it again tomorrow*". FG3*:"We also use fuelwood sustainably by preserving its use through extinguishing the fire after cooking so that the fuelwood can be used another time".* The habit of pouring water over fire in these communities corresponds to the study by Shellie-Dessert and Hosfield (1990) in Rwanda in which fire was extinguished after cooking in an attempt to minimize wastage. Similar findings were made by Chirwa, Ham, Maphiri and Marlett (2010) in a study that was done in South Africa. In this particular study, communities were practicing energy saving techniques through the use of portable efficient fuelwood stoves. Another study by Egeru, Kateregga and Majaliwa (2014) in Uganda found that households also extinguished fire after cooking.

Some of the key informant interviews also offered some perspective on the issues of energy conservation in the study areas. Interviewees indicated that households use less fuelwood to cook. The following comment illustrate participants' attempt to minimize wastage: KII 6 *"The amount of fuelwood that a household uses on the three stone fireplace for a week, they can use the same amount of fuelwood for three weeks when they are using the Chitetezo Mbaula. It is economical. It takes longer period to finish fuelwood on the Chitetezo stove".* Refer to figure 5.5 showing a three-stone fireplace:

FIGURE 5.5: A SAUCEPAN OF BEANS COOKING ON A THREE-STONE FIREPLACE

In addition to the above, households also displayed an understanding/ knowledge pertaining to trees and the preservation of fuelwood as can be noted from the following comments: (FG1)*: "We save fuelwood in stocks in preparation for rainy season. It is possible to last the whole rainy*

season for some. But for others it is not possible. It is possible for those that have Nsangu (faidherbia albida)*".* (FG1): "*Yes we plant trees. But the fast-growing blue gum trees cannot survive here because we have a lot of termites".* (FG4): *"Other types of trees are prone to diseases infestation. Blue gum is more resistant to diseases and blue gum trees also grow faster. A lot of people plant trees. But blue gum tree is the one that grows faster".* (FG2): *"When we cut down trees we need to replace them. We need to plant more trees. Yes, we plant more trees".*

The Forestry Department and community leadership encourage households to plant woodlots in order to assist women in sourcing fuelwood as the following statements from key informants indicate: (KII 2) *"To protect these women from travelling long distances, we agreed as a village that every household must plant trees around their houses or in their field. They can then cut down one tree and use if for cooking for a considerable time, even 3 months".* (KII 6) *"But if they have their own woodlots it is very easy to access trees from such woodlots. No one will threaten them. We can only advise them to plant more trees and also take care of the remaining trees for use later on".* It is important to acknowledge that women are burdened with fuelwood collection, according to (KII 3) "*Women are usually the ones responsible for fuelwood collection at household level. This is combined with other household responsibilities such as child rearing and food sourcing, putting a strain on women's livelihood".*

Households also use crop residues for cooking as the following focus group participants noted: (FG3): *"Collecting maize stalks after harvesting is much better than cutting down trees".* These represent sustainable practices in the sense that there will be reduction in deforestation as the demand for fuelwood from the forests can be reduced (Smith, Fischer, Hallett, Homans, Smith, Abdul-Salam, Emmerling and Phimiser, 2015). Households also use crop residues for cooking as the following focus group participants noted: (FG3): *"Collecting maize stalks after harvesting is much better than cutting down trees".*

Figure 5.6 shows a woman cooking on a three-stone fireplace with crop residues (maize stalks).

FIGURE 5.6: WOMAN COOKING ON A THREE-STONE FIREPLACE USING MAIZE STALKS

They also use energy saving stoves: (FG1): *"There are a few households that use the energy saving stoves in this village". (*FG3): *"Some households have energy saving stoves, others don't. They use less fuelwood for cooking i.e. they are fuel efficient".*

In summary, the previous sections focused on household members' practical consciousness that forms part of households' routines. This depends very much on embedded knowledge of how they do things, and behavior that is generally accepted by the community. The actors are hence performing different activities without giving it much thought. Practical consciousness is based on habits that have evolved over time. Usually, the households are not fully conscious of these forms of behavior and act out of the force of habit (Marechal, 2010). It is very important to understand households' practical consciousness because their prevalent behavior affects their everyday habits and routines, which may be unsustainable. The routines and habits are part of the households' ontology, having been socialized to consume in a particular way (Gram-Hanssen, 2010). It should however be noted, that consumers' behaviour (practical consciousness) can be jeopardised by the availability of resources and is not necessarily driven by what they know, or what they understand about the phenomenon.

What they do in fact understand, and know, was investigated through consumers' *discursive consciousness* of climate change and the sustainable use of resources, which is reported in the following section.

5.7 CONSUMERS' DISCURSIVE CONSCIOUSNESS OF CLIMATE CHANGE AND THEIR ENERGY CONSUMPTION PRACTICES (OBJECTIVE 3)

Objective 3: To explore and discuss households' *discursive consciousness* of climate change with regard to their consumption of different energy sources, specifically their ability to explain their choice of energy sources.

For the purpose of this investigation, the third objective was to explore consumers' discursive consciousness about climate change, in relation to their consumption practices, which refers to consumers' ability to explain their everyday household energy choices and activities in terms of actual knowledge about this complex topic. While their practical consciousness may suggest contemplated practices, it may merely be due to habit and not necessarily understanding why alternative procedures or choices are more wasteful (or may be more conserving).

Respondents were asked to respond to a battery of items in the questionnaire to measure their knowledge and understanding of climate change and related sustainable consumption practices. This was presented in the questionnaire as Section C. Responses were limited to *True, False* or *Do not know.* Of the 12 questions, the correct responses for 11 items were "True" and for one, the correct answer was "False". In Table 5.16, the results are indicated in terms of *correct* and *incorrect* to allow a calculation of the mean score across the sample as well as for each district. Respondents were also afforded the opportunity to indicate that they did not know as this was confirmation that they admitted to not knowing the correct answer and this would provide evidence of a need for education along with the incorrect responses. In the end, respondents could have guessed the correct answer and therefore there is merit in attending to the *do not know* responses.

5.7.1 The EFA procedure to investigate respondents' discursive consciousness of climate change and sustainable consumption practices

Exploratory factor analysis (EFA) was used to distinguish pertinent components/ dimensions of consumers' discursive consciousness and to identify the items relating to each factor. The Statistical Package for Social Sciences (SPSS) was again employed to perform the factorial procedure. The results are subsequently reported after presentation of Table 5.17, that presents the EFA outcomes. The extraction method used, was Principal Component Analysis, with Oblimin Rotation, using Kaiser Normalization. A Scree plot with Eigen values >1 was used to identify the number of factors/ dimensions, attending to relationship coefficients between the factors and variables (items) that sensibly distinguished coherent content (Yong and Pearce, 2013; Babbie, 2012:484; Fricker, Kulzy and Appleget, 2012). The EFA procedure provided a three-factor extraction that was labeled according to the items contained in each factor. This

study settled on the outcomes of the EFA procedure for further analyses as it was considered appropriate for reporting on the study.

The respective Cronbach's Alpha values of the three factors that were extracted (0.63; 0.64; 0.72) illustrate acceptable internal consistency within the factors (Field and Miles, 2010:583. The percentage variance explained amounted to 35.97%, which was the best that could be reported in the context of this study, given the context in which the study was done, i.e. the low educational levels of the respondents, as well as the complexity of the topic of investigation. Further attempts to improve the factor structure did not contribute to a better outcome and the only explanation is, that the context of the study was challenging. Standard deviations were relatively small for two of the factors (Salkind, 2014:237, 238), but indicated a larger fluctuation in the responses for factor 3 that concerns a more complex topic relating to economic growth. A clarification of the factors in terms of their content is presented in Table 5.17.

TABLE 5.17 STRUCTURE MATRIX FOR CONSUMERS' DISCURSIVE CONSCIOUSNESS

	Factor		
	1	2	3
Brick baking causes de-forestation	.637	.159	-.225
The average citizen can do much to reduce climate change	.549	.112	-.337
Climate change is currently one of the most critical problems that Malawi is facing	.485	.072	-.227
Environmental pollution taking place in South Africa has an impact on Malawi	.463	.033	-.409
Tobacco curing causes deforestation	.458	.262	-.097
An increase in the Malawi population will put further strain on our natural resources	.385	.163	-.246
Climate change does not affect me personally to the same extent that it affects fellow citizens in Malawi*	.268	.080	-.168
Climate change causes dry spells	.139	.846	-.020
Climate change causes flooding	.372	.621	-.197
The economic growth of Malawi is influenced by environmental problems	.333	.017	-.752
The amount of energy used by the household has a significant impact on Malawi	.296	.149	-.678
Saving energy in our everyday living will contribute to saving our planet	.437	.048	-.611
Mean	85.78	97.67	71.47
Standard deviation (SD)	14.97	11.60	33.52
% Variance explained	21.39	8.99	5.59
Cronbach's Alpha	.63	.64	.72

* Reverse coded

The three factors were labeled in accordance with their content, namely:

Factor 1: Micro and macro factors (7 items)

Factor 2: Rainfall patterns (2 items)

Factors 3: Energy consumption and economic growth factors (3 items).

5.7.2 Consumers' discursive consciousness of sustainable consumption practices

Responses were indicated as "True", "False" or "Don't know" and therefore the means for the three factors are indicated as mean percentage correct (maximum 100), which were interpreted in the following manner:

M=≥90 Excellent
M=≥70<90 Good
M=≥55<70 Above average
M=≥45<55 Average
M=≥35<45 Below average
M=<35 Poor

Respondents' knowledge pertaining to factor 1 (*Micro an Macro factor*s influencing climate change), was very good (M = 85.78) indicating an understanding that brick baking as well as tobacco curing (using wood) causes de-forestation; that the average citizen can do much to reduce climate change; that climate change is currently one of the most critical problems that Malawi is facing; that environmental pollution taking place in South Africa has an impact on Malawi; that an increase in the Malawi's population will put further strain on our natural resources; and that climate change affects one personally to the same extent that it affects fellow citizens. The SD = 14.97 suggest that this phenomenon is not understood as well as the preceding factor that dealt with changing rainfall patterns.

The mean percentages calculated for the three factors indicate: Excellence (M = 97.67) in terms of factor 2, concerning respondents' *knowledge about the implications of rainfall patterns*, i.e. there seems a very good understanding that climate change causes dry spells and flooding. The SD = 11.60 indicates some fluctuation in respondents' knowledge, nevertheless fluctuating in a range that can be interpreted as acceptable.

The lowest mean (M = 71.4) was calculated for factor 3, *Energy consumption and economic growth factors,* although it nevertheless produced an above average score, with considerable fluctuation in responses (SD = 33.57). Indications are that many respondents do not realise that the economic growth of Malawi is influenced by environmental problems; that the amount of energy used by the household has a significant impact on the country; and that saving energy in our everyday living will contribute to saving our planet. Lack of knowledge is probably because households in these rural areas possess low education levels and find it difficult to frame their situation in a bigger context that they know little about.

Table 5.17 above presents the results per item of the discursive consciousness investigation (that reflect respondents' knowledge of the topic of investigation), indicating results in terms of *correct* and *incorrect* responses for each district.

Again, the mean percentages (maximum 100), were interpreted in the following manner, for the two districts separately:

M=≥90 Excellent
M=≥70<90 Good
M=≥55<70 Above average
M=≥45<55 Average
M=≥35<45 Below average
M=<35 Poor

Based on the percentage "correct" scores, respondents in Balaka performed somewhat better than their counterparts in Phalombe. In both instances, the averageoverall percentages for the battery of questions were relatively high, indicating that consumers' knowledge about climate change is good overall. Because the overall score does not indicate what consumers in these households are well acquainted with , it was decided that there is merit in having a glance at the responses to individual items.

TABLE 5.18 DISCURSIVE CONSCIOUSNESS/ ENVIRONMENTAL KNOWLEDGE PER DISTRICT (N=231)

	Balaka n=118			Phalombe n=113			Sample (N=231)		
	Correct	Incorrect	Don't know	Correct	Incorrect	Don't know	Correct	Incorrect	Don't know
Brick baking causes deforestation	97.5	0.8	1.7	92.0	3.5	4.4	94.7	2.2	3.1
Climate change causes dry spells	96.6	2.5	0.8	98.2	0.9	0.9	97.4	1.7	0.8
Climate change is currently one of the most critical problems that Malawi is facing	94.1	0.0	5.9	92.0	0.9	7.1	93.1	0.5	6.5
Climate change causes flooding	94.1	1.7	4.2	98.2	0.0	1.8	96.2	0.8	3
An increase in the Malawi population will put further strain on our natural resources	91.5	1.7	6.8	88.5	2.7	8.8	90.0	2.2	7.8
Tobacco curing causes deforestation	90.7	0.8	8.5	95.6	1.8	2.7	93.2	1.3	5.6
The average citizen can do much to reduce climate change	88.1	2.5	9.3	85.8	4.4	9.7	86.9	3.5	9.5
Saving energy in our everyday living will contribute to saving our planet	84.7	0.0	15.3	86.7	0.9	12.4	85.7	0. 5	13.8
Climate change does not affect me personally to the same extent that it affects fellow citizens in Malawi	77.1	20.3	2.5	42.5	46.9	10.6	59.8	33.6	6.5
The amount of energy used by the household has a significant impact on the environment	67.8	5.9	26.3	71.7	3.5	24.8	69.7	4.7	25.5
Environmental pollution taking place in South Africa has an impact on Malawi	67.8	10.2	22.0	63.7	15.9	20.4	65.7	13.1	21.2
The economic growth of Malawi is influenced by environmental problems.	56.8	11.9	31.4	54.0	11.5	34.5	55.4	11.7	32.9

Encouraging results were reported for the following items:

The vast majority of respondents (more than 90%) affirmed that brick baking causes deforestation, that climate change causes dry spells as well as flooding, and that climate change is currently one of the most critical problems that Malawi is facing, as well as that an increase in the Malawi population will put further strain on the country's natural resources.

More than 75% of the respondents in both districts confirmed that the average citizen could do more to reduce climate change, for example by saving energy, that saving energy in everyday living will contribute to saving our planet.

However, responses that evoke concern are:

While 77.1 % of respondents in Balaka said that climate change does not affect them personally to the same extent that it affects fellow citizens in Malawi, only 42.5% in Phalombe reported the same. Reasons for this discrepancy might be ascribed to greater deforestation in Palombe, and can be investigated further.

Near one out of three respondents was not aware that the amount of energy used by the household has a significant impact on the environment and that environmental pollution in South Africa also affects Malawi.

Almost half of the respondents were not aware that the economic growth of Malawi is influenced by environmental problems, which should be addressed to encourage responsible consumption behaviour.

While respondents are apparently better informed about certain topics, there are topics that they are not at all well informed about and that may jeopardise responsible consumption behaviour. While the overall score for the different dimensions of respondents' discursive consciousness (Table 5.17) was encouraging, pertinent areas of concern emerged when scrutinising individual items (Table 5.18). These issues mostly require higher cognitive reasoning, indicating that formal education and concerted effort by governmental bodies are required to inform citizens about their potential role to address a complex issue that will also influence the well-being of future generations.

5.7.3 Qualitative insight pertaining to consumers' discursive consciousness in terms of climate change and sustainable consumption practices

Deliberate effort was made to explore households' discursive consciousness related to climate change and sustainable consumption practices during the focus group discussions. The qualitative focus group discussions further extended and substantiated some of the quantitative

findings in allowing participants to narrate their experiences, views and feelings concerning the causes and consequences of climate change and more specifically, their comprehension of the consequences of deforestation. Some participants for example articulated the role of population increases and the subsequent impact on the environment: (FG4): *"There is increase in population which leads into degradation of the environment".* Such factors as population increase are well deliberated as an underlying cause for climate change (Serdeczny, Adams, Baarsch, Coumou, Robinson, Hare, Schaeffer, Perette and Reinhardt, 2016; AFIDEP, 2012). Many of the participants also observed the occurrence of irregular weather patterns and rainfall, stating: (FG2): *"This area has been affected by dry spells and heavy rainfall that comes within a short period leading to floods"*. (FG2): *"Rain used to start early in the past. In October, but these days it starts in December".* (FG4): *"The rainfall pattern has changed. The time in which rain starts has changed. This year has been the worst (2015). We had dry spells. Climate change is about change in the weather patterns. It is man-made. Seasonal changes influence the natural weather cycle*".

The key informants also echoed similar sentiments about irregular rainfall as well as floods and droughts in both the Balaka and Phalombe districts e.g. (KII 3}: *"The impact of floods on the Chisengereni River left it generally degraded. After the dry spell that followed the floods, Kasongo area was negatively affected. The effects of climate change are evident in Kasongo EPA. They had floods. They also had drought".* (KII 2): *"This year we had some floods. It comes and goes. Last year we had drought. This year we had no drought but we had flooding". KII 1 "We had floods. We also had drought".* (KII 5): *"In the past four years rainfall patterns have drastically changed and are highly inconsistent. We have times when in one year you receive a lot of rain for a short period or early cessation of rainfall. The rainfall has been erratic".* (KII 4): *"Rivirivi as an EPA has been affected by climate change e.g. late onset of rains. Rivirivi has not been spared".* Further to that, according to (KII1): *"Climate change in the area has basically affected rainfall quantities; we received a lot of rainfall within a short time (in 2014)"*. These key informants' views reinforced those expressed by women who participated in the focus group discussions. The observation of late onset of rains was also made in a study in Ethiopia whereby respondents voiced their concern about the late onset of rainy seasons (Belay, et al., 2017).

From a grassroots level, the concerns pertaining to irregular weather patterns are justified as focus group participants agreed that it contributes to low crop yields, which directly affect them: (FG2): *"We had dry spells. This means that we do not get enough rainfall and this leads to low yields".* (FG3): *"We had no rains at the beginning, and then we had lots of rains but for a short period of time leading to floods. Crops did not do well (retardation, wilting)"*. The impact of crop devastation and food shortages was also noted in some of the key informant interviews, e.g.

(KII 1) *"This area has largely been affected by food shortages emanating from the impact of excessive rainfall experienced in the previous rainfall season. These rains damaged most of the cultivated crops. Communities are experiencing problems in search of food"*. (KII): 1 *"Crops were destroyed".* (KII3): *"In the three years that I have been here, Kasongo area's total food production is consistently low compared to other surrounding areas in the district".*

Focus group participants were also able to provide specific consequences related to deforestation. To begin with, respondents voiced their concern about general environmental degradation and climate change due to deforestation. Note the following comment from a focus group participant: (FG3): *"Cutting down trees damage the environment. When we plant trees around the houses, the houses are protected from blowing winds….If trees are not cut down, they bring some fresh air. When trees are cut down, we get a lot of diseases".* Another (FG4): noted: *"Others say climate change is because of careless cutting down of trees".* Yet another (FG3): noted: *"Yes it [fuelwood] affects the environment negatively."* With regards to irregular rainfall, focus group respondents noted the following (FG2): *"Rainfall patterns are affected by cutting down of trees….. Rainfall pattern has changed……back in the day we had a lot of trees which led to good rainfall".* (FG3): *"If we cut down trees, rainfall patterns are disturbed, and this delays the onset of rains".* (FG4): *"This is because trees are decreasing due to reckless cutting down which then leads to irregular rainfall patterns. It the trees are not cut down, they help to bring some rain".* Focus group participants also noted other specific consequences related to deforestation including soil erosion (FG1): "*Nsangu* (faidherbia albida) *trees are important…because they also improve soil structure".* (FG4): *"Trees also control soil erosion".* The issue of planting trees is also highlighted in a study done by Backstrand and Lovbrand (2006) that emphasises the role of forest plantations as carbon sinks in climate change mitigation. Planting trees limit atmospheric greenhouse gases as set out in the Kyoto Protocol (UNFCCC, 2017). Another report by Kooten, Shaikh and Suchaner (2002) recommended afforestation to mitigate climate change in Canada whereby farmers were required to convert their agricultural land to forests that would then act as carbon sinks.

As can be gathered from the aforementioned verbatim quotes, that participants were able to articulate some of the causes and consequences of climate change, particularly those that impact them on a grassroots level. Beyond merely cuting the sources of energy that they use in their households, they voiced environmental concerns during the focus group discussions that extended beyond the results of the quantitative survey. This is part of the households' discursive consciousness that gives people/ households capacity to reason and rationalize their behavior. Consumers hereby reflexively monitor their consumption behavior and this affects how social practices are conducted in a particular time and space. Discursive consciousness is important in mitigating unsustainable consumption behavior. When households reason and

rationalize their consumption behavior, they reflexively monitor their own consumption behavior through their discursive consciousness (Kasperen, 2000; Giddens, 1984). According to the social practice model that was developed by Spaargaren and Van Vliet (2000), it is important to understand the main dimensions, i.e. sustainable consumption (household lifestyles) and sustainable institutes of production (system of provision). The social practice model emphasizes the crucial role of human agency as well as the critical role of social structure (system of provision) (Spaargaren, 2003). It stipulates that consumers' daily consumption behavior is a result of the continuous interdependence and interaction between the agency and structure (Spaargaren and Van Vliet, 2000). The following section discusses the investigation of the systems of provision that affect households' and communities' energy consumption. The systems of provision are part of the structure side as specified in the structuration theory (Giddens, 1984).

5.8 THE ROLE AND INTERACTION OF SYSTEMS OF PROVISION IN HOUSEHOLDS' AND COMMUNITIES' CONSUMPTION OF ENERGY SOURCES

Objective 4: To explore and discuss the role and interaction of systems of provision (i.e. government, non-governmental organizations) in the selected geographic areas in Malawi, in terms of households' and communities' consumption of energy sources

5.8.1 Energy issues

The key informant interviews were held with the village leadership (chiefs), government officials (forestry extension officers and district agriculture development officers [DADO]) as well as other role players i.e. non-governmental organizations [NGOs] that were working closely with the villages in terms of their energy needs, i.e. Concern Universal in Balaka district and Malawi Environment Endowment Trust [MEET] in Phalombe. All of the informants observed that energy issues were at a critical need for intervention in Malawi. For example, (KII 7) pointing out that: *"Fuel and energy issues are critical at the moment. It's an area that needs a lot of intervention".* and (KII 7) noting that: *"Energy is a very critical issue. We need to be looking at alternatives and support them and move up the energy ladder".* Moving up the energy ladder simply entails households moving from using inferior sources of energy such as fuelwood and charcoal, to other better alternatives such as electricity and gas (Van der Kroon, 2016; Treiber, Grimsby and Aune, 2015).

Key informants also observed households' reliance on fuelwood as source of energy, for example noting (KII 4) that: *"Energy sources that are used in Balaka district are fuelwood, charcoal and electricity. But most rural households use fuelwood".* This corresponds with the

finding in the quantitative phase in which fuelwood was indicated as the major source of household energy. According to the quantitative data, 90.9% of households in the study sites rely on fuelwood for cooking. It was observed that (KII 3) *"There is heavy reliance on Chisemphere forest as a source of fuelwood".* However, there is an increased scarcity of fuelwood in the areas, as observed by the key informants who stated that (KII 8): *"Climate change has brought about challenges to biomass fuel access because we are now talking of non-productive forests or cleared forests";* (KII 1): *"Climate change has greatly affected households in this area, e.g. where to find and collect fuelwood. With increase in population, the fixed source of fuelwood remains inadequate";* (KII 2): *"Lately households have been experiencing difficulties in sourcing fuelwood".* Similar findings were also reported elsewhere where population was identified as an important factor that contributed to increased energy demands (Ouedraogo, 2017; Karlberg, Hoff, Flores-Lopez, Goetz and Matuschke, 2015).

From the households' perspectives, government is seen to fulfill a key role in the provision of energy. During the focus group discussions, participants noted the following in terms of the supply of electricity in the surrounding areas: (FG2): *"We want the Government to help us with access to electricity energy in our villages. If electricity is supplied some households would be able to afford the electricity".* (FG2): *"Government should supply electricity to the village….the cost cannot be covered by one person".* Thus, it became clear that failure by the Government to provide affordable electricity from the national grid resulted in communities searching for alternative energy sources including fuelwood that has a negative impact on the future of natural forests and subsequent climate change.

Focus group participants realized this and called on the government to uplift communities in their search for more sustainable energy sources as is evident from the following focus group discussion comments: (FG1):*"We cut down the trees because of domestic problems. We don't have anything else to use for cooking. Government should know that we are cutting down trees because we have problems. It should then assist us. Government should assist with business ventures, providing capital as well as with job opportunities".* Similar observations were also reported in Ethiopia were government and other role players were involved in re-greening their country (Lemenih and Kassa, 2014). It is important to acknowledge the crucial role that governments can play in the reforestation and afforestation of different countries, through policy and practice and enabling environments for the success of such efforts. This is part of the system of provision (Giddens, 1984; Oeba and Larwanou, 2017).

However, the participants also urged government to take an active role in enforcing penalties stating that: (FG3): *"Government should punish individuals who are damaging the environment".* However, the communities also expect the government to provide them with some training

opportunities: (FG3): *They [government] should send extension workers to teach villages how to preserve the environment";* (FG1): *"We need to listen and practice things that [Government] agriculture extension workers teach us."*

The focus group participants noted that there is need for further government support in order to protect and restore natural resources. The following comments from focus group participants illustrate this argument: (FG4): *". . . protecting of the mountain will bring back regular rainfall patterns. It will also protect the land from soil erosion";* (FG1): *"We urge the Government to help reclaim the environment so that rainfall pattern should be restored in order to increase our yield in the fields";* (FG4): *"The Forest Department wants to have forests that have trees. The Forest Department is protecting the environment. It does not want degradation. Forest Department wants to maintain the trees in the forest. If trees are not cut down, they bring some rain. Trees also control soil erosion".* The government also plays an advisory role in the sustainable harvesting and use of fuelwood. For example, during the key informant interviews it became clear that the government is promoting planting of trees: (KII 1) *"Government has encouraged reforestation as well as discouraged charcoal burning from trees in the forest".* Further to that stating (KII 3): *"Government forest personnel guide the communities on how to harvest fuelwood from the forest e.g. communities are usually advised to harvest dry branches with the use of hooks to pull down the branches";* (KII 4): *"The role of this office is ensuring that the use of fuelwood is done sustainably e.g. when an individual cuts down a tree, they are supposed to plant ten trees".*

5.8.1.1 Conservation practices by households, larger community, government and other role players

This issue relates to Objective 4 that aimed at investigating and discussing existing rules and practices on the mitigation of climate change as propagated by the government through district forestry management and local leadership.

Data that was derived from the focus group discussions that were held with the rural women in both districts at household level clearly indicated that households have to some degree devised ways in which to conserve energy bearing in mind that the fuelwood is becoming scarcer. Similar findings were made by Chirwa, *et al.,* (2010) in a study that was done in South Africa. In this particular study, communities were practising energy saving techniques through the use of portable efficient fuelwood stoves. Another study by Egeru*, et al.,* (2014) in Uganda found that households also extinguished fires after cooking.

On the other hand, the key informant interviews also offered some perspective on the issues of energy conservation in the study areas. As pointed out previously, the key informant interviews

were held with the village leadership (chiefs), government officials (forestry extension officers and district agriculture development officers [DADO]), as well as other role players i.e. non-governmental organizations [NGOs] that were working closely with the villages in terms of energy i.e. Concern Universal in Balaka district and Malawi Environment Endowment Trust [MEET] in Phalombe.

During the key informant interviews, interviewees also indicated that households use less fuelwood to cook. The following focus group comment is illustrative of the participants' attempt to minimize wastage in this study: (KII 6): *"The amount of fuelwood that a household uses on the three stone fireplace for a week, they can use the same amount of fuelwood for three weeks when they are using the Chitetezo Mbaula. It is economical. It takes longer period to finish fuelwood on the Chitetezo stove"*; (KII 8): *"The lasting contribution or change is the mindset of energy efficiency of wanting to use less energy to achieve the same results inter alia cook the same food but with less energy".*

From the key informant interviews it became apparent that government plays an advisory role to support the community. This is done through the forestry department, for example, the forest extension workers emphasized the importance of preserving natural resources as noted (KII 6): *"Our job is to offer advice to households to take care of natural resources; to teach households how they can plant trees, importance of natural resources to their well-being. That's what we do*"; (KII 6): *"We [government forestry department] also hold meetings where we advise households about the importance of taking care of the environment and natural resources".* The government, through its department of forestry, provides an advisory role in emphasizing the importance of preserving natural resources, also offering guidance on sustainable harvesting and use of fuelwood.

Households also displayed an understanding/ knowledge pertaining to trees and the preservation of fuelwood as can be noted: (FG1)*:"We save fuelwood in stocks in preparation for rainy season. It is possible to last the whole rainy season for some. But for others it is not possible. It is possible for those that have Nsangu* (faidherbia albida)*".* (Refer to figure 5.4 of fuelwood stock piling in the study area); (FG1): "*Yes, we plant trees. But the fast-growing blue gum trees cannot survive here because we have a lot of termites";* (FG4): *"Other types of trees are prone to diseases infestation. Blue gum is more resistant to diseases and blue gum trees also grow faster. A lot of people plant trees. But blue gum tree is the one that grows faster";* (FG2): *"When we cut down trees we need to replace them. We need to plant more trees. Yes, we plant more trees".* Further, focus group participants admit that The Forestry Department encourages households to plant woodlots in order to assist women in sourcing fuelwood as stated: (KII 2): *"To protect these women from travelling long distances, we agreed as a village*

that every household must plant trees around their houses or in their field. They can then cut down one tree and use if for cooking for a considerable time, even 3 months"; (KII 6): *"But if they have their own woodlots it is very easy to access trees from such woodlots. No one will threaten them. We can only advise them to plant more trees and also take care of the remaining trees for use later on"* There was recognition that women are burdened with fuelwood collection: (KII 3): "*Women are usually the ones responsible for fuelwood collection at household level. This is combined with other household responsibilities such as child rearing and food sourcing, putting a strain on women's livelihood".*

5.8.1.2 Efforts by communities, government and other stakeholders/ role players to mitigate climate change

There is intervention on community level to mitigate the effects of climate change. For example, the community is involved in planting trees, as the following comments from focus group discussions indicate: (FG 2): *"The whole village is responsible for planting trees. Both male and female";* (FG 3): *"Ourselves as owners of the environment, we need to protect the environment. We are supposed to take part in managing the environment, e.g. taking part in caring of trees. We have to be planting more trees and also make sure that everyone protects the environment";* (FG3): *"We have bought 150 trees and we have planted blue gum trees…in woodlots around the homesteads. Acting as fences around the homes. We also plant some in our fields";* (FG4): *"As a coping strategy we started planting our own trees in woodlots for fuelwood".*

Further to that, enforcement of guidelines, regulations and penalties for cutting trees in protected areas exist, as participants of focus group discussions noted: (FG1): *"There is a committee that takes care of this forest who deal with such people. No one can cut trees down from the forest anyhow. The individual seeks permission first from the committee. For example, when a house has collapsed, only then are individuals allowed to cut down some trees. They seek permission for trees to reconstruct their houses";* (FG3): *"There was an establishment of an organization (committee). The organization was called "chilimuthaka" literally meaning "what is in the soil". Other committees within the village also took part. The mountain had lost most of its natural trees. Then the community established a special committee to protect the mountain to prevent the total deforestation of the hill. People had cut down the trees. There was also no problem in the establishment of the committee because it was there to rejuvenate the mountain. The mountain had lost its trees. The committee was encouraging reforestation";* (FG4): *An offender is sent to the village headman where he is charged a fine".* During the key informant interviews, it also became clear that there were forest management committees: (KII 4): *"In the communities we have natural resource management committees at village level. They have their own bye-laws; they protect the indigenous trees";* (KII 3): *"Communities surrounding the*

hills are generally supportive in the sense that despite the fact that the project ended last year in 2014, the communities continue to look after the forest…. They also have committees that ensure that people do not cut down tree in the forest anyhow". They monitor and protect the forests as the following comments indicate: (KII 3): *"There is a main committee that governs the management of the forests. There are also smaller sub-sections of that committee. These sub-sections vary in purpose. The purpose of these sub-sections varies from managing firebreaks to providing regulations for would be intruders, to monitoring the forests, to replanting exercises where necessary. Some sub-committees provide manure for the woodlots raised in these communities".*

These findings concur with the findings of Cooke, Kohlin and Hyde (2008) who reported that forest management committees promote reforestation and manage forests for communities. That study also found that local forest committees significantly reduce collection of fuelwood from communal forests. Other studies such as the one by Edmonds (2002) that was conducted in Nepal, and the study of Bray, *et al.* (2003) that was conducted in Mexico, observed that the activities of forest management committees were beneficial to the communities as they are the ones who can legally get timber and other non-timber forest products from the forests.

There were also communities-based initiatives supported by government through the provision of seedlings/ trees. Focus group participants noted the following about these initiatives: (FG4): *"[government] agriculture extension workers provide us with seedlings of different trees that we can plant";* (FG4): *"Apart from that they [government/ agricultural extension workers] must also provide seeds for planting…."* The government also provides information and training to the community, as was noted from the following comments from focus group discussion: (FG4): *"Committee members and individuals from the Government must visit villages and encourage individuals to take good care of the environment…."* ; (FG2): *"[Government] agriculture extension workers teach the community how to manage the trees"*; (FG4):*"When the environment is protected, the government appreciates. They show their gratitude by providing us with seminars so that they can teach us more and better ways of preserving the environment".*

Key informants also mentioned joint ventures in terms of planting trees and establishing tree nurseries. They noted the following about these ventures: (KII 1}: *"In the 1980s President Dr Hastings Kamuzu Banda brought about tree planting campaigns, with tree species such as blue gum"; "As I pointed out earlier, the forestry department supplies new tree species to the community";* (KII 4): *"Ourselves in collaboration with the department of forestry. Forestry department supplies seeds and seedlings. We encourage the establishment of tree nurseries at community level. As of now, there are 300 nurseries established in the whole district";* (KII 3}:

“We work closely with government forestry personnel in order to ensure an increase in the number of tree species available in the forests. Apart from that, we also encourage community members to plant trees of their choice such as fruit trees. The main aim is to encourage tree planting”; (KII 8): *“The village was supposed to construct nursery shelter and also provide labour for pot filling, watering and general nursery work till completion of the project”.*

As noted earlier, the communities’ forest management committees, also enforce of regulations and penalties for cutting tree in protected areas. The following comments by focus group discussion members testify to that: (FG3): *"When you are caught cutting down trees in the mountain you answer a case against you. The mountain is protected. There is a committee set aside to manage the forest in the mountain. You start with the committee and then village headman; finally, you are taken to court";* (FG4): *"The mountain is now a protected area. It is protected by the forestry department. If anyone is caught cutting down trees, they are issued a fine or are answerable to a court case. There is a committee"; “We are the ones who drafted these rules and regulations. We collectively came up with rules and regulations concerning cutting down of trees from the forest on the mountain".* Because of these committees, the communities take good care of the forests in their villages: (KII 3): *”They [communities] only cut down trees only when it is for important purposes, usually they prune the trees. Communities have not reverted to the wanton cutting down of trees which shows that they appreciate afforestation and also shows how much the communities value these forests”.* There are good relationships that foster cooperation on reforestation between the community and government, plus the other stakeholders: (KII 8): *“We were working with government. We were using government extension workers. The partnership was with the district council locally and development sectors (forestry, community)”;* (KII 6): *“We have a good relationship between us because we are not here to confiscate things from people but to change their mindset; to let them know that cutting down trees anyhow is bad. It is not helpful. Little by little things are changing. At first, there were no cooperating, slowly they understand the importance of taking care of the environment and natural resources”.* There is collective formulation of regulations and endorsement of laws to protect forests by the communities and forestry personnel: (KII 2): *“The village headman, committee and forestry department discuss issues concerning governance of the forest. We collectively formulate the rules and regulations”;* (KII 2): *“The community is involved. The rules and regulations are formulated by the chief, committee and forestry department. The community is involved; they endorse the rules and regulations”;* (KII 5): *“Before forestry officials start working in the communities, chiefs communicate with their community members. Chiefs also promote cooperation between community members and forestry officials”. “A very healthy relationship exists between the office and the communities and the chiefs. We work hand in hand with the chief in selecting committee members”.*

The focus group participants noted that there is need for further government support in order to protect and restore natural resources. The following comments from focus group participants were made: (FG4): *". . . protecting of the mountain will bring back regular rainfall patterns. It will also protect the land from soil erosion";* (FG1): *"We urge the Government to help reclaim the environment so that rainfall pattern should be restored in order to increase our yield in the fields"; (*FG4): *"The Forest Department wants to have forests that have trees. The Forest Department is protecting the environment. It does not want degradation. Forest Department wants to maintain the trees in the forest. If trees are not cut down, they bring some rain. Trees also control soil erosion".* The government also provides advisory role in the sustainable harvesting and use of fuelwood. For example, during the key informant interviews it became clear that the government is promoting planting of trees: (KII 1) *"Government has encouraged reforestation as well as discouraged charcoal burning from trees in the forest".* Further to that (KII 3): *"Government forest personnel guide the communities on how to harvest fuelwood from the forest, e.g. communities are usually advised to harvest dry branches with the use of hooks to pull down the branches";* (KII 4): *"The role of this office is ensuring that the use of fuelwood is done sustainably, e.g. when an individual cuts down a tree, they are supposed to plant ten trees".*

Apart from this, the discussions also examined the supply of appropriate energy as was noted from the following comments: (FG2): *"We want the Government to help us with access to electricity energy in our villages. If electricity is supplied some households would be able to afford the electricity";* (FG2): *"Government should supply electricity to the village….the cost cannot be covered by one person".* Thus, it became clear that failure by the Government to provide affordable electricity from the national grid resulted in communities searching for alternative energy sources including fuelwood whose attendant negative impact include deforestation and subsequent climate change. Focus group participants realized this and called on the government uplift communities in their search for more sustainable energy sources as can be witnessed from the following focus group discussion comments: (FG1):*"We cut down the trees because of domestic problems. We don't have anything else to use for cooking. Government should know that we are cutting down trees because we have problems. It should then assist us. Government should assist with business ventures, providing capital as well as with job opportunities".*

However, the participants also urged government to take an active role in enforcing penalties: (FG3): *"Government should punish individuals who are damaging the environment".* The communities also expect the government to provide them with some training opportunities: (FG3): *They [government] should send extension workers to teach villages how to preserve the*

environment"; (FG1): *"We need to listen and practice things that [Government] agriculture extension workers teach us."*

Discursively, focus group participants seemed to grasp and understand the negative impact of environmental degradation, including deforestation on the environment. In particular, participants spoke of soil erosion as another negative impact on their livelihoods. The mention of deforestation leading to soil erosion is similar to a study by Kumar and Sharma (2009), that was done in the Himalayas, and in which they reported that over dependence on fuelwood leads to deforestation, which eventually leads to soil erosion.

5.8.1.3 Training and promoting the use of Chitetezo Mbaula (energy saving stoves)

The focus group discussions also mentioned other initiatives by other role players who are involved in the supply of energy saving stoves. For example: (FG1): *"Concern Universal wanted the households to use less fuelwood when cooking….we use less fuelwood when using these stoves* (Chitetezo Mbaula, refer to figure 5.7 below). Chitetezo Mbaula is a simple clay cook stove that is used for burning solid fuels in order to reduce household exposure to air pollution by burning fuel more efficiently than an open three stone fire place thereby reducing fuel consumption and producing fewer combustion products (Jary, Kachidiku, Banda, Kapanga, Doyle, Banda, Fox, Gordon and Mortimer, 2014). (FG1): *"The project started because of high levels of environmental degradation in this area".* However, the discussions noted some problems related to the project. In response to a question on the fire curing of energy saving stoves, focus group discussants noted: (FG1): *"Everyone involved in the venture cuts down trees from their field".*

The key informants triangulated the sentiments of the focus group discussions about the training and promotion of Chitetezo Mbaula. The following indicate: (KII 4): *"Concern Universal started working in the area in 2009. They are still here up to date. Concern Universal has trained communities about these cook stoves. Currently, Concern Universal has 72 clusters in which they have promoters for these stoves".* KII 8 *"But we also brought expertise and training course".* (KII 2): *"We [community] work with Concern Universal. They taught us how to use energy saving stoves (Chitetezo Mbaula). The stoves require only three pieces of fuelwood".* Essentially, the community at large realizes the need for sustainable consumption, the following verbatim indicates: (KII 8): *"The lasting contribution or change is the mindset of energy efficiency of wanting to use less energy to achieve the same results inter alia cook the same food but with less energy".*

FIGURE 5.7: CHITETEZO MBAULA

5.8.1.4 Collective reforestation efforts

Government plays an advisory role to support communities in reforestation efforts. This fosters cooperation on reforestation among the government, community and forestry department. Further to that, there is collective formulation of regulation and endorsement of laws to protect forest in the area. The following were shared: (KII 1): *"The forest department lays down rules on how to protect the forest on the hill"; (*KII 2): *"Yes, we do. The village headman, committee and forestry department discuss issues concerning the governance of the forest. We collectively formulate rules and regulations";* (KII 2): *"The community is involved. The rules and regulations are formulated by the chief, committee and forestry department. The community is involved; they endorse the rules and regulations";* (KII 4): *"We encourage the communities to make bye-laws in collaboration with the forestry department. Yes, we did that. At community level they have the mandate to do that";* (KII 6): *"As forestry department, we do not make bye-laws on our own to protect the forest or natural resources. But we tell the committee or the village headman to come up with the bye-laws".*

From this, it is evident that that there are commendable relationships that foster cooperation on reforestation among the different role players, i.e. the system of provision (government) and the actors (households). The following statements are an indication of this: (KII 1): *"We have a good relationship between the village headman and the villagers and the forestry department";* (KII 6): *"We have a good relationship between us because we are not here to confiscate things from the people but to change their mindset; to let them know that cutting down trees anyhow is bad. It is*

not helpful. Little by little things are changing. At first, they were not cooperating; slowly they understand the importance of taking care of the environment and natural resources".

There is joint enforcement of laws and penalties for unauthorized cutting of trees among the government, communities and forestry department at local level. (KII 2): *"All cases come to me. The offender is asked to pay a fine as punishment. This fine, can be in a form of a goat or chickens. The village knows what it means when they are told to pay a cow or a goat. Usually, they are asked to bring chickens. For example, MK3000 means three chickens".* (KII 3): *"If an individual is caught cutting down trees without permission, they are punished accordingly. However, there are instances in which corporal punishment is used. Generally, people are aware of regulations of the how the forest is managed and protected"; (*KII 6): *"Not cutting down trees any how; if one is found cutting down trees, they are brought to the committee and village headman. They are asked to pay a fine. The money goes to the committee. It is used for different developments within the village"*; (KII 3}: *"Yes, there are links. For instance, when an issue arises involving the forest and a community member, the committee does not have authority to punish the community member. The issue is handed over to the village headman and village development committee who then impose punishment on the offender".*

5.8.1.5 Other role players working in Balaka and Phalombe districts on energy issues

There exist systems of provision in these areas that affect households' energy consumption. For instance, the government, through its agricultural extension workers, provides extension services to these areas. There are also other stake holders operating n these areas, namely. Concern Universal in Balaka and Malawi Environment Endowment Trust (MEET) in Phalombe. These non-governmental organizations cooperate with government agricultural extension workers in the promotion of energy saving technologies i.e. Chitetezo Mbaula.

Concern Universal is a non-governmental organization that was working in Balaka district in T/A Msamala area. This study took place in Manjanja village, which is part of T/A Msamala. They managed a project that was called the Msamala sustainable energy project. Concern universal was promoting the use of clay stoves, locally known as Chitetezo mbaula. Concern Universal was working predominately with women to produce and market these stoves as part of the Msamala sustainable energy programme in Balaka (O'Shaughnessy, *et al., 2013). Concern* Universal is involved in supporting efforts in the production and sale of Chitetezo mbaula as the following key informants noted: (KII8): *". . . Concern Universal mobilized a group of individuals to go into production of energy saving stoves. They sold the stoves at village level. "But for the stove production, the village had to have access to good quality clay soil. Manjanja had good quality clay for the production of stoves".* (KII6): *"We have energy saving stoves in this village. They are made here. Other people buy from this village".*

Concern Universal also provided supplemental materials for the stove projects: (KII8): *"They bought bricks, stones and sand for the stove kiln and construction for the shelter. There was community mobilization. The project supplied iron sheets and other things that were bought from the shops;* (KII8): *"Concern Universal's role was to provide materials such as wheelbarrows, rakes, nursery tools such as polythene tubes and also provide supplementary seeds".*

Concern Universal also provided financial assistance for those who could not afford to buy the stoves: (KII 8): *"Concern Universal talked to donors that there are some 10% of households who fail to buy the stoves on their own";* (KII4): *"They [Concern Universal] have some beneficiaries of social cash transfer. These beneficiaries receive cook stoves free of charge".*

Essentially, there is support and collaboration between government and Concern Universal: (KII 8): *"It's a multi-lateral relationship in the sense that Concern Universal is on one end, government extension workers on the other and community groups on the other";* (KII4): *"There are partners that are involved in promoting the use of cook stoves that save or use little fuelwood. These partners are Concern Universal and also partly the forestry department"; (*KII 8): *"This is just a steering committee aimed at activating players in different places in the country to promote energy saving stoves. The aim is that by 2020, two million stoves will be distributed across the country. The core mandate is to move from the three stone fireplaces to new alternatives. The three stone fireplace is 20% efficient. The alternative can be any stove which has more than 20% efficiency. This is a government project whereby the government is targeting the most vulnerable 10% of the society. Concern Universal does not give out the stoves for free otherwise production will stop. There is a certain section of households that fail to buy because of income level; this is the group that the government is targeting".*

Malawi Environment Endowment Trust (MEET) is another non-governmental organization that was supporting activities regarding energy use in Phalombe district. It provided funds to different environmental projects in Malawi. It is a local Malawian non-profit organization that was formed as a sustainable funding mechanism. It works with already established structures in different areas in the protection of the environment in cooperation with other development stakeholders. MEET is mandated to address the environmental challenge in Malawi. (KII3): *"There are three forests around, namely Chisengereni in Kasongo EPA (extension planning area) and two others. One of the two other forests was rehabilitated with assistance from MEET and the other forest is a section of a larger forest on Mulanje Mountain. Measures have been put in place to rehabilitate these forests in order to discourage deforestation and encourage planting of alternative species such as pine tree*

rather than the more popular cider trees in these forests. This is because pine grows much faster than cider"; (KII7): *"There is a small component of tree planting that will take place but the main objective of the project is to produce stoves. They will distribute tree seedlings just to promote tree planting and increase sources of fuelwood". "The project done by MEET was to build on already existing knowledge about cook stoves and target women groups as primary users of fuel wood". "I think that this is an area that a lot of work has been done through other projects on cook stove issues. It's an area where GTZ (German Cooperation) and other previous programmes on fuel efficient cook stoves have been. This is an area that has a lot of awareness and sensitization has already been done".*

5.8 CONCLUSION

The chapter has established that households in the study areas strongly depend on fuelwood and crop residues to meet their energy needs. This is mainly because electricity remains out of reach of all households, due to poverty on the one hand, but also due to slow installation in these areas as residents' homes also do not necessarily meet the minimum requirements for electricity to be installed. The expense of connecting to the power grid is too high considering their incomes, and is further exacerbated by long distances from connection points.

Clearly, women bear the largest responsibility of ensuring that households have energy for consumption at home. They collect fuelwood and crop residues to ensure that the homes have energy for cooking and heating and this time consuming activity affects their availability to perform other important duties at home, as well as their socialising.

The study also established that energy sources that can be obtained for free, are mostly used. These include fuelwood, crop residues and grass. Other sources of energy are however also used, and paid for, but mostly for specific purposes, such as batteries, candles and charcoal, depending on affordability. Households' reliance on fuelwood inevitably contributes to deforestation because communities are exploiting nearby forests. However, the communities in this study have begun with initiatives to preserve community forests through forest management committees, implementation of regulations and even fines for irresponsible collection of fuelwood. Households have also taken the initiative of planting woodlots, and sometimes sell the wood to supplement their own incomes

The communities in this study displayed reatively high levels of practical consciousness, that indicate that their daily household consumption oractices are not necessariy irresponsible. The same applied for their discursive consciousness of sustainable consumption practices,

suggesting that households have a fairly good understanding of climate change as the cause of dry spells and high temperatures. However, it is cause for concern that they have little knowledge that environmental degradation negatively affects the economic growth of Malawi that indicates a pychological distance between their micro and meso environment, and that of the macro environment.

It was comforting to know that the systems of provision, that include several governmental bodies and departments are empathetic about rural households predicament concerning afforadable household energy sources and that they have instigated plans and measures to curb deforestation and to promote sustainable practices. Noteworthy, however, is role players' apparent understanding that women are largely exploited in terms of their role to collect energy sources for their households and the subsequent time pressure that disallows them opportunities to improve their education level and to care for their siblings. Further aggravating womens' situation, is their exposure to toxic fumes when using sub standard materials to make fire for cooking and heating purposes in the limited confinement of their homes. The related health issues is devastating enough to merit the elevation of rural households' problems to the top of the agenda of officials who have the power and negotiating power to facilitate change. In the end, the Malawi government is captured in a catch 22 situation as none of the environmentally friendly, more sustainable energy sources are available for free, or are affordably for the majority, which means that the dire financial situation of rural households is largely jeopardizing effort to promote sustainable energy consumption practices in Malawi.

CHAPTER 6

CONCLUSIONS

This chapter summarizes the results in terms of the objectives of the study and presents recommendations for future research based on the findings. Shortcomings of the research are noted and discussed. Recommendations are made for future research and policymaking.

6.1 INTRODUCTION

"*Climate change is important to Malawi, but many people see alternative energy more as a means to skip the government and get electricity and power. Deforestation is a huge problem in Malawi, which only adds to the problem. People cut down trees because they have no power to run electric stoves, etc. So they use fuelwood".* (As stated by William Kamkwamba, a Malawian innovator, engineer and author who gained fame in 2002 when he built a wind turbine to power multiple electrical appliances in his family home in Kasungu, Malawi. The movie "The Boy Who Harnessed the Wind" is based on his story).

Globally, climate change is threatening the environment as well as the survival of human beings. Consumer consumption has therefore come under the spotlight to encourage all role players to adopt more sustainable consumption practices. Consumers in all spheres, including households, are called upon and encouraged to reconsider their every day practices and to adopt sustainable practices that demonstrate concern about the environment and the well-being of the planet (Marx-Pienaar, 2015). Inarguably, household energy consumption is contributing to pollution, which then threatens atmospheric conditions, and subsequently, the livelihood and wellness of human beings, animals and every form of living that is part of the eco-system of this planet. As such, sustainable household energy consumption is important in order to reduce the consumption of available natural resources and to nuture what nature provides to us (Joung and Parl-Poaps, 2013; Marshak, 2012).

Research in the developed countries has shown that, although consumers are aware and even concerned about environmental issues, as was also found in this study, they are reluctant to change their way of living in order to preserve natural resources (Joung and Parl-Poaps, 2013). This rather selfish attitude-behaviour gap has been a topic of much debate among environmentalists and researchers, who have identified various contributing factors as the underlying cause for such inconsistency (Ha-Brookshire and Norum, 2011). Empirical evidence has to date mainly addressed these issues in developed countries (who are blamed as main

culprits for contributing to global warning), but these outcomes are not necessarily relevant in developing countries such as Malawi. Therefore, this research study mainly focused on generating empirical evidence of households' energy consumption as a consequence of their way of life (lifestyle) in rural Malawi, also attending to the systems of provisions as largely determined by Government policies through the prevailing Department of Forestry and Ministry of Agriculture DADO (district and agriculture development office) and traditional leadership. The study envisaged a contribution towards initiatives that may encourage sustainable household energy consumption behaviour amidst expressed concern about deforestation in the country and the irrevocable consequences in terms of climate change. This was done by gathering evidence of households' practical- and discursive consciousness concerning their energy consumption as pre-requisites to facilitate and promote behavioural change. The study aimed to indicate the potential contribution that households and communities could make to reduce their own carbon "footprint" (as a popular way of reference) to preserve the future health of the planet, and to instigate policies that would serve the cause.

Particular focus was drawn toward household energy consumption in the context of prevailing socio-economic conditions. Indiscriminate household energy consumption can be detrimental to the environment and could facilitate climate change through the emission of high levels of carbon dioxde into the atmosphere. It is said that households account for nearly three quarters of global carbon emissions. It is therefore imperative that household practices are understood when aiming to encourage low carbon emissions in the future (Druckman and Jackson, 2016). As most of the research on this topic refers to developed countries and have excluded African countries, this study aimed to make a contribution to the topic by studying households' energy consumption practices in a third world context. Malawi was chosen for the investigation as an example of a relatively poor, and vulnerable African country in order to expand extant literature. From the start, the study acknowledged the disadvantaged state that rural communities in Malawi find themselves in financially. However, the study never assumed that, as a consequence, households would be oblivious, indifferent or willingly irresponsibe with regard to their energy consumption practices. Empirial evidence of households' practical- and discursive consciousness concerning their energy consumption practices and climate change was therefore gathered to indicate how households could be supported to engage in initiatives to preserve the environment, and more specifically combat the dwindling forests in the country.

In order to accomplish this, a mixed method approach was employed with a household survey as the basis for the quantitative design, and focus group discussions and key informant interviews being part of the qualitative design. The survey was conducted in the southern region of Malawi, more especially in Balaka and Phalombe districts, involving a sample of 231 households that constituted 41.8% of the population in the selected areas at the time. Heads of

households or their informed proxies were targeted, which resulted in a predominat inclusion of females. Literature confirms that females are mostly involved in rural households' energy consumption practices and the situation in Malawi is no exception.

Focus group discussions were also held with four groups of women within the study sites, i.e. two from Balaka and another two groups from Phalombe. In addition, key informant interviews were conducted with government officers, i.e. government district agriculture and development officers (DADO) and government forestry extension officers as well as representatives from non-governmental organizations (NGOs) including Concern Universal and the Malawi Environment Endowment Trust (MEET). All of these organisations conduct work in the targeted districts on the issue of energy.

The data that was collected from the sample was then analysed according to the objectives of the study, using descriptive and inferential statistics for the quantitative data. On the other hand, the qualitative data from the focus group discussions and key informant interviews were transcribed verbatim and were open coded and analysed in terms of coherent themes benefiting the study.

The research objectives as well as the conceptual framework were based on the themes and constructs proposed by Spaargaren and van Vliet (2003), which are essentially based on the assumptions of the structuration theory (Giddens, 1984). Structuration theory was chosen because it consideres and acknowledges the duality of structure of both the agents (households) and systems of provision. In terms of the system of provision, the study involved both government and non-governmental organisations that dealt with issues of household energy consumption in the study area.

Based on the results of this research endeavour, the following findings were reached and are discussed to summarise the findings.

6.2 SUMMARY OF FINDINGS

The focus of this research was to investigate the household energy consumption practices and behavior in the rural Malawian context. In terms of the demographic results, the respondents were mainly female (or their proxies) N=224. All respondents were black with a minimum education level of up to ten years of formal schooling (n=205). The respondents, who were recruited as residents of Balaka and the Phalombe districts, earned an approximate household income of between a minimum of MK500 in Phalombe; MK1000 in Balaka and maximum of MK30, 000 in Balaka and MK80, 000 in Phalombe per month (respectively). When converted to

USD, households' average incomes were clearly below the poverty line of 2 USD per person per day. Mostly, households did not have much to spare in meeting their basic needs, which clearly left them desperate and dependent on whatever they could get hold of for free, to cope with their circumstances.

Objective 1: To investigate and discuss aspects of households' lifestyles specifically relating to their consumption of different sources of energy for daily use

None of the respondents (N=231) had electricity in their households. Not surprisingly then, the study found that 95% of households used collected fuelwood that they could access for free for cooking and other household chores, although they also used fair amounts of crop residuesand grass, that were freely available. The collection of fuelwood that was mostly done by women (93.5%), was time consuming, although the majority (80% of the sample) were able to collect fuelwood within two hours in terms of walking distince from their homes. Fuelwood was mostly collected from surrounding environments or community woodlots and the majority of households (57.1%) collected fuelwood weekly.

A range of energy sources were used and they were applied for specific purposes, for example, crop residues and grass were used for cooking, heating and lighting. Crop residues generally included maize stalks, pigeon peas, cotton and tobacco stems.

Respondents indicated that they spent MK5000 per month to buy fuelwood for cooking in both Balaka and Phalombe districts. Energy sources that households had to pay for, included batteries, charcoal, paraffin, and sometimes, extra fuelwood. Batteries are typically used for powering torches for lighting. Charcoal was used by only few households because it is fairly expensive. Households spent MK3000 [ZAR71] on charcoal in the Balaka district, while Phalombe respondents reported that they could not afford to use charcoal for cooking because it was too expensive. Paraffin was used by a very small percentage of households (2.6%) for lamps to produce light. For beer brewing, sacks and tyres were often used. The quantitative findings were triangulated by the focus group discussions, although participants - during the discussions - were afforded opportunity to explain why the used certain energy sources for specific tasks. During these discussions, comments about the unsuitability of their homes for electrical wiring and the high cost of cleaner fuels became apparent.

Objective 2: To investigate and discuss heads of households' practical consciousness about climate change and sustainsble consumption practices

Jackson (2005) identifies three conditions that indicate that energy consumption mostly constitutes habitual behavior: it is believed that decisions taken in everyday energy consumption are likely to be considered as having *less important consequences* than other decisions; the *low complexity of decisions related to everyday energy consumption* does not require a lot of cognitive effort; and the *constraints of society* also tend to encourage existing habits and routines. Therefore, it is difficult to expect consumers to be entirely capable to control their consumption of energy (Marechal and Lazaric, 2012). This study distinguished five factors relating to consumers' practical consciousness of the integrated topic, and concluded that households' practices reflect a moderate practical consciousness of what sustainable practices imply, i.e. in terms of:

- Factor 1: Food preparation practices, the best cooking methods used, the amount of food cooked, covering of pots);
- Factor 2: Cooking systems used, such as using an energy saving stove, efforts to save charcoal after use, limiting the size of the fire);
- Factor 3: Water heating practices, such as rather bathing in cold water and heating water in the sun in order to save energy), and
- Factor 4: Energy saving practices, such as switching off lamps in empty rooms, as well as opening, window coverings to allow natural light into the house to reduce the use of artificial light.
- Factor 5: Fuelwood consumption practices, Results suggest that households are fairly conscious (above average) of sustainable practices when using fuelwood.

Households' practical consciousness of sustainable household practices – based on how they operate and their decisions with regard to the use of energy sources in their homes, hence suggests some level of responsible sustainable behaviour, although not always commendable. Less than 60% of the respondents indicated that they always switch off lamps in vacant rooms or when going to bed, or that they open window coverings to allow natural light into the house to reduce the use of artificial light. Equally so, fires are not always closely managed to reduce fuelwood consumption, and very few households share fires for cooking to save on fuel needs. While households' practical consciousness of climate change and sustainable consumption practices was fairly good, much could be done to improve their behavioural practices.

Objective 3: To explore and discuss households' and communities' discursive consciousness of climate change with regard to their consumption of different energy sources, specifically their ability to explain their choice of energy sources

During the first phase, the quantitative survey, encouraging results were reported, for example, 90% of respondents affirmed that brick baking causes deforestation; climate change causes dry spells; climate change causes flooding; climate change is currently one of the critical problems in Malawi and also that an increase in Malawi population will put further strain on the country's natural resources. Key informants also retaliated about the issue of deforestation, explaining that challenges to biomass fuel access has resulted in entire forests being cleared. On the issue of population, they highlighted the fact that as the population increases, sources of fuelwood will remain inadequate and further add to the repercussions of climate change. Further to that, focus group discussions also indicated their concern about population growth: (FG 4): "*There is increase in population, which leads into degradation of the environment*". This issue was well triangulated in the study.

Responses that evoked concern during the survey, included that almost 80% of the respondents in Balaka said that climate change does not affect them personally to the same extent that it affects fellow citizens, while 42.5% of respondents in Phalombe said the same. Reasons for this discrepancy can be investigated further. During the focus group discussions, it was apparent that the discussants were aware of the causes and consequences of climate change in their areas. For example, they talked about irregular weather patterns and rainfall issues. They were able to aticulate that irregular rainfall results in low crop yields. Specific aspects were mentioned such as dry spells, which led to the retardation and wilting of seedlings on the one hand and the occurance of floods on the other, which eroded top soil and washed away entire fields.

While the overall score for the different dimensions of respondents' discursive consciousness (Table 5.17) was encouraging, pertinent areas of concern emerged when scrutinizing individual items (results presented in Table 5.19). Nearly a third of the respondents were not aware that the amount of energy used by households has a significant impact on the environment and that environmental pollution in South Africa also affects Malawi. Almost half of the respondents were not aware that the economic growth of Malawi is influenced by environmental problems, which should be addressed to encourage responsible consumption behaviour. Furthermore, a third of the respondents, who were also the households' decision-makers, were unaware that environmental pollution emanating from neighbouring countries affects Malawi. Respondents therefore seem better informed about certain topics, although some topics are not well

understood, and that may jeopardise responsible consumption practices. These issues mostly require higher cognitive reasoning, indicating that formal education and concerted efforts by governmental bodies are required to inform citizens about their potential role to address a complex issue that will also influence the well-being of future generations.

Objective 4: To explore and discuss the role and interaction of systems of provision (i.e. government, non-governmental organizations) in these areas in terms of households' and communities' consumption of energy sources

The study found encouraging evidence of cooperation and coordination between and among role players in pursuit of mitigation of climate change. The government of Malawi plays an advisory role and the non-governmental organizations work within the policies and legislation advanced by the government. Non-governmental organizations also cooperate with government extension officers in their drive to support the government's initiatives. The local leadership in the persons of local chiefs also work hand in hand with the government extension officers. For instance, there is enforcement of guidelines, regulations and penalties for the illegal cutting of trees in protected areas, as was noted by participants during the focus groups discussions and which key informants confirmed.

6.3 IMPLICATIONS FOR INDUSTRY AND POLICY FORMULATION

It is encouraging that considerable attempt has been made already in terms of efforts to mitigate climate change in Malawi. Notwitstanding, much still needs to be done. At the crux of the problem is poverty that leaves households with no option other than to chop down trees for fuelwood. Concerted effort is thus needed to reduce the vulnerability of low income households in society who are often confined to rural areas where their living conditions are less than optimal. Particularly women and children are baring the brunt of ineviable socio-econmic conditions. As such, the contribution of government and policies could signal an understanding of households' predicament, for example having to chop down trees because they can not afford alternative energy sources. Instead of fines to curb the chopping of trees in forest reserves, governing bodies could for example assit to make available wood that is procured in a responsible manner, and to subsidise other sources of energy, for example for lighting. The availability of energy saving stoves is another practical way to support households. Such initiatives and improved access to alternative energy sources may in fact alleviate many of the underlying factors that contribute to the current rate of deforestation in Malawi.

Overall, government policies are needed to present programmes that encourage sustainable consumption of household energy and, ultimately, management of the environment should be

shared by public and private sectors (Mastamet-Mason, 2013; Jackson, 2005:132). Government policies have the ability to sway consumers through legislation, regulation and standards, for example, recyclability, sustainable consumption patterns and also encouraging pro-environmental behavior (Steg and Vlek, 2009; Jackson, 2005:129). It is inevitable that governing bodies and authorities should prioritise the dilemma and make concerted efforts to promote sustainable behavioural practices. The topic of climate change must be prioritized and communicated in a practical manner across different levels of society to accommodate citizen's varying education levels. Educating citizens about environmental degradation should promote more desirable consumption behavior. Combined efforts by the systems of provision as well as the households (actors) will be required to strengthen the prevailing duality in their onslaught on indiscriminate consumption. In the end, the worldview of how consumers are expected to behave is important (Steg and Vlek, 2009; Jackson, 2005:130), although the vulnerability of consumers should not be negated.

It is important to remember that households are often locked into their circumstances and they need to be supported in practical, tangible ways to share in a general concern about climate change - which they are apparently fairly acquainted with and should therefore make the process to involve them so much easier. Government should not just expect, and try to enforce change in households' consumption habits and practices. They should firstly demonstrate empathy and initiative to provide guidance whilst setting an example and by filtering through, clear pro-environmental messages and interventions that consumers' households can associate with.

What can NGOs do to help these people?

NGOs are development partners. It is therefore important for the NGOs to advance the legislature being promoted by the government regarding the energy sector. For the most part, NGOs need to be commended for supplementing the government's drive for sustainable energy consumption. Normally, these NGOs work with the poor households. It is imperative that there are initiatives that demonstrate an understanding that climate change affects the poorest even more than how it affects affluent societies. It is important to make sure that the poor are also considered at the global level as they struggle to make end meet and can often hardly see how hey can adapt their consumption practices and habits unless tangibly supported in some way. NGOs therefore have a pivotal role to play in highlighting the plight of the poor among the more developed nations to ensure that they are not left behind in the pursuit of sustainability.

What can the UN do based on the results of the study?

The United Nations is promoting responsible consumption behaviour, advising countries to take action to curb climate change and to ensure that nations/ communities have access to

affordable and clean energy. This aspect clearly culminated as a pressing issue in this study that also emphasised that households/ consumers should be educated to become more knowledgeable (increasing their discursive consciousness) about sustainable consumption practices. This study indicated that households are fairly acquainted with sustainable consumption practices, as well as the implications of environmental change although room for improvement exists.

Globally, there is talk about sustainable development goals (SDGs) in terms of seventeen goals, or so-called pillars of reform. Pillar 1, refers to poverty alleviation which is a pressing issue in rural Malawi. Pillar 7 deals with affordable, and clean energy, that rural Malawi households do not have access to, and cannot access on their own, while Pillar 1 remains unresolved. This was confirmed in this study that cautions that, while nations are being called upon to become more energy-efficient and to invest in clean energy sources such as solar and wind, certain communities, such as rural Malawi households remain incapable to do anything on their own. Pillar 12, refers to responsible consumption and production whereby countries are urged to move towards more responsible consumption of natural resources in consideration of future generations. Pillar 13, refers to action to combat climate change and its impacts so as to reduce the undesirable consequences such as earthquakes, tsunamis, tropical cyclones and flooding. Further to that, vulnerable regions such as land-locked countries and island states are encouraged to take precaution to become become resilient. Incidentally, Malawi is a land-locked country that has recently been hit by floods and tropical cyclones as a consequence of climate change.

Based on the UN development goals, it seems that rural Malawi, which was the focus of the study, is particularly vulnerable and deserves to be supported to improve the complex situation that has seized their well-being entirely. It is therefore high time that evidence of situations such as these are brought to the attention of the world, as the eventual well-being of certain countries is not unique to them. Eventually, all of Africa, and even the rest of the world will be affected unless environmental matters are taken more seriously, and attended to purposefully. This is the principle of the duality of structure that refers to shared interest in the welfare of others. The spill-over effect of unsustainable consumption to neighbouring countries and the rest of the world could be devastating, which elevates the merit of this particular study that could be used as an example for the UN to act on.

6.4 THEORETICAL CONTRIBUTION

To date, Giddens' structuration theory was tried and tested in the developed countries (Kaspersen, 2000; Karsten, 2008; Lizardo, 2010) and in emerging markets [BRICS] (Marx-

Pienaar, 2015). This empirical investigation aimed at closing the gap in literature by gathering empirical data that would highlight the plight of households in Malawi, as an example of the situation in a Third World country. Structuration theory was applied to a developing country context. This study reflected the duality of structure as proposed by Anthony Giddens (1984) whereby both the agents and systems of provision where drawn into the investigation. As such, the theoretical contribution of the study is that it sheds light on rural households' consciousness of climate change and sustainable household energy consumption practices - a topic that has not yet accrued the attention it deserves. It is unfortunate that scholars who have attended to topics related to sustainable consumption practices and environmental concern, have mostly focused on affluent countries in the Western world, to caution them to refrain from wasteful consumption that typify a throw-away society, and to rather recycle and share commodities to avoid an indiscriminate consumption of valuable resources and ultimately reduce their footprint. This study shifted the focus to poorer communities in a particular land locked context who are literally captured by trying socio-economic conditions and who are, amidst their trying circumstances, being accused of environmental abuse. This study has shown, that while rural Malawi households' habit to chop down trees that has led to major, alarming deforestation in the country with multiple undesirable environmental consequences, the households have limited alterntives other than to follow the status quo unless they are given support (by systems of provision). These households are simply not financially equipped to adapt, even though they have a reasonable understanding that their current behavior may have negative consequences for their future well being.

This study therefore contributed to an understanding of the complexity of pro-environmental behaviour in developing countries where households are very vulnerable to the impact of climate change, while being challenged to adopt alternative energy sources despite their prevailing socio-economic conditions. Simply stated, these households can not afford alternative, cleaner sources of energy. It is therefore imperative that future investigation must build forth on the theoretical insights derived from this study in order to inform policy and intervention. Government policies and non-governmental organizations should be encouraged to facilitate more sustainable use of, and access to fuelwood. Agroforestry can be promoted as part of the accomplishment of the UN's sustainable development goals (Toth, *et al,* 2017; Schuenemann, *et al*., 2018). Crucial to these households and communities, is SDG7 that aims to ensure that everyone has access to affordable, reliable, sustainable and modern energy by 2030 (McCollum *et al.,* 2018), admitting that vulnerable populations cannot do it on their own and that all will suffer if their dire situation is not attended to as a matter of urgency.

6.5 LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

It is not easy to attain representative data in developing countries such as Malawi due to the lack of sampling frames (Burgess and Steenkamp, 2006). This particular study was conducted in two rural areas in Malawi, i.e. Balaka and Phalombe districts, therefore the results cannot be generalized to the rest of the country. A more representative sample would be needed to make conclusions about Malawian households in general. In this regard it is recommended that future research should involve larger and more representative samples across the country.

Topics suggested for future research, based on the insights and experiences gained from this study, are, to replicate this study among urban Malawi households and to compare the findings with the outcomes for the rural sample as an indication of differences that could be attributed to exposure to a broader range of energy sources, and increased affordability. Eventually, this would allow a holistic perspective about Malawi and by extension also provide an opportunity for a comparison of different geographical areas. A suggestion would be to replicate this investigation nationally or at least in different districts in all three administrative regions of Malawi including the north, centre and south regions, or even a bigger geographical scope which includes other sub-Saharan countries. In repeating this study among households in adjacent countries, a comparison can be drawn. It would reflect the potential importance of research in Africa and make up for scarcity of empirical evidence as mentioned before.

It is important to note that Africa remains a difficult context for researchers to enter into. Access to communities is difficult and has to be organized through particular systems. Incidentally, the researcher knew the area, which was to the advantage of the research. The researcher was able to approach the topic empathetically and with sensitivity. This facilitated the adoption of a pragmatic approach by including both quantitative and qualitative methods to assess household energy consumption practices in the wake of climate change

With regard to the qualitative investigation, it was observed that during the key informant interviews, availability of the desired interviewees was a problem. For example, access to the key informants was not possible in one of the districts where the district agriculture development officer (DADO) delegated a junior officer to conduct the interview with. Apart from that, the whole exercise of collecting data from these key informants was very time consuming. In the end only a few key informant interviews were conducted, but it nonetheless provided valuable information that was in line with the aim of the study. These key informant interviews were done purposively to substantiate the research problem. In retrospect, it might be good to incorporate quantitative approach among this group of respondents in order to generalize findings concerning the systems of provision.

The use of quantitative techniques in developing contexts such as Malawi is however not exempt from problems. In terms of the quantitative data that was gathered for this study, it became apparent that some statistical thresholds could not be achieved. For example, the Cronbach's Alpha for certain scale items could not achieve the 0.70 threshold and in the discursive consciousness investigation, the percentage of variance in the data was relatively low. This points to the need for further scale development to adequately assess the constructs among respondents who might not necessarily relate to the wording or concepts that are typically communicated in more developed contexts. Despite considerable effort that was directed toward the development of the survey questionnaire, it is possible that the people who took part in this survey did not understand some of the constructs which in turn influenced the reliability statistics. It is therefore recommended to find simpler versions to assess the constructs for the purposes of future investigation.

Fortunately, this study used a mixed-method research design thereby providing findings that can be considered influential in terms of extrapolating the problem at hand. The mixed method worked well to attend to the issue at hand and the qualitative methods, in particular, produced desired outcomes. Perhaps, future research may do well to investigate households' daily behavior from a purely qualitative approach and incorporate research methods such as observations. These qualitative methods are growing in support and could possibly provide valuable insight.

In conclusion, this study highlighted the use of selected alternative sources of energy, but future research could delve deeper into the viability of alternative sources of energy, considering households' ingrained practices that have cultural meaning. For example, cooking is also a social occasion for many. In addition, this study could be extended to involve other disciplines such as health practitioners to attend to the issue of smoke inhalation when using certain energy sources and the related negative consequences for people's health (Schuenemann, *et al.,* 2018). Apart from health consequences, it is imperative that climate change communication is improved in an effort to reduce vulnerability of the households in Malawi. Future research could investigate ways to inform and educate households to adopt more sustainable energy consumption practices so as to design and introduce appropriate intervention strategies.

REFERENCES

AALTO, P. 2016. The new International Energy Charter: instrumental or incremental progress in governance? *Energy Research and Social Science,* 11:92-96.

ABDILAHI, A.M., MUSTAFA, M.W., ABUJARAD, S.Y. & MUSTAPHA, M. 2018. Harnessing flexibility potential of flexible carbon capture power plants for future low carbon power systems. *Renewable and Sustainable Energy Reviews,* 81:3101-3110.

ABDULHAMID, B., ABUBAKAR, E.M. & DAWAKI, S.A. 2017. An assessment of potential contributions of agroforestry to food security in Katsina, Sudan Savannah Area, Nigeria. *Current Life Sciences* 3,(3):39-46.

ABRAHAMSE, W., STEG, L., VLEK, C. & ROTHENGATTER, T. 2005. A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology,* 25:273-291.

ABRAHAMSE, W. & STEG, L. 2011. Factors related to household energy use and intention to reduce it: The role of psychological and socio-demographic variable. *Human Ecology Review,* 18(1):30-40.

ACKERSON, C., ADAM, E., ARNOLD, J., FIORENZA, A.S., JANGDA, H., MALCOMB, D., KNOP-NARBUTIS, A., MAGERO, V., PEEK, N., PHILLIPS, P. & MAO, G. , PEEK, N, PHILLIPS, P, RAMIREZ, A, SCHILLACI; TIBBETS, J, USHER, K & YEAGER, K. 2013.*Climate change and aid in Malawi.* In: WEAVER, C. & PERATSAKIS C. (eds.) Climate change and development in Africa. Austin, Texas: The Robert S. Strauss Center for International Security and Law.

ADAMS, S. & ACHEAMPONG, A.O. 2019. Reducing carbon emissions: the role of renewable energy and democracy. *Journal of Cleaner Production*, 240(118245):1-13.

ADAMS, S., KLOBODU, E.K.M. & APIO, A. 2018. Renewable and non-renewable energy, regime type and economic growth. *Renewable Energy,* 125:755-767.

ADAMS, S., KLOBODU, E.K.M. & OPOKU, E.E.O. 2016. Energy consumption, political regime and economic growth in sub-Saharan Africa. *Energy Policy,* 96:36-44.

ADENLE, A.A., FORD, J.D., MORTON, J., TWOMLOW, S., ALVERSON, K., CATTANEO, A., CERVIGNI, R., KURUKULASURIYA, P., HUQ, S., HELFGOTT, A. & EBINGER, J.O. 2017. Managing climate change risks in Africa- a global perspective. *Ecological Economics,* 141:190-201.

ADGER, W.N. 2010. Climate change, human well-being and insecurity. *New Political Economy,* 15(2):275-292.

ADGER, W.N., ARNELL, N. & TOMPKINS, E.L. 2005. Successful adaption to climate change across scales. *Global Environmental Change,* 15(2):77-86.

ADGER, W.N. & KELLY, P.M. 1999. Social vulnerability to climate change and the architecture of entitlements. *Mitigation and Adaptation Strategies for Global Change*, 4(3–4):253–266.

ADHIKARI, B., FALCO, S.D. & LOVETT, J.C. 2004. Household characteristics and forest dependency: evidence from common property forest management in Nepal. *Ecological Economics* 48: 245-257

ADKINS, E., OPPELSTRUP, K. & MODI, V. 2012. Rural household energy consumption in the millennium villages in sub-Saharan Africa. *Energy for Sustainable Energy Development*, 16(3):249-259.

ADKINS, E., EAPEN, S., KALUWIZE, F., NAIR, G. & MODI, V. 2010. Off-grid energy services for the poor: Introducing LED lighting in the millennium villages project in Malawi. *Energy Policy,* 38(2):1087-1097.

ADKINS, E., TYLER, E., WANG, J., SIRIRI, D. & MODI, V. 2010. Field-testing and survey evaluation of household biomass cook stoves in rural sub-Saharan Africa. *Energy for Sustainable Development,* 14:172-185.

AFIDEP (AFRICAN INSITUTE FOR DEVELOPMENT POLICY). 2012. *Population, climate change and sustainable development in Africa*. [Online] Available from: pai.org/wp-content/uploads/2012/06/PAI-AFIDEP.pdf Population Action International. [Accessed: 09/02/2019].

AHLBORG, H., BORANG, F., JAGERS, S.C. & SODERHOLM, P. 2015. Provision of electricity to African households: The implication of democracy and institutional quality, *Energy Policy,* 87:125-135.

AHLBORG, H. & HAMMAR, L. 2014. Drivers and barriers to rural electrification in Tanzania and Mozambique – grid-extension, off-grid, and renewable energy technologies. *Renewable Energy*, 61(C):117-124.

AJAYI, O.C., AKINNIFESI, F.K. & AJAYI, A.O. 2016. How by-laws and collective action influence farmers' adoption of agroforestry and natural resource management technologies: lessons from Zambia. *Forests, Trees and Livelihoods,* 25(2):102-113.

AKTER, S. & BENNETT, J. 2011. Household perceptions of climate change and preferences for mitigation action: the case of the carbon pollution reduction scheme in Australia. *Climatic Change,* 109(3-4):417-436.

ALEMAYEHU, Y.A. 2015. Status and benefits of renewable energy technologies in the rural areas of Ethiopia: a case study on improved cooking stoves and biogas technologies. *International Journal of Renewable Energy Development,* 4(2):103-111.

ALKON, M., HARISH, S.P. & URPELAINEN, J. 2016. Household energy access and expenditure in developing countries: evidence from India, 1987-2010. *Energy for Sustainable Development,* 35:25-34.

AL-MULALI, U. & SAB, C.N.B.C. 2012. The impact of energy consumption and CO2 emission on the economic growth and financial development in the sub-Saharan African countries. *Energy,* 39:180-186.

ALI, A., BATRA, D.K., RAVICHANDRAN, N., MUSTAFA, Z. & REHMAN, S.U. 2012. Consumer socialization of children: A conceptual framework. *International Journal of Scientific and Research Publications,* 2(1):1-5.

ALIYU, A.A., BELLO, M.V., KASIM, R. & MARTIN, D. 2014. Positivist and non-positivist paradigm in social science research: Conflicting paradigms or perfect partners. *Journal of Management and Sustainability,* 4(3):79-95.

ALMALKI, S. 2016. Integrating quantitative and qualitative data in mixed methods research-challenges and benefits. Journal of Education and Learning 5(3): 288-296

ALSTONE, P., GERSHENSON, D. & KAMMEN, D.M. 2015. Decentralised energy systems for clean electricity access. *Nature Climate Change,* 5:305-314.

ALVARADO, E., IBANEZ, M. & BRUMMER, B. 2018*. Understanding how risk preferences and social capital affect farmers' behaviour to anticipatory and reactive adaptation options to climate change: the case of vineyard farmers*. IAAE. 30th International Conference of Agricultural Economists. July 28-August 2, 2018. Vancouver

AMIGUN, B., MUSANGO, J.K. & STAFFORD, W. 2010. Africa technology options for renewable energy production and distribution. Johannesburg, South Africa: Africa Institute of South Africa. *Energy Transition in Africa*, 143-171.

AMIGUN, B., MUSANGO, J.K. & STAFFORD, W. 2011. Biofuels and sustainability in Africa. *Renewable and Sustainable Energy Reviews,* 15(2):1360-1372.

AMOAH, S.T. 2019. Determinants of household's choice of cooking energy in a global south city. *Energy and Buildings,* 196:103-111.

ANDREONI, V. & GALMARINI, S. 2016. Drivers in CO2 emissions variation: a decomposition analysis for 33 world countries. *Energy,* 103:27-37.

ANTWI, S.K. & HAMZA, K. 2015.Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European Journal of Business and Management,* 7(3):217-225.

APERGIS, N., JEBLI, M.B. & YOUSSEF, S.B. 2018. Does renewable energy consumption and health expenditures decrease carbon dioxide emissions? Evidence for sub-Saharan Africa countries. *Renewable Energy,* 127:1011-1016.

ARCHIBALD, M.M. 2016. Investigation triangulation: A collaborative strategy with potential for mixed methods research. *Journal of Mixed Methods Research,* 10(3):228-250.

ARNDT, C., SCHLOSSER, A., STRZEPEK, K. & THURLOW, J. 2014. Climate change and economic growth prospects for Malawi: An uncertainty approach. *Journal of African Economies*, 23(AERC Supplement 2):83–107.

ARTHUR, R., BAIDOO, M. & ANTWL, E. 2011. Biogas as a potential renewable energy source: A Ghanaian case study. *Renewable Energy,* 36:1510-1516.

ASFAW, S., MCCARTHY, N., LIPPER, L., ARSLAN, A., CATTANEO, A. & KACHULU, M. 2013. *Climate variability, adaptation strategies and food security in Malawi.* Rome, Italy: Food and Agriculture Organization of the United Nations (FAO). Agricultural Development Economics Division (ESA).

ASHTON S.F., WORKMAN S.W., HUBBARD, W.G. & MOORHEAD, D.J. 2011. *The role of agroforestry in fuelwood for domestic and income generation activities - a case study of three communities in the Sunyani district of Brong Ahafo Region Ghana.* Paper presented at the 12th North American Agroforestry Conference, Athens, Greece. 4-9 June 2011.

AVRUCH, K. 1998. *Culture and conflict resolution.* Washington: United States Institute of Peace Press.

AZEVEDO, I.M.L., MORGAN, M.G. & LAVE, L. 2011. Residential and regional electricity consumption in the US and EU: How much will higher prices reduce CO_2 emissions. *The Electricity Journal,* 24(1):21-29

AZIMOH, C.L., KLINTENBERG, P., MBOHWA, C. & WALLIN, F. (2017). Replicability and scalability of mini-grid solution to rural electrification programs in sub-Saharan Africa. *Renewable Energy,* 106:222-231.

BABBIE, E.R. 2016. *The practice of social research*. 14th ed. Boston: Cengage Learning.

BABIKIER, M., REILLY, J.M. & JACOBY, H.D. 2000. The Kyoto Protocol and developing countries. *Energy Policy,* 28(8):525-536.

BACKSTRAND, K. & LOUBRAND, E. 2006. Planting trees to mitigate climate change: Contested discourses of ecological modernization, green governmentality and civic environmentalism. *Global Environmental Politics,* 6(1):50-75.

BAILIS, R., EZZATI, M. & KAMMEN, D.M. 2003. Greenhouse gas implications of household energy technology in Kenya. *Environmental Science and Technology,* 37(10):2051-2059.

BALAND, J.-M., LOIBOIS, F. & MOOKHERJEE, D. 2017. Forest degradation and economic growth in Nepal. *Journal of the Association of Environmental and Resource Economists,* 2003-2010:1-56. [Online] Available from: http://people.bu.edu/dilipm/wkpap/Baland%20Libois%20Mookherjee%20revApr2017.pdf [Accessed: 2018-04-23].

BALAND, J-M., BARDHAN, P., DAS, S. & MOOKHERJEE, D. 2010. Forests to the people: Decentralization and forest degradation in the Indian Himalayas. *World Development*, 38(11):1642–1656.

BALAND, J.-M. & MOOKHERJEE, D. 2014. *Deforestation in the Himalayas: myths and reality*. *Development without deforestation*. UNDP Policy in Focus. New York, USA: United Nations Development Programme.

BANDYOPADHYAY, S., SHYAMSUNDAR, P. & BACCINI, A. 2011. Forests, biomass use and poverty in Malawi. *Ecological Economics,* 70(12):2461-2471.

BANG, G. 2010. Energy security and climate change concerns: triggers for energy policy change in the United States*. Energy Policy,* 38(4):1645-1653.

BANG, G., HOVI, J. & SPRINZ, D.F. 2012. US presidents and the failure to ratify multilateral environmental agreements. *Climate Policy,* 12(6):755- 763.

BARNARD, M. 2014. SADC's response to climate change- the role of harmonised law and policy on mitigation in the energy sector*. Journal of Energy in Southern Africa,* 25(1):26- 32.

BARNES, D.F. & FLOOR, W.M. 1996. Rural energy in developing countries: A challenge for economic development. *Annual Review of Energy and the Environment,* 21(1):497-530.

BARRY, J., MOL, A.P.J. & ZITO, A.R. 2013. Climate change ethics, rights, and policies. *Environmental Politics,* 22(3):361-376.

BARTIAUX, F. 2008. Does environment information overcome practice compartmentalization and change consumers' behavior? *Journal of Cleaner Production,* 16(11):1170-1180.

BARTLETT, J.E., KOTRLIK, J.W. & HIGGINS, C.C. 2001. Organizational research: Determining appropriate sample size in survey research. *Information Technology, Learning, and Performance Journal,* 19(1):43-50.

BAUMERT, S., LUZ, A.C., FISHER, J., VOLLMER, F., RYAN, C.M., PATENAUDE, G., ZORILLA-MIRAS, P., ARTUR, L., NHANTUMBO, I. & MACQUEEN, D. 2016. Charcoal supply chains from Mabalane to Maputo: Who benefits? *Energy for Sustainable Development,* 33:129-138.

BAURZHAN, S. & JENKINS, G.P. 2017. On-grid solar PV versus diesel electricity generation in sub-Saharan Africa. Economics and GHG emissions. *Sustainability,* 9(3):372-387. [Online] Available from: https://www.mdpi.com/2071-1050/9/3/372/pdf [Accessed: 2018-05-20].

BAILIS, R., EZZATI, M. & KAMMEN, D.M. 2005. Mortality and greenhouse gas impacts of biomass and petroleum energy futures in Africa. *Science,* 308:98–103.

BALMES,J.R. 2019. Household air pollution from domestic combustion of solid fuels and health. *Journal of Allergy and Clinical Immunology,* 143(6):1979-1987.

BANERJEE, S.G., MORENO, F.A., SINTON, J., PRIMIANI, T. & SEONG, J. 2017. *Regulatory indicators for sustainable energy*. World Bank other operational studies 26099, The World Bank.

BARRON, M & TORERO,M. 2017. Household electrification and indoor air pollution. *Journal of Environmental Economics and Management,* 86:81-92.

BARR, S., GILG, A. & SHAW, G. 2011. Citizens, consumers and sustainability: (Re)Framing environmental practice in an age of climate change. *Global Environmental Change,* 21:1224-1233.

BARTIAUX, F. 2007. Greening some consumption behaviours: Do new routines require agency and reflexivity. *Sustainable Consumption, Ecology and Fair Trade,* 91-108.

BAYALA, J., KALINGANIRE, A., SILESHI, G.W. & TONDOH, J.E. 2018. Soil organic carbon and nitrogen in agroforestry systems in sub-Saharan Africa: a review. Improving the profitability, sustainability and efficiency of nutrients through site specific fertilizer recommendations in West Africa. *Agro-Ecosystems,* 51-61

BAYEN, P., LYKKE, A.M. & THIOMBIANO, A. 2016. Success of three soil restoration techniques on seedling survival and growth of three plant species in the Sahel of Burkina Faso (West Africa). *Journal of Forestry Research,* 27(2):313-320.

BAYLISS, K., FINE, B. & ROBERTSON, M. 2013. *From financialization to consumption: the systems of provision approach applied to housing and water*. London, UK: University of London. [Online] Available from: https://eprints.soas.ac.uk [Accessed: 2017-03-25].

BAZILLIAN, M., NUSSBAUMER, P., ROGNER, H.H., BREW-HAMMOND, A., FOSTER, V., PACHAURI, S., WILLIAMS, E., HOWELLS, M., NIYONGABO, P., MUSABA, L., GALLACHOIR, B.O., RADKA, M. & KAMMEN, D.M. 2012. Energy access scenario to 2030 for the power sector in sub-Saharan Africa. *Utilities Policy,* 20(1):1-16.

BAZILLIAN, M., ROGNER, H., HOWELLS, M., HERMANN, S., ARENT, D., GIELEN, D. & YOMKELLA, K.K. 2012. Considering the energy water and food nexus: Towards an integrated modelling approach. *Energy Policy,* 39:7896-7906.

BEAVERS, A.S., LOUNSBURY, J.W., RICHARDS, J.K., HUCK, S.W. SKOLITS, G.J. & ESQUIVEL, S.L. 2013. Practical considerations for using exploratory factor analysis in educational research. *Practical Assessment, Research and Evaluation,* 18(6):1-13

BEHERA, B. & ALI, A. 2016. Factors determining household use of clean and renewable energy sources for lighting in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews,* 72:661-672.

BEHERA, B. & ALI, A. 2016. Patterns and determinants of household use of fuels for cooking: Empirical evidence from sub-Saharan Africa. *Energy,* 117:93-104.

BELAY, A., RECHA, J., WOLDEAMANUEL, T. & MORTON, J.F. 2017. Smallholder farmers adaptation to climate change and determinants of their adaptation in the central rift valley of Ethiopia. *Proceedings of the impact of El Nino on Biodiversity, Agriculture and Food Security*, 63.

BELWARD, A., BISSELINK, B., BODIS, K., BRINK, A., DALLEMANA, J.F., DE ROO, A., HULD, T., KAYITAKIRE, F., MAYAUX, P., MONER-GIRONA, M., OSSENBRINK, H., PINEDO, I., SINT, H., THIELEN, J., SZABO, S., TROMBONI, V. & WILLEMEN, L. 2011. Biomass contribution to sub-Saharan Africa's energy needs. In: MONFORTI, F. (ed.) *Renewable Energies in Africa.* JRC Scientific and Technical Reports. Brussels, Belgium: European Commission.

BENEDEK, J., SEBESTYEN, T-T., & BARTOK, B. 2018. Evaluation of renewable energy sources in peripheral areas and renewable energy-based rural development. *Renewable and Sustainable Energy Reviews,* 90:516-535.

BENGTSSON, M., ALFREDSSON, E., COHEN, M., LOREK, S. & SCHROEDER, P. 2018. Transforming systems of consumption and production for achieving the sustainable development goals: moving beyond efficiency. *Sustainability Science,* 13:1533-1547.

BENFICA, R., SQUARCINA, M. & FUENTE, A. 2018 *Structural transformation and poverty in Malawi.* IFAD.

BERGESON, L.L. 2017. The Montreal protocol is amended and strengthened. *Management,* 26(3).

BERGMANN, C., RODEN, P. & NUSSER, M. 2019. Contested fuelscapes: producing charcoal in sub-Saharan drylands. *Area,* 51(1):55-63.

BERVOETS, J., BOERSTLER, F., DUMAS-JOHANSEN, M., THULSTRUP, A. & XIA, Z. 2016. Forests and access to energy in the context of climate change: the role of the woodfuel sector in selected INDCs in sub-Saharan Africa. *Unasylva*, 67(246):53 -60.

BERNARDI, R. 2017. Health information systems and accountability in Kenya: a structuration theory perspective. *Journal of the Association for Information Systems,* 18(12):931-957.

BERVOETS, J., BOERSTLER, F., BORELLI, S., DUMAS-JOHANSEN, M., THULSTRUP, A. & XIA, Z. 2017. Achieving food and wood security in the context of climate change:the role of forests and agroforestry in the Nationally Determined Contributions in sub-Saharan Africa. *Nature and Faune, 31(1):*22-25.

BERVOETS, J., BOERSTLER, F., BORELLI, S., DUMAS-JOHANSEN, M., THULSTRUP, A. & XIA, Z. 2016. Forests and acess to energy in the context of climate change: the role of the woodfuel sector in selected INDCs in sub-Saharan Africa. *Unaslyva,* 67(246):53.

BEZUIDENHOUDT, M.L. 2015. *A case study of office occupants' environmental consciousness and practices in the context of a green-star-SA certified building*. Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria.

BERRANG-FORD, L., FORD, J.D. & PATERSON, J. 2011. Are we adapting to climate change. *Global Environmental Change,* 21(1):25-33.

BHATTACHARYYA, S.C. 2012. Financing energy access and off-grid electrification: A review of status, options and challenges. *Renewable and Sustainable Energy Reviews,* 20:462-472.

BHATTACHARYYA, S.C. 2012. Energy access programmes and sustainable development. A critical review and analysis. *Energy for Sustainable Development,* 16(3):260-271.

BICKERSTAFF, K. & WALKER, G. 2001. Public understanding of air pollution: The localization of environmental risk. *Global Environmental Change,* 11(2):133-145.

BIE, S.W., MKWAMBISI, D. & GOMANI, M. 2008. *Climate change and rural livelihoods in Malawi: Review study report of Norwegian support to FAO and SCC in Malawi, with a note on some regional implications.* Noragric Report 41. The Royal Norwegian Embassy, Lilongwe.

BIN, S. & DOWLATABADII, H. 2005. Consumer lifestyle approach to US energy use and the related CO2 emissions. *Energy Policy,* 33:197-208.

BIRAN, A., ABBOT, J. & MACE, R. 2004. Families and fuelwood: a comparative analysis of the costs and benefits of children in fuelwood collection and use in two rural communities in sub-Saharan Africa. *Human Ecology,* 32(1):1-25.

BISAGA, I. & PARIKH, P. 2018. To climb or not to climb? Investigating energy use behaviour among solar home system adopters through energy ladder and social practice lens. *Energy Research and Social Science,* 44:293-303.

BITHAS, K. & KALIMERIS, P. 2016. A brief history of energy use in human societies. *Revisiting the Energy-Development Link,* 5-10.

BLORE, M. 2015. *The role of social capital in community-based natural resource management: A case study from South Africa.* Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria. [Online] Available from: http://hdl.handle.net/2263/48954 [Accessed: 2017-08-19].

BLUM, J. 2017. Contribution of ecosystem services to air quality and climate change mitigation policies: the case of urban forests in Barcelona, Spain. *Urban Forests,* 21-54.

BOGDAN, R.C. & BIKLEN, S.K. 1998. *Qualitative research in Education: an introduction to theory and methods.* 3rd ed. Needlam Heights: Allyn and Bacon.

BOHRINGER, C. & VOGT, C. 2003. Economic and environmental impacts of the Kyoto Protocol. *Canadian Journal of Economics,* 36(2):475-496.

BONE, R.A., PARKS, K.E., HUDSON, M.D., TSIRINZENI, M. & WILLCOCK, S. 2017. Deforestation since independence: a quantitative assess of four decaded of land-cover change in Malawi. *Southern Forests: a Journal of Forest Science,* 79(4):269-275.

BORGSTEDE, C., ANDERSSON, M. & JOHNSON, F. 2013. Public attitudes to climate change and carbon mitigation- implications for energy-associated behaviours. *Energy Policy,* 57:182-193.

BOTHA, B.N., NKOKA, F.S. & MWUMVANEZA, V. 2018. *Hard hit by El Nino: Experiences, responses and options for Malawi.* World Bank.

BOYCE, J.K. 2018. Carbon pricing: effectiveness and equity. *Ecological Economics,* 150:52-61.

BOUZAROVSKI, S. & PETROVA, S. 2015. A global perspective on domestic energy deprivation: Overcoming the energy poverty-fuel poverty binary. *Energy Research and Social Science,* 10:31-40.

BRAY, D.B., MERINO-PEREZ, L., NEGREROS-CASTILLO, P., SEGURA-WARNHOLTZ, G., TORRES-ROJO, J.M. & VESTER, H.F.M. 2003. Mexico's community-managed forests as a global model for sustainable landscapes. *Conservation Biology,* 17(3):672–677.

BRYANT, C. & WHITE, L.G. 2018. *Managing development in the third world*. Routledge, Tayler & Francis group. London and New York

BREW-HAMMOND, A. & KEMAUSOUR, F. (eds.) 2009. *Energy for rural areas in Africa. The enterprise development approach.* Kumasi, Ghana: Kwame Nkrumah University of Science and Technology (KNOST).

BREW-HAMMOND, A. 2010. Energy access in Africa: challenges ahead. *Energy Policy,* 38:2291-2301.

BROOKS, D.H., PAJUOJA, H., PECK, T.J., SOLBERG, B. & WARDLE, P.A., 1996. Long term trends in World demand and supply for wood. In: SOLBERG, B. (ed). *Long term trends and prospects in world supply and demand for wood and implications for sustainable forest management*. Research Report No 6. Joensuu, Finland: European Forest Institute.

BROTO, V.C. & BULKELEY, H. 2013. A survey of urban climate change experiments in 100 cities. *Global Environmental Change,* 23(1):92-102.

BROUWER, I.D., HOORWEG, J.C. & VAN LIERE, M.J. 1997. When households run out of fuel: Responses of rural fuel wood availability in Ntcheu district, Malawi. *World Development,* 2592:255-266.

BROUWER, R. & FALCAO, M.P. 2004. Wood fuel consumption in Maputo, Mozambique. *Journal of Biomass and Bioenergy,* 27(3):233-245.

BROWN, D. 2011. Making the linkages between climate change adaptation and spatial planning in Malawi. *Environmental Science and Policy,* 14(8):940-949.

BROWN INTERNATIONAL ADVANCED RESEARCH INSTITUTES. 2011. Climate change and its impacts: Water in a changing climate. https://watson.brown.edu/biari/institutes/brown/2011/climate-change-impacts (Accessed 12 June 2017).

BRUCE, N., POPE, D., REHFUESS, E., BALAKRISHNAN, K., ADAIR-ROHANI, H & DORA, C. 2015. WHO indoor air quality guidelines on household fuel combustion: strategy implications of new evidence on intervention and exposure-risk function. *Atmospheric Environment,* 106:451-457.

BRYMAN, A. 2017. Quantitative and qualitative research: further reflections on their integration. *Mixing Methods: Quantitative and Qualitative Research*, 57-78.

BUCKLAND, H., FRAME, D., DAUENHAUER, P., EALES, A. & STRACHAN, S. 2017. *Sustainability of solar PV systems in Malawi*. University of Strathclyde

BUGAJE, I.M. 2006. Renewable energy for sustainable development in Africa: A review. *Renewable and Sustainable Energy Reviews,* 10(6):603-612.

BUHAUG, H., BENJAMINSEN, T.A., SJAASTAD, E. & THEISEN, O.M. 2015. Climate variability, food production shocks, and violent conflict in sub-Saharan Africa. *Environmental Research Letters,* 10(12):125015.

BURGESS, S. & STEENKAMP, J.-B. 2006. Marketing renaissance: how research in emerging markets advances marketing science and practice. *International Journal of Research in Marketing,* 23:337-356.

BURKE, P.J. & DUNDAS, G. 2015. Female labor force participation and household dependence on biomass energy: Evidence from national longitudinal data. *World Development,* 67:424-437.

BUSCO, C. 2009. Giddens' structuration theory and its implications for management accounting research. *Journal of Management and Governance,* 13:249-260. Reviews and Overviews. https://DOI 10.1007/s/0997-008-9081-6

CABEZA, L.F., PALACIOS, A., SERRANO, S., URGE-VORSATZ, D. & BARRENECHE, C. 2018. Comparison of past projections of global and regional primary and final energy consumption with historical data. *Renewable and Sustainable Energy Reviews,* 82:681-688.

CALVO, C.M. 1991. *Case studies in the role of women in rural transport: access of women to facilities.* Environmentally Sustainable Department. Washington DC, USA: The World Bank, Technical Department, Africa Region.

CANTORE, N. 2011. Distributional aspects of emissions in climate change integrated assessment models. *Energy Policy,* 39(5):2919-2924.

CANTORE, N. & PADILLA, E. 2010. Equality and CO2 emissions distribution in climate change integrated assessment modelling. *Energy,* 35(1):298-313.

CAPSTICK, S., WHITMARSH,L., POORTINGA, W., PIDGEON,N. & UPHAM,P. 2015. International trends in public perceptions of climate change over the past quarter century, *Wiley Interdisciplary Reviews: Climate Change*, 6(1), 35-61.

CARRICO, A.R., VANDENBERGH, M.P., STERN, P.C., GARDNER, G.T., DIETZ, T. & GILLIGAN, J.M. 2011. Energy and climate change: key lessons for implementing the behavioural wedge. *Journal of Energy and Environmental Law,* 2(1):61-67.

CASILLAS, C.E. & KAMMEN, D.M. 2012. Quantifying the social equity of carbon mitigation strategies. *Climate Policy,* 12(6):690-703.

CASLEY, D.J. & KUMAR, K. 1988. *The collection, analysis, and use of monitoring and evaluation data.* Baltimore, USA: The John Hopkins University Press.

CARTER, N. & CHILDS, M. 2018. Friends of the earth as a policy entrepreneur: "The Big Ask" campaign for a UK climate change act. *Environmental Politics,* 27(6):994-1013.

CECELSKI, E., DUNKERLEY, J. & RAMSAY, W. 2015. *Household energy and the poor in the Third World.* Routledge Revivals.

CHAN, S, BRANDI, C. & BAUER, S. 2016. Aligning transnational climate action with international climate governance: The road from Paris. *Review of European, Comparative & International Environmental Law, 2*5(2):238-247.

CHARLES, C.M. 1995. *Introduction to education research.* 2nd ed. San Diego: Longman

CHARMAZ, K. 2006. *Constructing grounded theory: a practical guide through qualitative analysis.* Thousand Oaks, CA: Sage.

CHEN, M-F. 2016. Extending the theory of planned behaviour model to explain people's energy savings and carbon reduction behavioural intentions to mitigate climate change in Taiwan-moral. *Journal of Cleaner Production,* 112:1746-1753.

CHIDIEBERE, O., CHIRWA, P.W., FRANCIS, J. & BABALOLA, F.D. 2016. *Conceptualising climate change in forest-based rural areas of South Africa: Community perceptions and*

attitudes. Pretoria, South Africa: Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria.

CHIDIEBERE, O., CHIRWA, P.W., FRANCIS, J. & BABALOLA, F.D. 2017. *Assessing vulnerability of rural communities to climate change: A review of implications for forest-based livelihoods in South Africa.* Pretoria, South Africa: Forestry and Agricultural Biotechnology Institute (FABI), University of Pretoria.

CHIDUMAYO, E.N. 2019. Is charcoal production in Brachystegia-Julbernadia woodlands of Zanbia sustainable? *Biomass and Bioenergy,* 125:1-7.

CHIDUMAYO, E.N. & GUMBO, D.J. 2013. The environmental impacts of charcoal production in tropical ecosystems of the world: A synthesis. *Energy for Sustainable Development,* 17(2):86-94.

CHILONGO, T. 2014. Livelihood strategies and forest reliance in Malawi. *Forests, Trees, Livelihoods,* 23(3):188-210.

CHINANGWA, L.L., PULLIN, A.S. & HOCKLEY, N. 2017. Impact of forest co-management programs on forest conditions in Malawi. *Journal of Sustainable Forestry,* 36(4):338-357.

CHINSEU, E., STRINGER, L. & DOUGILL, A. 2018. Policy integration and coherence for conservation agriculture initiatives in Malawi. *Sustainable Agriculture Research,* 7(4):51-62.

CHIRAMBO, D. 2018. Towards the achievement of SDG& in sub-Saharan Africa: creating synegies between power Africa, sustainable energy for all and climate finance in order to achieve universal energy access before 2030. *Renewable and Sustainable Energy Reviews,* 94:600-608.

CHIRAMBO, D. 2017. *Enhancing renewable energy deployment in Malawi through climate finance instruments: policy challenges and prospects*. Brandenburgische Technische Universitat Cottbus-Senfenberg.

CHIRAMBO, D. 2016. Addressing the renewable energy-financing gap in Africa to promote universal energy access: Integrated renewable energy financing in Malawi. *Renewable and Sustainable Energy Reviews,* 62:793-803.

CHIRWA, P.W., HAM, C., MAPHIRI, S.E. & MARLETT, B. 2010. Bioenergy use and food preparation practices of two communities in Eastern Cape Province of South Africa. *Journal of Energy in Southern Africa,* 21(4):26-31.

CHITAWO, M.L, CHIMPHANGO, A.F.A . & PETERSON, S.O. 2016. *Systems approach model for sustainable production of bioenergy from primary forest residues from Viphya plantations in Malawi.* 4th Annual System Dynamics Conference, 56.

CHONG, D. 2018. The sustainable development goals and climate change. *Social Alternatives,* 37(1):43-48.

CHOY, L.T. 2014. The strength and weaknesses of research methodology: Comparison and complimentary between qualitative and quantitative approaches. *Journal of Humanities and Social Sciences,* 19(4):99-104.

CLAR, C. & STEURER, R. 2019. Climate change adaptation at different levels of government: characteristics and conditions of policy change. *Natural Resource Forum,* 43:121-131.

CLASTRES, C. 2011. Smart grids: Another step towards competition, energy security and climate change objectives. *Energy Policy*, 39(9):5399-5408.

COLLIER, P., CONWAY, G. & VENABLES, T. 2008. Climate change and Africa. *Oxford Review of Economic Policy,* 24(2):337-353.

COLMAN, A. & PULFORD, B. 2006. *A crash course in SPSS for Windows.* Oxford: Blackwell.

CONNELLY, L.M. 2016. Trustworthiness in qualitative research. *Medsurg Nursing,* 25(6):435-437.

CONNOLLY-BOUTIN, L. & SMIT, B. 2016. Climate change, food security and livelihoods in sub-Saharan Africa. *Regional Environmental Change,* 16(2):385-399.

COOKE, P., KOHLN, G. & HYDE, W.F. 2008. Fuelwood, forest and community management: Evidence from household studies. *Environment and Development Economics,* 13: 103-135.

CORNER, A. & RANDALL, A. 2011. Selling climate change? The limitations of social marketing as a strategy for climate change public engagement. *Global Environmental Change,* 21(3):1005-1014.

COULIBALY, J.Y., MBOW, C., SILESHI, G.W., BEEDY, T., KUNDHLANDE, G. & MUSAU, J. 2015. Mapping vulnerability to climate change in Malawi: Spatial and social differentiation in the Shire river basin. *American Journal of Climate Change,* 4:282-294.

COVERT, T., GREENSTONE, M. & KNITTEL, C.R. 2016. Will we ever stop using fossil fuels? *Journal of Economic Perspectives,* 30(1):117-138.

CRATE, S.A. & NUTTALL, M. 2016. Introduction: Anthropology and climate change. *Anthropology and Climate Change,* 9-36.

CRESWELL, J.W. 2009. *Research design: qualitative, quantitative and mixed methods approaches.* 3rd ed. Los Angeles, USA: Sage.

CRESWELL, J.W. 2014. *Research design: qualitative, quantitative and mixed methods approaches.* 4th ed. Los Angeles, USA: Sage.

CRESWELL, J.W. & CLARK, V.L.P. 2011. *Designing and conducting mixed methods research*. 2nd ed. Los Angeles, USA: Sage.

CRESWELL, J.W. & CLARK, V.L.P. 2007. *Mixed methods research*. Thousand Oaks, USA: Sage.

CRESSWELL, J.W. & CRESWELL, J.D. 2018. Research design: qualitative, quantitative and mixed methods approaches. 5th ed. Thousand Oaks, CA: Sage.

CREUTZIG, F., AGOSTON, P., GOLDSCHMIDT, J.C., LUDERER, G., NEMET, G. & PIETZCKER, R.C. 2017. The underestimated potential of solar energy to mitigate climate change. *Nature Energy*, 2(9):17140.

CREUTZIG, F. 2016. Economic and ecological views on climate change mitigation with bioenergy and negative emissions. *GCB Bioenergy,* 8(1):4-10.

CRIVITS, M., PAREDIS, E., BOULANGER, P-M., MUTOMBO, E.J.K., BAULER, T. & LEFIN, L. 2010. Scenarios based on sustainability discourses: Constructing alternative consumption and consumer perspectives. *Futures,* 42(10):1187-1199.

CROCKER, L. & ALGINA, J. 1986. *Introduction to classical and modern test theory*. Philadelphia, USA: Harcourt Brace Jovanovich College Publishers.

CRONKLETON, P., ARTATI, Y., BARAL, H., PAUDYAL, K., BANJANE, M.R., LIU, J.L., TU, T.Y., PUTZEL, L, BIRHANE, E. & KASSA, H. 2017. How do property rights reforms provide incentives for forest landscape restoration? Comparing evidence fron Nepal, China and Ethiopia. *International Forestry Review,* 19(4):8-23.

CURRIER, A. & LEWIS, R. 2015. *Predicting at-risk areas of deforestation in Malawi*. Atlas of Maine (2) 6, USA: Environmental Studies, Colby College Waterville.

DAGNACHEN, A.G., LUCAS, P.L., HOF, A.F. & VUUREN, D.P. 2018. Trade-offs and synergies between universal electricity access and climate change mitigation in sub-Saharan Africa. *Energy Policy,* 114:355-366.

DAGNACHEN, A.G., LUCAS, P.L., HOF, A.F., GERNAAT, D.E.H.J., BOER, H.-S. & VUUREN, D.P. 2017. The role of decentralized systems in providing universal electricity access in sub-Saharan Africa- A model-based approach. *Energy*, 139:184-195.

DAMELIO, M., GARRONE, P. & PISCITELLO, L. 2016. Can multinational enterprises light up developing countries: Evidence from the access to electricity in sub-Saharan Africa*. World Develop*ment, 88:12-32.

DAS, I., JAGGER, P. & YEATTS, K. 2017. Biomass cooking fuels and health outcomes for women in Malawi. *Ecohealth,* 14(1):7-19.

DASAPPA, S. 2011. Potential of biomass energy for electricity generation in sub-Saharan Africa. *Energy for Sustainable Development*, 15(3):203-213.

DATTA, C. 2018. Fuelwood collection: A time consuming and risky work in the forest-fringe area of Garumara and Jaldapara national park, Duars, West Bengal, India. *International Journal of Innovative Knowledge Concepts,* 6(6):91-96.

DAUENHAUER, P. 2015. *Programme impact overview: Malawi renewable energy acceleration programme (MREAP) report.* Glasgow: University of Strathclyde.

DAVIDSON, D. 2016. Gaps in agricultural climate adaptation research. *Nature Climate Change,* 6(5):433.

DAVIES, I. & SILCOCK, D. 2015. Pragmatism and Consumer Research. *Advances in Consumer Research,* 43:212-217.

DECHEZLEPRETRE, A., GLACHANT, M., HASCIC, I., JOHNSTONE, N. & MENIERE, Y. 2011. Invention and transfer of climate change–mitigation technologies: A global analysis. *Review of Environmental Economics and Policy,* 5(1):109-130.

DEGRAFF, D.S., LEVISON, D. & DUNGUMARO, E.W. 2017. Environmental chores, household time use, and gender in rural Tanzania. *Gender and Time Use in a Global Context*, 407-434.

DEICHMANN, U., MEISNER, C., MURRAY, S. & WHEELER, D. 2011. The economics of renewable energy expansion in rural sub-Saharan Africa. *Energy Policy,* 39:2150227.

DELIENS, T., DEFORCHE, B., BOURDEAUDHUJI, I.D. & CLARYS, P. 2015. Determinants of physical activity and sedentary behavior in universitystudents: a qualitative study using focus group discussions. *BMC Public Health,* 15(1):201.

DENSCOMBE, M. 2008. Communities of practice: A research paradigm for mixed methods approach. *Journal of Mixed Methods Research,* 2(3):270-283.

DEVEREUX, S. 2015. *Social protection for enhanced food security in sub-Saharan Africa.* Brighton, UK: United Nations Development Programme Institute of Development Studies.

DEVEREUX, S. 2006. *The impact of droughts and floods on food security and policy options to alleviate negative effects*. Institute of Development Studies. University of Sussex, Brighton, UK.

DE VOS, A.S., STRYDOM, H., FOUCHE, C.B. & DELPORT, C.S.L. 2005. *Research at grassroots: for the social sciences and human science professions.* Pretoria, South Africa: Van Schaik.

DIMITROV, R.S. 2016. The Paris Agreement on climate change: Behind closed doors. *Global Environmental Politics,* 16(3):1-11.

DIPROSE, K., LIU, C., VALENTINE, G., VANDERBECK, R.M. & MCQUAID, K. 2019. Caring for the future: Climate change and intergenerational responsibility in China and the UK. *Geoforum,* 105:158-167.

DONG, C., DONG, X., JIANG, Q., DONG, K. & LIU, G. 2018. What is the probability of achieving the carbon dioxide emission targets of the paris agreement? Evidence from the top ten emitters. *Science of the Total Environment,* 622:1294-1303.

DUBOIS, G., SOVACOOL, B., AALL, C., NILSSON, M., BARBIER, C., HERRMANN, A., BRUYERE, S., ANDERSSON, C., SKOLD, B., NADAUD, F., DORNER, F., MOBERG, K.R., CERON, J.P., FISCHER, H., AMELUNG, D., BALTRUSZEWICZ, M.M., FISCHER, J., BENEUISE, F., LOUIS, V.R. & SAVERBORN, R. 2019. It starts at home? Climate policies targeting household consumption and behavior decisions are key to low-carbon futures. *Energy Research and Social Science,* 52:144-158.

DUMENU, W.K. & OBENG, E.A. 2016. Climate change and rural communities in Ghana: social vulnerability, impacts, adaptations and policy implications. *Environmental Science and Policy,* 55:208-217.

DU BRANDT, I.M. 2016. *The influence of external stimuli on consumers' experiential value perceptions of interior retail outlets*. Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria. [Online] Available from: http://hdl.handle.net/2263/53486 [Accessed: 2018-08-12].

EALES, A. & UNYOLO, B. 2018. *Renewable energy mini-grids in Malawi: status, barriers and opportunities*. Glasgow: University of Strathclyde.

EALES, A., FRAME, D., DAUENHAUER, P., KAMBOMBO, B. & KAMANGA, P. 2017. *Electricity access options appraisal in Malawi: Dedza district case study.* Paper presented at the 2017 IEEE PES Power Africa Conference: Harnessing Energy, Information and Communications Technology (ICT) for Affordable Electrification of Africa - GIMPA Conference Centre, Accra, Ghana. 27 June 2017.

EBERHARD, A., GRATWICK, K., MORELLA, E. & ANTMANN, P. 2017. Accelerating investments in power in sub-Saharan Africa. *Nature Energy, 2:*17005.

EBHOTA, W.S. & INAMBAO, F.L. 2017. Facilitating greater energy acces in rural and remote areas of sub-Saharan Africa: Small hydropower. *Energy and Environment,* 28(3):316-329.

EBHOTA, W. & TABAKOV, P.Y. 2017. Hydropower potentials and effects of poor manufacturing infrastructure on small hydropower development in sub-Saharan Africa. *International Journal of Energy Economics and Policy,* 60-67.

EGERU, A., KATEREGGA, E. & MAJALIWA, G.J.M. 2014. Coping with fuelwood scarcity in Sonti district of Eastern Uganda. *Open Journal of Forestry,* 4(1):70-74.

EINSIEDEL, E.F., BOYD, A.D., MEDLOCK, J. & ASHWORTH, P. 2013. Assessing socio-technical mindsets: Public deliberations on carbon capture and storage in the context of energy sources and climate change. *Energy Policy,* 53:149-158.

EKHOLM, T, KREY, V, PACHAURI, S. & RIAHI, K. 2010. Determinants of household energy consumption in India*. Energy Policy,* 38(10):5696-5707.

ELLEGARD, K. & PALM, J. 2011. Visualizing energy consumption activities as a tool for making everyday life more sustainable. *Applied Energy,* 88 (5):1920-1926.

ELLIS, F. 2000. *Rural livelihoods and diversity in developing countries.* Oxford: Oxford University.

ELLIS, J., WINKLER, H., CORFEE-MORLOT, J., & GAGNON-LEBRUN, F. 2007. CDM: Taking stock and looking forward. *Energy Policy,* 35:15-28.

EMERSON, R.W. 2015. Convenience sampling, random sampling, and snowball sampling: How does sampling affect the validity of research? *Journal of Visual Impairment and Blindness,* 109(2):164-168.

ERIKSEN, S. & BROWN, K. 2011. Sustainable adaptation to climate change. *Climate and Development,* 3(3-6). https://doi.org/10.3763/cdev.2010.0064

EVANS, D., WELCH, D. & SWAFFIELD, J. 2017. Constructing and mobilizing 'the consumer": Responsibility, consumption and the politics of sustainability. *Environment and Planning,* 49(6):1396-1412.

FANDOHAN, A.B. 2016. Domesticating and conserving indigenous tree species: an ecosystem based approach for adaptation to climate change in sub-saharan Africa. *Sciences de la vie, de la terre et Agronomie,* 3(1).

FALCHETTA, G., KASAMBA, C. & PARKINSON, S.C. 2020. Monitoring hydropower reliability in Malawi with satellite data and machine learning. *Environmental Research letters*. 014011. IOP publishing DOI:10.1088/1748-9326/ab6562

FAO (Food and Agriculture Organization of the United Nations). 2018. *Sustainable management of Miombo woodlands: food security, nutrition and wood energy*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO (Food and Agriculture Organization of the United Nations). 2017. *Greening Zambia's charcoal business for improved livelihoods and forest management through strong producer groups*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO (Food and Agriculture Organization of the United Nations). 2015. *Country fact sheet on food and agriculture policy trends Malawi. Food and agriculture policy decision analysis*. Rome, Italy: Food and Agriculture Organization of the United Nations. [Online] Available from: http://www.fao.org/3/a-i4491e.pdf [Accessed: 2017-06-28].

FAO (Food and Agriculture Organization of the United Nations). 2010. *Country report Malawi: forest resources*. Rome, Italy: Food and Agriculture Organization of the United Nations. [Online] Available from: www.fao.org/docrep/004/ab585e/AB585E04.htm [Accessed: 2018-08-18].

FAO (Food and Agriculture Organization of the United Nations). 2009. A*n integrated approach to improve the management of forests and other natural resources: The case of Malawi*. Forest Management working paper. Rome, Italy: Food and Agriculture Organization of the United Nations. [Online] Available from: www.fao.org/tempref/docrep/fao/011/k4850e/k4850e00.pdf [Accessed: 2015-09-20].

FAO (Food and Agriculture Organization of the United Nations). 1993. *More than wood. Special options on multiple use of forests*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FALCAO, M.P. 2008. *Charcoal production and use in Mozambique, Malawi, Tanzania and Zambia, historical overview, present situation and outlook*. In: Kwashick, R. (ed.) Paper presented at Conference on Charcoal and Communities in Africa. Maputo, Mozambique. 16-18 June 2008.

FALCAO, M.P. 2005. *Policy impact on stakeholder benefits and resource use and conservation in Mozambique: the case study of MOFLOR forest concession area and Pindanganga community area*. Unpublished doctoral thesis. Stellenbosch, South Africa: University of Stellenbosch.

FELTON, J. & SIACHIWENA, H. 2018. *Climate change, government management pose challenges in agriculture-dependent Malawi.* Afrobarometer.

FERREIRA, D., MARX-PIENAAR, N.J.M.M. & SONNENBERG, N.C. 2016. Post-modern consumers' consciousness of climate change and actions that could mitigate unsustainable consumption. *Journal of Family Ecology and Consumer Studies (Special Edition),* 1:13-24.

FERREIRA, D. 2014. *An exploratory investigation into Tshwane postmodern consumers' consciousness and practices that relate to sustainable food procurement*. Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria.

FIELD, A. & MILES, J. 2010. *Discovering statistics using SAS*. Newcastle, UK: Sage.

FLICK, V. 2015. *Introducing research methodology: a beginner's guide to doing a research project.* 2nd ed. Berlin, Germany: Sage.

FIORENZA, S., HOOR, J., MALCOMB, D. & MAO, G. 2011. *International development aid in Malawi*. In: Weaver, C. & Peratsakis, C. (eds). Climate change and development in Africa. Students Working Paper #5. Austin, Texas: The Robert Strauss Centre for International Security and Law.

FIORENZA, S., JANGDA, H., MALCOMB, D. & MAO, G. 2013. *International development aid in* Malawi. In: WEAVER, C. & PERATSAKIS, C. (Eds.). *Climate change and African political stability student working paper series*, 05 (pp.18-29). The Robert S. Strauss Centre for International Security and Law. [Online] Available from: http://www.dtic.mil/dtic/tr/fulltext/u2/a613139.pdf https://www.usaid.gov/malawi/environment [Accessed: 2015-06-12].

FISHER, M., ABATE, T., LUNDUKA, R.W., ASNAKE, W., ALEMAYEHU, Y. & MADULU, R.B. 2015. Drought tolerant maize for farmer adaptation to drought in sub-Saharan Africa: Determinant of adoption in Eastern and Southern Africa. *Climatic Change,* 133:283-299.

FISHER, M., CHAUDHURY, M., & McCUSKER, B. 2010. Do forests help rural households adapt to climate variability: evidence from southern Malawi. *World Development,* 38(9):1241-1250. ISSN: 0305-750X.

FLORINI, A. & SOVACOOL, B.K. 2011. Bridging the gaps in global energy governance: A review of multilateralism and international organizations. *Global Governance: A Review,* 17(1):57-74.

FOELL, W., PACHAURI, S., SPRENG, D. & ZERRIFFI, 2011. Household cooking fuels and technologies in developing economies. *Energy Policy,* 39(12):7487-7496.

FOUQUET, R. 2016. Historical energy transitions: speed, prices and system transformation. *Energy Research and Social Science,* 22:7-12.

FREDERIKS, E.R., STENNER, K. & HOBMAN, E.V. 2015. Household energy use: applying behavioural economics to understand consumer decision-making and behaviour. *Renewable and Sustainable Energy Reviews,* 41:1385-1394.

FREEDMAN, M. & JAGGIE, B. 2005. Global warming, commitment to the Kyoto Protocol, and accounting disclosures by the largest global public firms from polluting industries. *The International Journal of Accounting,* 40:215-232.

FRICKER, R.D, KULZY, W.W. & APPLEGET, J.A. 2012. *From data to information; using factor analysis with survey data*: 1-12. [Online] Available from:

https://vtechworks.lib.vt.edu/bitstream/handle/10919/73891/Fricker-Kulzy-ApplefetPha/anxArticle.pdf?sequence=1 [Accessed: 2016-08-18].

FUDGE, S. & PETERS, M. 2011. Behaviour change in the UK climate debate: An assessment of responsibility agency and political dimensions. *Sustainability*, 3(16):789-808.

FUGARD, A.J.B. & POTTS, H.W.W. 2015. Supporting thinking on sample sizes for thematic analyses: a quantitative tool. International *Journal of Social Research Methodolody,* 18(6):669-684.

FUSCH, P.T. & NESS, L.R. 2015. Are we there yet? Data saturation in qualitative research. *The Qualitative Report*, 9(1):1408-1418.

FUSSEL, H.-M. 2010. How inequitable is the global distribution of responsibility, capability and vulnerability to climate change: a comprehensive indicator-based assessment. *Global Environmental,* 20(4):597-611.

GADENNE, D., SHARMA, B., KERR, D., & SMITH, T. 2011. The influence of consumers' environmental beliefs and attitudes in energy saving behaviour. *Energy Policy,* 39(12):7684-7694.

GABRIEL, Y. & LANG, T. 1995*. The unmanageable consumer*. Thousand Oakes, USA: Sage.

GAGNON-LEBRUN, F. & AGRAWALA, S. 2006. *Progress on adaptation to climate change in developed countries: an analysis of broad trends*. Paris, France: Organization for Economic Co-operation and Development (OECD).

GAMULA, G.E.T., HUI, L. & PENG, W. 2013. An overview of the energy sector in Malawi. *Energy and Power Engineering*, 5:8-17.

GASPAR, R. & ANTUNES, D. 2011. Energy efficiency and appliance purchases in Europe: Consumer profiles and choice determinants. *Energy Policy*, 39:7335-7346.

GAUNTLETT, D. 2002. *Media, gender and identity*. London, UK: Routledge.

GEIGER, S.M., FISCHER, D. & SHRADER, U. 2018. Measuring what matters in sustainable consumption: an integrative framework for the selection of relevant behaviours. *Sustainable Development, 2*6:18-33.

GETU, M. & MULINGE, M.M. (ed). 2013. *Impacts of climate change and variability on pastoralist women in sub-Saharan Africa.* Kampala, Uganda: OSSREA Fountain Publishers.

GIBSON, C., HEAD, L., GILL, N. & WAITT, G. 2010. Climate change and household dynamics: beyond consumption, unbounding sustainability. *Royal Geographical Society,* 36:3-8.

GIDDENS, A. 1983. *Profiles and critiques in social theory*. Berkeley, CA: University of California Press.

GIDDENS, A. 1984. *The constitution of society*. Cambridge, UK: Polity Press.

GIDDENS, A. 1985. *Capitalism and modern social theory: an analysis of the writings of Karl Marx, Emile Durkheim and Max Weber.* Cambridge, UK: Cambridge University Press.

GIDDENS, A. 1986. *The constitution of society: outline of the theory of structuration.* Cambridge, UK: Polity Press.

GIFFORD, R. & COMEAU, L.A. 2011. Message framing influences perceived climate change competence, engagement and behavioural intentions. *Global Environmental Change,* 21:1301-1307.

GIFFORD, R., KORMOS, C. & MCINTYRE, A. 2011. Behavioural dimensions of climate change: drivers, responses, barriers and interventions. *WIREs Climate Change,* 2:801-827.

GIRDIS, D. & HOSKOTE, M. 2005. *Malawi: rural energy and institutional development Energy Sector Management Assistance Program (ESMAP)*. Washington, D.C. U.S.A.: World Bank Group (US). [Online] Available from: https://www.esmap.org/sites/esmap.org/files/06905.Malawi%20Rural%20Energy%20and%20Institutional.pdf [Accessed, 2014-09-25].

GLEMAREC, Y. 2012. Financing off-grid sustainable energy access for the poor. *Energy Policy,* 47:87-93.

GLESNE, C. & PESHKIN, P. 1992. *Becoming qualitative researchers: An introduction.* White Plains, New York, USA: Longman.

GOLDSMITH, E.B. & GOLDSMITH, R.E. 2011. Social influence and sustainability in households. *International Journal of Consumer Studies,* 35(2):117-121.

GONZALEZ-EGUINO, M. 2015. Energy poverty: An overview. *Renewable and Sustainable Energy Reviews,* 47:377-385.

GOODMAN, S.N., FANELLI, D. & LOANNIDIS, J.P.A. 2016. What does research reproducibility mean? Perspective, 8(341):1-6.

GOSENS, J., HEDENUS, F & SANDÉN, B.A.2017. Faster market growth of wind and PV in late adopters due to global experience build-up, *Energy* 131: 267-278,

GOSSLING, S. & BUCKLEY,R. 2016. Carbon labels in tourism: persuasive communication? Journal of Cleaner Production 111: 358 – 369.

GOVERNMENT OF MALAWI. 2003. *National Energy Policy for Malawi.* Ministry of Energy and Mining, Lilongwe, Malawi.

GOVERNMENT OF MALAWI. 2018. *Integrated household survey 2010-2011.* Lilongwe, Malawi: Government of Malawi.

GOVERNMENT OF MALAWI. 2017. *The Malawi Growth and Development Strategy (MGDS) iii (2017-2022). Building a productive, competitive and resilient nation*. Lilongwe, Malawi: Government of Malawi.

GOVERNMENT OF MALAWI MALAWI GROWTH DEVELOPMENT STRATEGY (MGDS III): 2017-2022, 2018. [Online] Available from: https://www.afidep.org/resource-centre/downloads/policy-guidelines/malawi-growth-development-strategy-mgds-iii-2017-2022/.

GOVERNMENT OF MALAWI. 2009. *Malawi biomass energy strategy*. Lilongwe, Malawi: Government of Malawi.

GOVERNMENT OF MALAWI. 2003. *National energy policy for Malawi.* Lilongwe, Malawi: Ministry of Energy and Mining.

GOVERNMENT OF MALAWI. 2001. "*Country presentation: Malawi*." Paper presented at the Third United Nations Conference on the Least Developed Countries, Brussels, Belgium, 14-20 May 2001.

GRAM-HANSSEN, K. 2010. Standby consumption in households analysed with a practice theory approach. *Journal of Industrial Ecology,* 14(1):150-165.

GRAM-HANSSEN, K., BARTIAUX, F., JENSEN, O.M. & CANTAERT, M. 2007. Do homeowners use energy labels? A comparison between Denmark and Belgium. *Energy Policy,* 35(5):2879-2888.

GRANEHEIM, U.H., LINDGREN, B-M. & LUNDMAN, B. 2017. Methodological challenges in qualitative content analysis: a discussion paper. *Nurse Education Today,* 56:29-34.

GRASHAM, C.F., KORZENEVICA, M. & CHARLES, K.J. 2019. On considering climate resilence in urban water security: a review of the vulnerability of the urban poor in sub-Saharan Africa. *Wiley Interdisciplinary Reviews,* Water 6(3):e1344.

GRIESHOP, A.P., MARSHALL, J.D. & KANDLIKAR, M. 2011. Health and climate benefits of cook stove replacement options. *Energy Policy,* 39(12):7530-7542.

GRIMM, M., MUNYEHIRWE, A., PETERS, J.E. & SIEVERT, M. 2016. A first step up the energy ladder: Low cost solar kits and households' welfare in rural Rwanda. *The World Bank Economic Review,* 31(3):631-649.

GRINNEL, R.M. 2001. *Social work research and evaluation: quantitative and qualitative approaches.* Itasca, Illinois, USA: Peacock.

GROENING, C., SARKIS, J. & ZHU, Q. 2018. Green marketing consumer-level theory review: a compendium of applied theoris and further research direction. *Journal of Cleaner Production,* 172:1848-1866.

GRONHOJ, A. & THOGERSEN, J. 2011. Feedback on household electricity consumption: learning and social influence processes. *International Journal of Consumer Studies,* 35(2):138-145.

GROS, C., BAILEY, M., SCHWAGER, S., HASSAN, A., ZINGG, R., UDDIN,M.M., SHAHJAHAN, M., ISLAM, H., LUX,S., JAIME, C. & PEREZ, E.C. 2019. Household-level effects of providing forecast-based cash in anticipation of extreme weather events: Quasi-experimental evidence from humanitarian interventions in the 2017 floods in Bangladesh. *International journal of Disaster Risk Reduction.* 41: 1-11 (101275)

GROSSMAN, P.Z. 2019. Utilizing Ostrom's institutional analysis and developemt framework towards an understanding of crisis-driven policy. *Policy Sciences,* 52(1):3-20.

GRUBB, M., VROLIJK, C. & BRACK, D. 2018. *Routledge revivals: Kyoto Protocol (199): A guide and assessment*. Routledge

GRUBB, M.J., HOPE, C. & FOUQUET, R. 2002. Climate implications of the Kyoto Protocol: The contribution of international spillover. *Climatic Change,* 54(2):11-28.

GUILD, J. & SHACKLETON, C.M. 2018. Informal urban fuelwood markets in South Africa in the context of socio-economic change. *Energy Policy,* 117:136-141.

GUJBA, H., THORNE, S., MULUGETTA, Y., RAI, K. & SOKONA, Y. 2012. Financing low carbon energy access in Africa. *Energy Policy,* 47:71-78.

GUMBO, D.J., DUMAS-JOHANSEN, M., MUIR, G., BOERSTLER, F. & ZUZHANG, X. 2018. *Sustainable management of Miombo woodlands: food security, nutrition and wood energy.* Food and Agriculture Organization of the United Nations (FAO), Rome

GUTA, D.D. 2014. Effect of fuelwood scarcity and socio-economic factors on household bio-based energy use and energy substitution in rural Ethiopia. *Energy Policy,* 75:217-227.

GWAVAUYA, S.G., ABELE, S., BARFUSS, I., ZELLER, M. & MULLER, J. 2012. Household energy economics in rural Ethiopia: A cost benefit analysis of biogas energy. *Renewable Energy,* 48:202-209.

GWENZI, W., CHAUKURA, N., MUKOME, F.N.D., MACHADO, S. & NYAMASOKA, B. 2015. Biochar production and applications in sub-Saharan Africa: Opportunities, constraints, risks and uncertainities. *Journal of Environmental Management:* 150:250-261.

HAFNER, M., TAGLIAPIETRA, S., FALCHETTA, G. & OCCHIALI, G. 2019. Renewables for energy access and sustainable development in East Africa. Springer briefs in Energy. http://www.springer.com/seriess/8903HAILU, Y.G. 2012. Measuring and monitoring energy access: Decision-support tools for policymakers in Africa. *Energy Policy,* 47(1):56-63.

HALLEGATE, S. 2009. Strategies to adapt to an uncertain climate change. *Global Environmental Change,* 19(2):240-247.

HAK, T., JANOUSKOVA, S. & MOLDAN, B. 2016. Sustainable development goals: a need for relevant indicators. *Ecological Indicators*, 60:565-573.

HANCOCK, K.J. 2015. The expanding horizon of renewable energy in sub-Saharan Africa: Leading research in the socialisation. *Energy Research and Social Science,* 5:1-8.

HAO, Y., CHEN, H., WEI, Y-M. & LI, Y-M. 2016. The influence of climate change on CO2(carbon dioxide) emissions: An empirical estimation based on Chinese provincial panel data. *Journal Of Cleaner Production,* 131:667-677.

HARDY, B., CORNELIS, J-T., HOUBEN, D., LAMBERT, R. & DUFEY, J.E. 2016. The effect of pre-industrial charcoal kilns on chemical propertied of forest soil of Wallonia, Belgium. *European Journal of Soil Science,* 67(2):206-216.

HARGAARD, M. 1997. *The constitution of power: a theoretical analysis of power.* Manchester, UK: Manchester University Press.

HELTBERG, R., SIEGEL, P.B. & JORGENSEN, S.L. 2009. Addressing human vulnerability to climate change: towards a 'no-regrets' approach. *Global Environmental Change,* 19(1):89-99.

HELTBERG, R. 2005. Factors determining household fuel choice in Guatemala. *Environment and Development Economics* 10:337–61.

HELTBERG, R. 2003. *Household fuel and energy use in developing countries – a multi-country study.* Washington DC, USA: World Bank.

HENDERSON, B., GOLUB, A., PAMBUDI, D., HERTEL, T., GODDE, C., HERRERO, M., CACHO, O. & GERBER, P. 2017. The power and pain of market-based carbon policies: A global application of greenhouse gases from ruminant livestock production. *Mitigation and Adaptation Strategies for Global Change,* 23(3):349–369.

HIEMSTRA-VAN DER HORST, G. & HOVORKA, A.J. 2009. Reassessing the "the energy ladder": Household energy use in Maun, Botswana. *Energy Policy*, 36(9):3333-3344.

HILTON, C.E. 2017. The importance of pretesting questionnaires: a field research example of cognitive pretesting the exercise referral quality of life scale (ER-QLS). *International Journal of Social Research Methodology,* 20(1):21-34.

HITZ, S. & SMITH, J. 2004. Estimating global impacts from climate change. *Global Environmental Change,* 14(3):201-218.

HOBSON, K. 2003. Thinking habits into action: the role of knowledge and process in questioning household consumption practices. *Local Environment: The International Journal of Justice and Sustainability*, 8(1):95-112.

HOEL, M.O., KITTELSEN, S.A.C.& KVERNDOKK, S. 2019. Correcting the climate externality: Paretomimprovements across generations and regions. *Environmental and Resource Economics,* 74(1):449-472.

HOUGHTON, J. 2009. Global warming, climate change and sustainability. Challenge to scientists, policy makers and Christians. Briefing paper 14*. The John Ray Initiative,* 1-16.

HUANG, M.-H. & RUST, R.T. 2011. Sustainability and consumption. *Journal of Academy of Marketing Science,* 39:40-54.

HUI, L. & PENG, W. An overview of the energy sector in Malawi. *International Journal of Sustainable Energy Development,* 3(1):115-126.

HUSSEIN, A. 2009. The use of triangulation in social sciences research: Can qualitative and quantitative methods be combined? *Journal of Comparative Social Work,* 1-12.

HUSSEIN, Z., HERTEL, T. & GOLUB, A. 2013. Climate change mitigation policies and poverty in developing countries. *Environmental Research Letters,* 8(3):1- 10.

IBRAHIM, Y.Z., BALZTER, H. & KADUK, J. 2018. Land degradation continues despite greening in the Nigeria-Niger border region. *Global Ecology and Conservation,* 16:e00505.

IFEGBESAN, A.P., RAMPEDI, I.T. & ANNEGARN, H.J. 2016. Nigerian households' cooking energy use, determinants of choice, and some implications for human health and environmental sustainability. *Habitat International,* 55:17-24.

IIASA 2005. *Model for energy supply strategy alternatives and their general environmental impact (MESSAGE). model description*. [Online] Available from: http://www.iiasa.ac.at/Research/ESS/docs/models.html#MESSAGE>www.iiasa.ac.at/Research/ECS/docs/models.html/#MESSAGE [Accessed: 2014-08-24].

IIASA, 1998. *Global energy perspectives international institute for applied systems analysis, World Energy Council joint study*. Cambridge, UK: Cambridge University Press.

IKEJEMBA, E.C.X., MPUAN, P.B., SCHUUR, P.C. & VAN HILLEGERSBERG, J. 2017. The empirical reality and sustainable management failures of renewable energy projects in sub-Saharan Africa (part 1 of 2). *Renewable Energy,* 102(Part A):234-240. [Online] Available from: http://10.1016/j.renene.2016.10.037 Ikejemba2017empirical open [Accessed 2019-08-25].

IKEJEMBA, E.C.X., MPUAN, P.B., SCHUUR, P.C. & VAN HILLEGERSBERG, J. 2017. Failures and generic recommendations towards the sustainable management of renewable energy projects in sub-Saharan Africa (part 2 of 2). *Renewable Energy,* 102:234-240.

IIYAMA, M., NEUFELDT, H., DOBIE, P., NJENGA, M., NDEGWA, G. & JAMNADASS, R. 2014. The potential of agroforestry in the provision of sustainable wood fuel in sub-Saharan Africa. *Current Opinion in Environmental Sustainability,* 6:138-147.

IIYAMA, M., NEUFELDT, H., DOBIE, P., NJENGA, M., NDEGWA, G. & JAMNADASS, R. 2014. The potential of agroforestry in the provision of sustainable woodfuel in sub-Saharan Africa. *Current Opinion in Environmental Sustainability,* 6:138-147.

IMF (International Monetary Fund). 2016. *Financial development in sub-Saharan Africa. Promoting inclusive and sustainable growth*. African Department.

INGLESI-LOTZ, R. & DOGAN, E. 2018. The role of renewable versus non-renewable energy to the level of CO2 emissions a panel analysis of sub-Saharan africa's Big 10 electricity generators. *Renewable Energy,* 123:36-43.

INTERNATIONAL ENERGY AGENCY. 2010. *World energy outlook.* OECD/IED. Paris, France: International Energy Agency.

INTERNATIONAL ENERGY AGENCY (IEA) 2017. *World energy outlook*. Available at: www.eia.gov/ieo (Accessed: 2018-08-12).

INVIDIATA, A. & GHISI, E. 2016. Impact of climate change on heating and cooling energy demand in houses in Brazil. *Energy and Buildings,* 130:20-30.

ISHAYA, S. & ABAJE, I.B. 2008. Indigenous people's perception on climate change and adaptation strategies in Jema's local government area of Kaduna state, Nigeria. *Journal of Geography and Regional Planning,* 1(8):138-143.

JACKSON, T. 2005. *Motivating sustainable consumption: a review of evidence on consumer behaviour and behavioural change*. Sustainable Development Research Network. Centre for Environmental Strategy. Surrey, UK: University of Surrey.

JAGGER, P., PEDIT, J., BITTNER, A., HAMRICK, L., PHWANDAPHWANDA, T. & JUMBE, C. 2017. Fuel efficiency and air pollutant concentrations of wood-burning improved cookstoves in Malawi: Implications for scaling-up cookstove programs. *Energy for Sustainable Development,* 41:112-120.

JAGGER, P. & PEREZ-HEYDRICH, C. 2016. Land use and household energy dynamics in Malawi. *Environmental Research Letters,* 11(12).

JAGGER, P. & JUMBE, C. 2016. Stoves or sugar? Willingness to adopt improved cook stoves in Malawi. *Energy Policy, 92(cc):409-419.*

JANTUNEN, M.J., KATSOUYANNI, K., KNOPPEL, H., KUENZLI, N., LEBRET, E., MARONI, M., SAARELA, K., SRAM, R. & ZMIROU, D. 1999. *Final report. Air pollution exposure in European cities: the EXPOLIS study*. Kupio, Finland: Kuopion Yliopiston Painatuskeskus.

JANTUNEN, M., JAAKKOLA, J.J.K. & KRZYZANOWSKI, M. 1997. *Assessment of exposure to indoor pollutants*. European Series, 78. WHO Regional Publications.

JAVADI, F.S., RISMANCHI, B., SARRAF, M., AFSHAR, D., SAIDUR, R., PING, H.W. & RAHIM, N.A. 2013. Global policy of rural electrification. *Renewable and Sustainable Energy Reviews,* 19:402-416.

JIANG, L. & HARDEE, K. 2011. How do recent population trends matter to climate change? *Population Research and Policy Review,* 30(2):287-312.

JIMU, L., MATARUSE, L., MUSEMWA, L. & NYAKUDYA, I.W. 2017. The miombo ecoregion up in smoke: the effect of tobacco curing. *World Development Perspectives,* 5:44-46.

JOHNSON, N.G. & BRYDEN, K.M. 2012. Factors affecting fuelwood consumption in household cook stove in an isolated rural West African village. *Energy,* 46(1):310-321.

JOHNSON, R.B. & ONWUEGBUZIE, A.J. 2004. Mixed methods research: A research paradigm whose time has come. *Educational Researcher,* 33(7):14-26.

JOHNSTON, S., MATARE, D., PETTERSEN, D., MUMBA, R., PULLANIKKATIL, D., ZACHARY, S. & KARIMI, N. 2018. *Kenya-Malawi biomass energy project summary report*. School of Interdisciplinary Studies.

JONES, M.R. & KARSTEN, H. 2008. Giddens' structuration theory and information systems research. *MIS Quarterly,* 32(1):127-157.

JONES, D., RYAN, C.M. & FISHER, J. 2016. Charcoal as a diversification strategy: The flexible role of charcoal production in the livelihoods of smallholders in Central Mozambique. *Energy for Sustainable Development,* 32:14-21.

JOPPE, M. 2000. *The research process*. Brighton, UK: University of Brighton. [Online] Available from: http://www.ryetson.ca/~mjoppe/rp.htm [Accessed: 2014-08-16].

JUMBE, C.B.L. 2004. Cointegration and causality between electricity consumption and GDP: Empirical evidence from Malawi. *Energy Economics,* 26(1):61-68.

JUMBE, C.B.L. & ANGELSEN, A. 2011. Modelling choice of fuelwood source among rural households in Malawi: A Multinomial probit analysis. *Energy Economics,* 33(5):732-738.

KACHALE MCHAKULU, M.G., ERASMUS, A.C. & SONNENBERG, N.C. 2019. The sustainability of rural Malawi households'energy consumption practices amidst prevailing socio-economic conditions. Journal of Consumer sciences 47: 71-91 ISSN 0378-5254

KAHSAI, M.S., NONDO, C., SCHAEFFER, P.V. & GEBREMEDHIN, T.G. 2017. Income level and the energy consumption – GDP nexus: Evidence from sub-Saharan Africa. *Energy Economics*, 34:739-746.

KAKOTA, T., NYARIKI, D., MKWAMBISI, D. & KOGI-MAKAU, W. 2011. Gender vulnerability to climate variability and food insecurity. *Climate and Development,* 3:298-309.

KALAME, F.B., NKEM, J., IDINOBA, M. & KANNINEN, M. 2009. Matching national forest policies and management practices for climate change adaptation in Burkina Faso and Ghana. *Mitigation and Adaptation Strategies for Global Change,* 14:135–151. [Online] Available from: https://cgspace.cgiar.org/handle/10568/19984 [Accessed: 11 June 2017].

KALUMIANA, O.J. 2003. *Country data validation: Zambia*. Nairobi, Kenya: AFREPREN/FWD.

KALUMIANA, O.J. 2000. *Charcoal consumption and transportation: energy subcomponent of the Zambia CHAPOSA Study*. Paper presented for discussion at the Second CHAPOSA Annual Workshop. Morogoro, Tanzania, 2-4 April 2000. [Online] Available from: http://www.sei.se/chaposa/documents/chrc_cons_transp.pdf [Accessed: 2014-10-23].

KANAGAWA, M. & NAKATA, T. 2007. Analysis of the energy access improvement and its socio-economic impacts in rural areas of developing countries. *Ecological Economics,* 62(2):319-329.

KAREKEZI, S. & KITHYOMA, W. 2002. Renewable energy strategies for rural Africa: Is a PV-led renewable energy strategy the right approach for providing modern energy for the rural poor of sub-Saharan Africa? *Energy Policy,* 30:1071-1086.

KARIMU, A, ASIEDU, E. & ABOR, J. 2018. Energy poverty and classes missed by a child. Evidence from a developing country. Researchgate.net

KARIMU, A. 2015. Cooking fuel preferences among Ghanaian households: An empirical analysis. *Energy for Sustainable Development, 27:10-17*

KARLBERG, L., HOFF, H., FLORES-LOPEZ, F., GOETZ, A. & MATUSCHKE, I. 2015. Tackling biomass scarcity- from vicious to virtuous cycles in sub-Saharan Africa. *Current Opinion in Environmental Sustainability,* 15:1-8.

KARP, L. & ZHANG, J. 2016. Taxes versus quantities for a stock pollutant with endogenous abatement costs and asymmetric information. *The Economics of The Global Environment,* 493-533.

KASPERSEN, L.B. 2000. *Anthony Giddens: an introduction to a social theorist*. Maiden, USA: Blackwell Publishers Inc.

KATUMBI, N., NYENGERE, J. & MKANDAWIRE, E. 2015. Drivers of deforestation and forest degradation in Dzalanyama forets reserve in Malawi. *International Journal of Science and Researc*h, 6:889-893.

KAUNDA, C.S. 2013. Energy situation, potential and application status of small-scale hydropower systems in Malawi. *Renewable and Sustainable Energy Reviews,* 26(C):1-19.

KAYAMBAZINTHU, D. & OEBA, V.O. 2019. An overview of the development of the woodfuel industry in southern Africa: opportunities and challenges. *International Forestry Review,* 21(1):51-66.

KAYAMBAZINTHU, D. & LOCKE, C. 2002. *Forest management and diverse livelihoods in Malawi.* Ladder Working Paper 114. Norwich, UK: University of East Anglia.

KAYITAKIRE, F., MAYAUX, P., MONER-GIRONA, M., OSSENBRINK, H., PINEDO, I., SINT, H., THIELEN, J., SZABO, S., TROMBONI, U. & WILLEMEN, L. 2011. *Renewable energies in Africa.* JRC Scientific and Technical Reports. Brussels, Belgium: European Commission.

KAYGUSUZ, K. 2011. Energy services and energy poverty for sustainable rural development. *Renewable and Sustainable Energy Reviews*, 15(2):936-947.

KAYGUSUZ, K. 2012. Energy for sustainable development: a case of developing countries. *Renewable and Sustainable Energy Reviews,* 16(2):1116-1126.

KEBEDE, E., KAGOCHI, J. & JOLLY, C.M. 2010. Energy consumption and economic development in sub-Saharan Africa. *Energy Economics,* 32(3):532-537.

KELLOGG, W.W. 2019. *Climate change and society: consequences of increasing atmospheric carbon dioxed.* Routledge.

KELLY, C.A., CRAMPIN, A.C., MORTIMER, K., DUBE, A., MALAVA, J., JOHNSON, D., UNTERHALTER, E. & GLYNN, J.R. 2018. From kitchen to classroom: Assessing the impact of cleaner burning biomass-fuelled cookstoves on primary school attendance in karonga district, northern Malawi. *PloS One,* 13(4):e0193376. doi:10.1371/journal.pone.0193376.

KEMMLER, A. & SPRENG, D. 2007. Energy indicators for tracking sustainability in developing countries. *Energy Policy* 35(4):2466-2480.

KENNEDY, A-M. 2015. Macro-social marketing. *Journal of Macromarketing* 36(3):354-365.

KENNEDY, E.H., COHEN, M.J. & KROGMAN, N.T. 2015. Social practice theories and research on sustainable consumption. *Putting sustainability into practice: Applications and Advances in Research on Sustainable Consumption,* 3-22.

KHANAL, V. & WILSON, C. 2019. Derivation of a climate change adaptation index and assessing determination and barriers to adaptation among farming households in Nepal. *Environmental Science and Policy* 101:156-165

KING, A.D., & HARRINGTON, L.K. 2018. The inequality of climate change from 1.5 to 2C of global warming. *Geophysical Research Letters,* 45(10):5030-5033.

KING, A. 2005. Structure and agency. In: Harrington, A. (ed). *Modern social theory: an introduction.* Oxford, UK: Oxford University Press.

KIRENGA, B.J., WISE, R.A., GIANELLA, G.E., CHECKLEY, W., CROCKER, M.E., ROA, C., GOODMAN, D. & SIMKOVICH, S.M. 2019. The health and social implications of household air pollution and respiratory diseases. *Nature Research*. http://doi.org/10.1038/s41533-019-0126-x.

KIRK, J. & MILLER, M.L. 1986. *Reliability and validity in qualitative research*. Beverly Hills, Sage Publications.

KNIGHT, K.W. & ROSA, E.A. 2012. *Population Environment,* 33:365. [Online] Available from: https://doi.org/10.1007/s11111-011-0151-3 [Accessed: 2011-04-12].

KOOTEN, G.C., SHAIKH, S.L. & SUCHANER, P. 2002. Mitigating climate change by planting trees: The transaction costs trap. *Land Economics,* 78(4):559-572.

KOLB, S.M. 2012. Grounded theory and the constant comparative method: valid research strategies for educators. *Journal of Emerging Trends in Educational Research and Policy Studies,* 3(1):83-86.

KOLLMUSS, A. & AGYEMAN, J. 2010. Mind the gap: Why do people act environmentally and why are the barriers to pro-environmental behaviour? *Environmental Education Research*, 8(3):239-260.

KOMAREK, A.M. & MSANGI, S. 2018. Effect of changes in population density and crop productivity on farm households in Malawi. *The Journal of the International Association of Agricultural Economics* 50:615-628

KOWSARI, R. & ZERRIFFI, H. 2011. Three dimensional energy profile: A conceptual framework for assessing household energy use. *Energy Policy,* 39(12):75005-7517.

KRAMER, S. 2018. Monitoring and evaluating Malawi youth conservation engagement after community-based environmental education workshops. Master of Environmental Management project report. Portland State University.

KREY, V. 2018. A people-centred approach to limiting gloabal warming to 1.5 oC. IAMC (IIASA-International Institute For Applied Systems Analysis) meeting, Seville, 13-15 November, 2018

KRIEGLER, E., WEYANT, J.P., BLANFORD, G.J., KREY, V.; CLARKE, L., EDMONDS, J., FAWCETT, A., LUDERER, G., RIAHI, K., RICHELS, R., ROSE, S.K., TAVONI, M. & VAN VUUREN, D.P. 2014. The role of technology for achieving climate policy objectives: overview of the EMF 27 study on global technology and climate policy strategies. *Climatic Change*, 123(3-4):353-367.

KRISHNAMURTHY, L., KRISHNAMURTHY, P., RAJAGOPAL, I. & SOLARES, A.P. 2019. Can agroforestry systems thrive in the drylands? Characteristics of successful agroforestry systems in the arid and semi-arid regions of Latin America. *Agroforestry Systems,* 93(2):503-513.

KROON, B. 2016. *Climbing the African energy ladder: internal and external factors influencing household demand for improved cookstoves and modern fuels in sub-Saharan Africa*. PhD thesis Vrije Universiteit, Amsterdam

KUMAR, R. 2018. *Research methodology: a step by step guide for beginners.* 5th ed. Los Angeles, USA: Sage.

KUMAR, R. 2011. *Research methodology: a step by step guide for beginners.* 3rd ed. Los Angeles, USA: Sage.

KUMAR, M. & SHARMA, C.M. 2009. Fuelwood consumption pattern at different altitudes in rural areas of Garhwal Himalaya. *Biomass and Bioenergy,* 33:1413-1418.

KURAMOCHI, T., NASCIMENTO, L., CASAS, M.J.V., FEKETE,H.,VIRERO, G., LUI, S.,KURDZIEL, M., MOISIO, M., TANGUY, P.,JEFFREY, L., SCHIEFER, T., SUZUKI, M., HOHNE, N., SOEST, H., ELZEN, M., ESMEIJER, K., ROELFSEMA, M., FORSELL, N. &

GUSTI, M. 2019. Greenhouse gas mitigation scenarios for major emitting countries: Analysis of current climate policies and mitigation commitments: 2019 update. New Climate Institute. PBL Netherlands Environmental Assessment Agency. IASA Science for Global Insight (www.iiasa.ac.at) http://newclimate.org/publications/

KUTENGULE, M. 2000. *Farm and non-farm sources of income: rural livelihoods diversification in Malawi.* Unpublished doctoral thesis. Norwich, UK: University of East Anglia.

LABORDENA, M., PATT, A., BAZILIAN, M., HOWELLS, M. & LILLISTAM, J. 2017. Impact of political and economic barriers for concentrating solar power in sub-Saharan Africa. *Energy Policy,* 102:52-72.

LANCASTER,K. 2017. Confidentiality, anonymity and power relations in elite interviewing: conducting qualitative policy research in a politicized domain. *International Journal of Social Research Methodology,* 20(1):93-103.

LAU, L.C., LEE, K.T. & MOHAMED, A.R. 2012. Global warming mitigation and renewable energy policy development from the Kyoto Protocol to the Copenhagen Accord - A comment. *Renewable and Sustainable Energy Reviews,* 16(7):5280-5284.

LEEDY, P.D., ORMROD, J.E. & JOHNSON, L.R. 2019. *Practical research: planning and design.* 12th ed. New York, USA: Pearson.

LEEDY, P.D. & ORMROD, J.E. 2005. *Practical research: planning and design.* 8th ed. Upper Saddle River, New Jersey, USA: Prentice Hall.

LEIMBACH, M, ROMING,N, SCHULTES, A & SCHWERHOFF, G. 2016. Development perspectives of sub-Saharan Africa under climate policies. *EcoMod2016.*

LEMENIH, M. & KASSA, H. 2014. Re-greening Ethiopia: History, challenges and lessons. *Forests,* 5:1896-1906. doi:10.3390/f5081896.

LENTH, R.V. 2001. Some practical guidelines for effective sample size determination. *The American Statistician,* 55(3):187-193.

LI,J, CHEN, C & LIU, H. 2019. Transition from non-commercial to commercial energy in rural China: Insights from the accessibility and affordability. *Energy Policy,* 127:392-403.

LIMUWA, M., SITAULA, B., NJAYA, F. & STOREBAKKEN, T. 2018. Evaluation of small-scale fishers' perceptions on climate change and their coping strategies: Insights from Lake Malawi. *Climate,* 6(2):34. doi:10.3390/cli6020034

LINDMARK, M. & OLSSON-SPJUT, F. 2018. From organic to fossil and in-between. New estimates of energy consumption in the Swedish manufacturing industry 1800-1913. *The Scandinavian Economic History Review,* 66:1-18.

LIZARDO, O. 2010. Beyond the antinomies of structure: Levi-Strauss, Giddens, Bourdieu and Sewell. *Theory and Society,* 39:651-688.

LOISON, SA. 2015. Rural livelihood diversification in sub-Saharan Africa: a literature review. *The Journal of Development Stud*ies, 51(9):1125-1138.

LONGONI, A. & CAGLIANO, R. 2018. Sustainable innovativeness ans the triple bottom line: the role of organizational time perspective. *Journal Of Business Ethics,* 151:1097-1120.

LOPES, M.A.R., ANTUNES, C.H. & MARTINS, N. 2012. Energy behaviours as promoters of energy efficiency: A 21st century review. *Renewable and Sustainable Energy Reviews,* 16(6):4095-4104.

LORENZONI, I. & PIDGEON, N.F. 2006. Public views on climate change: European and USA perspectives. *Climatic Change,* 77(1-2):73-95.

LOUW, K., CONRADIE, B., HOWELLS, M. & DEKENAH, M. 2008. Determinants of electricity demand for newly electrified low-income African households. *Energy Policy,* 36(8):2812-2818.

LUND, H., OSTERGAARD, P.A. & STADLER, I. 2011. Towards 100% renewable energy systems. *Applied Energy,* 88(2):419-421.

LUOGA, E.J., WITKOWSKI, E.T.F. & BALKWILL, K. 2000. Economics of charcoal production in miombo woodlands of eastern Tanzania: some hidden costs associated with commercialisation of the resources. *Ecological Economics*, 35:243–257.

MACINTOSH, N.B. & SCAPENS, R.W. 1990. Structuration Theory in Accounting. *Accounting Organizations and Society,* 15(5):455-477.

MAES, W.H. & VERBIST, B. 2012. Increasing the sustainability of household cooking in developing countries: Policy implications. *Renewable and Sustainable Energy Reviews*, 16(6):4204-4221.

MAGOMBO, E., EDRISS, A. & PHIRI, M.A.R. 2017. Determinants of Malawi's cotton exports from 2001 to 2013. *Journal of Developemnt and Agricultural Economics,* 9(4):80-86.

MAGUZA-TEMBO, F., EDRISS, A-K. & MANGISONI, J. 2017. Determinants of climate smart agriculture technology adoption in the drought prone districts of Malawi using a multivariate probit analysis. *Asian Journal of Agricultural Extension, Economics & Sociology*, 16(3):1-12.

MAKONDO, C.C. & THOMAS, D.S.G. 2018. Climate change adaptation: linking indigenous knowledge with western science for effective adaptation. *Environmental Science & Policy,* 88:83-91.

MAKONESE, T., IFEGBESAN, A.P. & RAMPEDI, I.T. 2018. Household cooking fuel use patterns and determinants across southern Africa: Evidence from the demographic and health survey data. *Energy & Environment,* 29(1):29-48.

MALAWI POWER AFRICA FACT SHEET. 2017. . [Online] Available from:https://www.usaid.gov/powerafrica/malawi [Accessed: 2017-08-09].

MAPHIRI, S. 2009. *Forest biomass energy use and perceptions on tree planting and community woodlots in households of two rural communities in Keiskammahoek, Eastern Cape, South Africa.* Unpublished masters' dissertation. Stellenbosch, South Africa: University of Stellenbosch. [Online] Available from: http://hdl.handle.net/10019.1/503 [Accessed: 2015-05-26].

MARECHAL, K. 2010. Not irrational but habitual: The importance of 'behavioural lock-in' in energy consumption. *Ecological Economics,* 69:1104-1114.

MARECHAL, K. & LAZARIC, N. 2012. Changing habits into routines in energy consumption: how to account for both individual and structural influences while integrating the motivational dimension. *The Economics of Climate Change and the Change of Climate in Economics,* 1-30.

MAREE, K. 2007. *First steps in research.* Pretoria, South Africa: Van Schaik.

MARINO, E. & RIBOT, J. 2012. Special issue introduction: Adding insult to injury: Climate change and the inequities of climate intervention. *Global Environmental Change,* 22(2):323-328.

MARTIMORT, D. & STRAUB, S. (2016), How to design infrastructure contracts in a warming world: a critical appraisal of public–private partnerships*. International Economic Review*, 57:61-88.

MARX-PIENAAR, N.J.M.M. 2015. *Urban South African consumers' ability to discursively reflect on the sustainability of their households' fresh produce consumption and waste practices amidst global concern about climate change*. Unpublished doctoral thesis. Pretoria, South Africa: University of Pretoria.

MARX-PIENAAR, N.J.M.M. & ERASMUS, A.C. 2014. Status consciousness and knowledge as potential impediments of households' sustainable consumption practices of fresh produce amidst times of climate change. *International Journal of Consumer Studies,* 38(4):419-429.

MASEKAMENI, D, KASANGANA, KK & MAKONESE, T. 2017 . A comprehensive review on small-scale combustion technologies in Southern Africa, what is known, done and emergent knowledge gaps? 2017 International Conference on the Domestic Use of Energy (DUE).

MATHIESEN, B.V., LUND, H. & KARLSSON, K. 2011. 100% renewable energy systems, climate mitigation and economic growth. *Applied Energy,* 88(2):488-501.

MATHIEU, H. 2009. Habitus, freedom and reflexivity. *Theory and Psychology,* 19(6):728-755.

MATHISON, S. 1988. Why triangulate? *Educational researcher*, 17(2):13-17.

MATSIKA, R., ERASMUS, B.F.N. & TWINE, W. 2013. A tale of two villages: Assessing the dynamics of fuelwood supply in a communal landscape within the Kruger to Canyons Biosphere in South Africa. *Environment Conservation*. *Environmental Conservation*, 40:71–83.

MASEBO, N. & MENAMO, M. 2016. A review paper on the role of agroforestry for rehabilitation of degraded soil. *Journal of Biology, Agriculture and Healthcare*, 6(5):128-136.

MASTAMET-MASON, A. 2013. The impact of textile and clothing processes on the environment: how knowledgeable are consumers in sub-Saharan Africa. In: EBEWO, P., STEVENS, I., & SIRAYI M. (eds). *Africa and beyond: arts and sustainable development*. Newcastle, UK: Cambridge Scholars publishing.

MATTHEWS, J. 2007. Seven steps to curb global warming. *Energy Policy,* 35(8):4247-4259.

MAUAMBETA, D., CHITEDZE, D. & MUMBA, R. 2010. *Status of forests and tree management in Malawi*. A position paper prepared for the coordination union for rehabilitation of the environment (CURE). Enviroconsult services. Technical Report. doi:10.13140/2.1.3497.7926. (Accessed 15 June 2018).

MCCOLLUM, D.L., ECHEVERRI, L.G., BUSCH, S., PACHAURI, S., PARKINSON, S., ROGELJ, J., KREY, V., MINX, J.C., NILSSON, M., STEVANCE, A.-S. & RIAHI, K. 2018. Connecting the sustainable development goalssustainable development goalssustainable development goalssustainable development goals by their energy inter-linkages. *Environmental Research Letters,* 13:033006. [Online] Available from: https://doi.org/10/1088/1748-9326/aaafe3 [Accessed: 2019-03-25].

MCCOLLUM, D.L., KREY, V., RIAHI, K., KOLP, P., GRUBLER, A., MAKOWSKI, M. & NAKICENOVIC, N. 2013. Climate policies can help resolve energy security and air pollution challenges. *Climate Change*, 119:479-494.

MCCKENDRY, P. 2002. Energy production from biomass (part 1): overview of biomass. *Bioresource Technology,* 83:37-46.

MCPHEE, R.D. & CANARY, H.E. 2016. Structuration theory. *The International Encyclopedia of Communication Theory and Philosophy,* 1-15.

MCQUAID, K., VANDERBECK, R.M., VALENTINE, G., LIU, C., CHEN, L., ZHANG, M. & DIPROSE, K. 2018. Urban climate change, livelihood vulnerability and narratives of generational responsibility in Jinja, Uganda. *Africa*, 88(1):11-38.

MECKLING, J. 2017. The developmental state in global regulation: Economic change and climate policy. *European Journal of International relations,* 24(1):58-81.

MELOSI,. 2017. Energy transitions in historical perspective. *Energy and Culture,* 3-18.

MENSAH, J.T. & ADU, G. 2013. *An empirical analysis of household energy choice in Ghana.* Working Paper. Stockholm, Sweden: Swedish University of Agricultural Sciences.

MENDUM, R. & NJENGA, M. 2018. Integrating wood fuels into agriculture and food security agendas and research in sub-Saharan Africa. *FACETS,* 3(1):1-11.

MEYER, E.L. & ODEKU, K.O. 2008. Climate change, energy, and sustainable development in South Africa: developing the African continent at the crossroads. *Sustainable Development Law and Policy,* 49-53.

MIAH, D., KABIR, R.R.M.S., KOIKE, M., AKTHER. S. & YONG SHIN, M. 2010. Rural household energy consumption pattern in the disregarded villages in Bangladesh. *Energy Policy,* 38(2):997-1003.

MIDDLEMISS, L. 2011. *The power of community: how community-based organizations stimulate sustainable lifestyles among participants*. London, England: Society and Natural Resources, Taylor and Francis.

MIKULEWICZ, M. 2018. Politicizing vulnerability and aadaptation: on the need to democratize local responses to climate impacts in developing countries. *Climate and Development,* 10(1):18-34.

MILANZI, S.A. & DAW, D. 2018. The impact of electricity supply in Malawi on economic development. Presented at the 3rd Annual International Conference on Public administration and

Development Alternative, 4-6 July, 2018, Stellenbosch University, Saldahna Bay, South Africa. http://hdl.handle.net/10386/2435

MILLER, G. & MOBARAK, A.M. 2013. *Gender differences in preferences, intra-household externalities and low demand for improved cook stoves*. NBER Working Paper #18964. Cambridge, UK: National Bureau of Economic Research.

MILLER, G & MOBARAK, M. 2013. *Marketing of stoves through social networks to combat indoor air pollution.* Policy brief. International Growth Centre. https://www.theigc.org/wp-content/uploads/2015/07/Miller-Mobarak-2013-Policy-Brief.pdf. (Accessed 10 August 2018).

MILLS, B. & SCHLEICH, J. 2012. Residential energy-efficient technology adoption, energy conservation, knowledge and attitude: An analysis of European countries. *Energy Policy,* 49:616-628.

MIROSA, M., LAWSON, R. & GNOTH, D. 2011. Linking personal values to energy-efficient behaviours in the home. *Environment and Behaviour,* 45(4):455-475 [Online] Available from: https://doi.org/10.1177/0013916511432332 [Accessed: 2019-04-15].

MISSANJO, E & KAMANGA-THOLE, G.2015. Estimation of biomass and carbon stock for Miombo Woodland in Dzalanyama forest reserve, Malawi. Research *Journal of Agriculture and Forestry Sciences.* ISSN 2320, 6063

MIYAMOTO, M. & TAKEUCHI, K. 2019. Climate agreement and technology diffusion: Impact of the Kyoto Protocol on international patent applications for renewable energy technologies. *Energy Policy,* 129:1331-1338.

MOHAMMED, Y.S., BASHIR, N. & MUSTAFA, M.W. 2015. Overuse of wood-based bioenergy in selected sub-Saharan Africa countries: Review of unconstructive challenges and suggestion. *Journal of Cleaner Production,* 96:501-519.

MOHAMMED, Y.S., MUSTAFA, W.M. &, BASHIR, N.. 2013. Energy storage for renewable energy power sector integration and mitigation of intermittency. *Renewable and Sustainable Energy Reviews*, 35:499-514.

MOLONEY, S., HORNE, R.E. & FIEN, J. 2010. Transitioning to low carbon communities - from behaviour change to systemic change: lessons from Australia. *Energy Policy*, 38:7614-7623.

MOOMBE, K.B., SAMBOKO, P.C., SYAMPUNGANI, S. & DLAMINI, C. 2016. *Load shedding and charcoal use in Zambia: What are the implications on forest resources*? IAPRI Indaba Agricultural Policy Research Institute, 85.

MORGAN, D.L. 2007. Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods research*. 1:48-76.

MORREN, M. & GRINSTEIN, A. 2016. Explaining environmental behaviour across borders: a meta-analysis. *Journal of Environmental Psychology,* 47:91-106.

MORRISON, K. 2004. *Marx, Durkheim, Weber: formations of modern social thought.* London, UK: Sage.

MORTIMORE, M.J. & ADAMS, W.M. 2001. Farmer adaptation, change and 'crisis' in the Sahel. *Global Environmental Change,* 11(1):49-57. doi:10.1016/S0959-3780(00)00044-3.

MOSER, S.C. 2016. Reflections on climate change communication research and practice in the second decade of the 21st century: what more is there to say? *Wiley Interdisciplinary Reviews: Climate Change,* 7(3):345-369.

MOUTON, J. 1996. *Understanding social research*. Pretoria, South Africa: Van Schaik.

MSHANDETE, A.M. & PARAWIRA, W. 2009. Biogas technology research in selected sub-Saharan African countries: A review. *African Journal of Biotechnology,* 8(2):116-125.

MWAMPAMBA, T.H., GHILARDI, A., SANDER, K. & CHAIX, K.J. 2013. Dispelling common misconceptions to improve attitudes and policy outlooks on charcoal in developing countries. *Energy for Sustainable Development*, 17(2):75-85.

MUGIDO, W. & SHACKLETON, C.M. 2017. The safety net function of NTFPs in different agro-ecological zones of South Africa. *Population and Environment,* 39(1):107-125.

MUHUMUZA, R., ZACHAROPOULOS, A., MONDOL, J.D., SMYTH, M. & PUGSLEY, A. 2018. Energy consumption levels and technical approaches for supporting development of alternative energy technologies for rural sectors of developing countries. *Renewable and Sustainable Energy Reviews,* 97:90-102.

MUKHERJEE, S. & BENSON, T. 2003 The Determinants of Poverty in Malawi, 1998. *World Developmen*t, 31:339-358.

MULUGETTA, Y., HAGAN, E.B. & KAMMEN, D.M. 2018. Energy access for sustainable development*. Environmental Research Letters*.

MUPEDZISWA, R. & KUBANGA, K.P. 2017. Climate change, urban settlements and quality of life: The case of the Southern African Development Community region. *Journal of Development Southern Africa,* 34(2):196-209.

MURECHAL, K. 2010. Not irrational but habitual. The importance of "behavioural lock-in" in energy consumption. *Ecological Economics,* 69:1104-1114.

MURRAY, U., GEBREMEDHIN, Z., BRYCHKOVA, G. & SPILLANE, C. 2016. Smallholder farmers and climate smart agriculture: technology and labour-productivity constraints amongs women smallholders in Malawi. *Gender, Technology and Development,* 20(2):117-148.

MUSAVENGANE, R. & SIMATELE, D. 2017. Significance of social capital in collaborative management of natural resources in sub-Saharan African rural communities: a qualitative meta-analysis. *South African Geographical Journal,* 99(3):267-282.

MWAMPAMBA, T.H., OWEN, M. & PIGAHT, M. Opportunities, challenges and way forward for the charcoal briquette industry in sub-Saharan Africa. *Energy for Sustainable Development* 17:158-170.

MZUZA, M.K., ZHANG, W., KAPUTE, F & WEI, X. 2019. The impact of land use and land cover changes on the Nkula dam in the middle Shire river catchment, Malawi. Geospatial Analyses of Earth Observation (EO) data, Antonio Pepe and Qing Zhao, IntechOpen,

DOI.10.5772/intechopen.86452. https://www.intechopen.com/books/geospatial-analyses-of-eart-obervation-eo-data/the-impact-of-land-use-and-land-cover-changes.on-the-nkula-dam-in-the-middle-shire-river-catchment.m

NABANOGA, N.G., NAMAALWA , J.J. & BOMUHANGI, A. 2019. Impacts of climate change on smallholder households in mt Elgon region of Uganda: Does gender matter? *Agriculture And Ecosystem Resilience in Sub Saharan Africa:* 673-690

NADIMI, R. & TOKIMATSU, K. 2018. Energy use analysis in the presence of quality of life, poverty, health and carbon dioxide emissions. *Energy,* 153:671-684.

NATIONAL STATISTICAL OFFICE OF MALAWI. 2008. *Malawi census main report*. Zomba, Malawi: National Statistical Office.

NATIONAL ADAPTATION PROGRAMME OF ACTION TO CLIMATE CHANGE (NAPA) 2006. Council of Ministers in its Meeting on 20 October 2006. Royal Government of Cambodia. . [Online] Available from: https://unfccc.int/resource/docs/napa/khm01.pdf [Accessed: 2016-06-14].

NANGOMA, E. 2007. National adaptation strategy to climate change impact: A case study of Malawi. *Human Development Report* 2007/2008. [Online] Available from: http://hdr.undp.org/en/content/national-adaptation-strategy-climate-change-impacts-case-study-malawi (Accessed: 2016-04-].

NDOVI, M. & MIAO, X. 2019. High fertility rates for the education infrastructure crisis in developing countries: the case of Malawi. Proceedings of the first International conference on progressive civil society (ICONPROCS 2019). *Advances in Social Science, Education and Humanities Research* https://doi.org.10.2991/iconprocs/9/2019.56

NELSON, N. 2018. Climate change mitigation measures in Ghana. *AES Bioflux,* 10(2):97-105.

NEMA, P., NEMA, S. & ROY, P. 2012. An overview of global climate changing in current scenario and mitigation action. *Renewable and Sustainable Energy Reviews,* 16(4):2329- 2336.

NERFA, L. 2018. Forest dependence and forest degradation in southern Malawi. Master of Science, University of British Columbia

NERFA, L. & RHEMTULLA, J.M. 2019. Changes in tree species diversity, composition and aboveground biomass in areas of fuelwood harvesting in miombo woodland ecosystems of southern Malawi. *Forests, Trees and Livelihoods,* 28(3): 176-193

NERINI, F.F., TOMEI, J., TO, L.S., BISAGA, I., PARIKH, P., BLACK, M., BORRION, A., SPATARU, C., BROTO, V.C., ANANDARAJAH, G., MILLIGAN, B. & MULUGETTA, Y. 2018; Mapping synergies and trade-offs between energy and the Sustainable development goals. *Nature Energy, 3(1):*10-15.

NEUFELDT, H., LANGFORD, K., FULLER, J., IIYAMA, M. & DOBIE, P. 2015. *From fuel to viable energy source: Improving sustainability in the sub-Saharan charcoal sector.* World Agroforestry Centre Working Paper No. 196. [Online] Available from: http://www.worldagroforestry.org/cop22/publications [Accessed: 2018-06-15).

NEUMAN, W.L. 2014. *Social research methods: qualitative and quantitative approaches.* 7th ed. Harlow, Essex, UK: Pearson.

NEUMAN, W.L. 2006. *Social research methods: qualitative and quantitative approaches.* 6th ed. Boston, USA: Pearson/Allyn and Bacon.

NEUPANE, S., CLARK, C. & LAMBERT, D. 2017. *Time allocation model for fuelwood collection in rrural Nrepal: An empirical analysis.* Coference paper/presentation. Southern Agricultural Economics Association (SAEA). 4-7 February, 2017. Mobile, Alabama.

NEWELL, P. & BULKELEY, H. 2017. Landscape for change? International climate policy and energy transitions: evidence from sub-Saharan Africa. *Climate Policy,* 17(5):650-663.

NGONGONDO, C., JAMU, D., SAGONA, W., LIKONGWE, P., CHIOTHA, S., CHAPOTERA, M. & MWALE, C. 2018. Monitoring etreme weather events and ecosysytems to enhance responsive capacity to climate change impacts. *Socio-Ecological Resilience to Climate Change in a Fragile Ecosystem,* 211-244.

NGULUBE, M.R. 1999. The utilization of non-timber forest products from the Miombo woodlands in Malawi: a case study. In: NGULUBE, M.R., MWABUMBA, L. & CHIRWA, P. (eds). *Community-based management of Miombo woodlands.* Proceedings of the Forestry Research Institute of Malawi, Lilongwe, Malawi, 27-29 September 1999.

NGUM, S.A., GREGORIO, E. & TURNER, J. 2016. *Empowering women in Africa through access to sustainable energy. a desk review of gender-focused approaches in the renewable energy sector.* Tunis, Tunisia: African Development Bank Group.

NGWIRA, S. & WATANABE, J. 2019. An analysis of the causes of deforestation in Malawi: A case of Mwazisi Land 2019, 8, 48. doi:10.3390/land8030048. [Online] Available from:www.mdpi.com/journal/land [Accessed: 2019-08-07].

NIEMEYER, S. 2010. Consumer voices adoption of residential energy efficient practices. *International Journal of Consumer Studies,* 34(2):140-145.

NIJKAMP, P & PERRELS,A. 2018. *Sustainable cities in Europe*. Routledge

NJENGA, M., GITAU, J.K., IIYAMA, M., JAMNADASSA, R., MAHMOUD, Y. & KARANJA, N. 2019. Innovative biomass cooking approaches for sub-saharan Africa. *African Journal of Food, Agriculture, Nutrition and Development,* 19(1):14066-14087.

NJENGA, M., IIYAMA, M., JAMNADASS, R., HELANDER, H., LARSSON, L., LEEUW, J.D., NEUFELDT, H., NOWINA, K.R. & SUNDBERG, C. 2016. Gasifier as a cleaner cooking system in rural Kenya. *Journal of Cleaner Production,* 121:208-217.

NJITI, C.F. & KEMCHA, G.M. 2003. *Survey of fuelwood and service wood production and consumption in the Sudano-Sahelian region of Central Africa. The case of Garoua, Cameroon and its rural environs.* Paper presented at Actes du Colloque, Garoua, Cameroon, 27-31 May 2002. [Online] Available from: https://hal.archives-ouvertes.fr/ha-00135780 [Accessed: 2014-10-25].

NKOMO, J.C. 2007. Energy use, poverty and development in the SADC. *Journal of Energy in Southern Africa,* 18(3):10-17.

NKOMWA, E.C., KALANDA-JOSHUA, M., NGONGONDO, C. & CHIPUNGU, F. 2013. Assessing indigenous knowledge systems and climate change adaptation strategies in agriculture: A case study of Chagaka Village, Chikhwawa, Southern Malawi. *Physics and Chemistry of the Earth*, Parts A/B/C:67-69.

NOBLE, H. & SMITH, J. 2015. Issues of validity and reliability in qualitative research. *Evidence-based Nursing,* 18(2):34-35.

NONAKA, I. & TOYAMA, R. 2015. The knowledge-creating theory revisited: knowledge creation as a synthesizing process. *The essentials of knowledge management,* 95-110.

NTUPANYAMA, Y. & MUGHOGHO, N. 2013. *Forests, rangelands and climate change adaptation in Malawi.* [Online] Available from: www.fao.org/forestry/38069-073886f44b766b8982dec68ac4c3a7849.pdf [Accessed: 2017-4-28].

NUNES, A.K.F., BARROSO, R.C.A. & SANTOS, J.F. 2019. The use of triangulation as a tool for validation of data in qualitative research in education. *World Conference on Qualitative Research,* 1:334-336.

NUSSBAUMER, P., BAZILIAN, M. & MODI, V. 2012. Measuring energy poverty: Focusing on what matters. *Renewable and Sustainable Energy Review*, 16(2012):231–243.

NYE, M. & BURGESS, J. 2008. *Promoting durable change in household waste and energy use behaviour: a technical research report completed for the Department for Environment, Food and Rural Affairs*. Norwich, UK: University of East Anglia.

ODENY, D., KARANJA, F., MWACHALA, G., PELLIKKA, P. & MARCHANT, R. 2018. Comparison and prediction of the above ground carbon storage in croplands on the inhabited slopes on Mount Kilimanjaro (Tanzania) and the Taita Hills (Kenya). *Journal of Geographic Information System,* 10:415-438.

OEBA, V.O. & LARWANOU, M. 2017. Climate change adaptation in Africa: fostering resilence and capacity to adapt. *Forest and reliance to climate change: a synthesis on application of forest-based adaptation strategies to reduce vulnerability among communities in sub-Saharan Africa.* FILHO, W.L., SIMANE, B., KALANGU, J., WUTA, M., MUNISH, P. & MUSIYIWA, K. (eds.). *Manuscript submitted for oral presentation during symposium on climate change adaptation in Africa.* Addis ababa, Ethiopia 21-23 February, 2016 DOI 10.1007/978-3-319-49520_10.

OLADOKUN, M., MOTAWA, I. & BANFILL, P. 2012. *Understanding and improving household energy consumption and carbon emissions policies - a system dynamics approach*. Paper presentation presented at the international Conference for Enhanced Building Operations, University of Salford, Manchester, United Kingdom, 23– 26 October 2012.

O'LEARY, Z. 2013. *The essential guide to doing your research project.* Newcastle, UK: Sage.

OLSEN, W. 2004. Triangulation in social research qualitative and quantitative methods can really be mixed. In: Holborn, M. (ed). *Developments in Sociology.* Ormskirk, UK: Causeway Press.

OLSEN, W. 2004. Methodological triangulation and realist research: an Indian exemplar. In: CARTER, B. & NEU, C. (eds). *Making realism work: realist social theory and empirical research*. London, UK: Routledge.

OPENSHAW, K. 2010. Biomass energy: Employment generation and its contribution to poverty alleviation. *Biomass Bioenergy*, 34(3):365-378.

ORDNER, J.P. 2017. Community action and climate change. *Nature Climate Change*, 7(3):161.

ORGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD). 2002. *Policy case study series*. *Policies to promote sustainable consumption: an overview*. Paris, France: Organization for Economic Co-operation and Development.

ORR, A., KAMBOMBO, B., ROTH, C., HARRIS, D. & DOYLE, V. 2015. Adoption of integrated food-energy systems: improved cookstoves and pigeonpea in Southern Malawi. *Experimental Agriculture,* 51(2):191-209.

OSBERGHAUS, D., DANNENBERG, A., MENNEL, T. & STURM, B. 2010. The role of government in adaptation to climate change. *Environment and planning C: Government and Policy,* 28:834-850.

OSTLUND, V., KIDD, L., WENGSTROM, Y. & ROWA-DEWER, N. 2011. Combining qualitative and quantitative research within mixed method research design: a methodological review. *International Journal of Nursing Studies,* 48:369-383.

OSTROM, E. 2012. Nested externalities and polycentric institutions: must we wait for global solutions to climate change before taking actions at other scales. *Economic Theory,* 49(2):353-369.

OUEDRAOGO, N.S. 2017. Africa energy future: Alternative scenarios and their implications for sustainable development strategies. *Energy Policy,* 106:457-471.

OUEDRAOGO, NS . 2017. Modeling sustainable long-term electricity supply-demand in Africa. *Applied Energy,* 190:1047-1067.

OSENI, M. 2019. *Cost of enreliable electricity to African fir*ms. Energy for growth hub.Nigerisn Electricity Regulatory Commission.

OXFAM INTERNATIONAL ANNUAL REPORT, 2006. [Online] Available from: https://www.oxfam.org/sites/www.oxfam.org/files/OI-annual-report-2006-en_1.pdf [Accessed: 2018-06-12].

OZAKI, R. 2011. Adopting sustainable innovation: what makes consumers sign up to green electricity? *Business Strategy and the Environment*, 20(1):1-17.

PAAVOLA, J. & ADGER, W.N. 2006. Fair adaptation to climate change. *Ecological Economics,* 56(4):594-609.

PACHAURI, S. & SPRENG, D. 2011. Measuring and monitoring energy poverty. *Energy Policy,* 39(12):7497-7504.

PALM, J. 2010. The public/private divide in household behaviour: How far into the home can energy guidance reach? *Energy Policy,* 38(6):2858-2864.

PALTSEV, S.V. 2001. The Kyoto Protocol: regional and sectoral contributions to the carbon leakage. *The Energy Journal,* 22(4):53-79.

PARAWIRA, W. 2009. Biogas technology in sub-Saharan Africa: Status, prospects and constraints. *Reviews in Environmental Science and Bio-Technology,* 8(2):187-200.

PASQUINI, L. 2019. The urban governance of climate change adaptation in least developed African countries and in small cities: the engagement of local decision-makers in Dar es Salaam, Tanzania. *Climate and Development,* 1-12.

PAUW, K., THURLOW, J. & SEVENTER, D. 2010. *Droughts and floods in Malawi: assessing the economy wide effects*. Washington DC, USA: International Food Policy Research Institute (IFPRI).

PATTON, M.Q. 2002. *Qualitative evaluation and research methods*. 3rd ed. Thousand Oaks, CA, USA: Sage.

PETTENGER, M.E. 2016. Introduction: power, knowledge and the social construction of climate change. *The Social Construction of Climate Change,* 25-44.

PELLING, M. & HIGH, C. 2005. Understanding adaptation: What can social capital offer assessments of adaptive capacity? *Global Environmental Change,* 15:308-319.

PIERCE, J., SCHIANO, D.J. & PAULOS, E. 2010. *Home, habits and energy: examining domestic interactions and energy consumption.* Paper presented at the SIGCHI Conference on Human Factors in Computing Systems, Atlanta, Georgia, USA, 10-15 April 2010.

POTHITOU, M., HANNA, R.F., & CHAIVATZIS, K.J. 2016. Environmental knowledge, pro-environmental behaviour and energy savings in households: an empirical study. *Applied Energy,* 184:1217-1229.

POWELL, R.A. & SINGLE, H.M. 1996. Methodology matters-V. *International Journal for Quality in Health Care* 8(5):499-508 Elsevier Science

PRASAD, G. & VISAGIE, E. 2005. *Renewable energy technologies for poverty alleviation: initial assessment report: South Africa*. Cape Town, South Africa: Energy Research Centre, University of Cape Town.

PRADHAN, B.B., SHRESTHA, R.M., HOA, N.T. & MATSUOKA, Y. 2017. Carbon prices and greenhouse gases abatement from agriculture forestry and land use in Nepal. *Global Environment Change,* 43:26-36.

QUINN, A.K., BRUCE, N., PUZZOLO, E., DICKINSON, K., STURKE, R., JACK, D.W., MEHTA, S., SHANKAR, A., SHERR, K. & ROSENTHAL, J.P. 2018. An analysis of efforts tonscale up clean household energy for cooking around the world. *Energy for Sustainable Development,* 46:1-10.

RAE, C. & BRADLEY, F. 2012. Energy autonomy in sustainable communities - A review of key issues. *Renewable and Sustainable Energy Reviews,* 16(9):6497-6506.

RAHUT, D.B., BEHERA, B. & AKHTER, A. 2016. Household energy choice and consumption intensity: Empirical evidence from Bhutan. *Renewable and Sustainable Energy Reviews,* 53(C):993-1009.

RAHUT, D.B., BEHERA, B. & ALI, A. 2017. Factors determining household use of clean and renewable energy sources for lighting in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews,* 12:661-672.

RAM, P.T., BAHADUR, R.H. & SHUKUYA, M. 2019. Rural household energy use and thermal environment in three climatic regions of Nepal. IOP Conference Series: *Earth and Environmental Science,* 294(1)012093:1-7.

RAMIREZ, A., SCHILLACI, V., TIBBETS, J., USHER, K. & YEAGER, K. *Climate change and development in Africa.* Austin, Texas: The Robert S. Strauss Center for International Security and Law.

RAO, N.D. & PACHAURI, S. 2017. Energy access and living standards: some observations on recent trends. *Environmental Research Letters,* 12:025011.

RASAGAM, G. & ZHU, D. 2018. Delivering on the promnise of distributed renewable energy entrepreneurship in |sub-Saharan Africa. *Current Sustainable/Renewable Energy Reports,* 5(4):230-239.

RAWAT, D.S., JOSHI, R. & JOSHI, M. 2000. Indigenous methods for storage and use of bio resources: Case study, Indian Central Himalaya. *AMBIO: A Journal of the Human Environment,* 29(6):356- 358.

REN, Z., CHEN, Z. & WANG, X. 2011. Climate change adaptation pathways for Australian residential buildings. *Building and Environment,* 46(11):2398-2412.

REN, Z., GROZEV, G. & HIGGINS, A. 2016. Modelling impact of PV battery systems on energy consumption and bill savings of Australian houses under alternative tariff structures, *Renewable Energy, 89:*317-330.

RIAHI, K., KRIEGLER, E., JOHNSON,N., BERTRAM,C., DEN ELZEN,M., EOM,J., SCHAEFFER, M., EDMONDS, J., ISAAC, M., KREY, V., LONGDEN, T., LUDERER,G., MÉJEAN,A., MCCOLLUM, D. L., MIMA, S., TURTON,H.,. VAN VUUREN, D. P., WADA,K., BOSETTI,V., CAPROS,P., CRIQUI,P., HAMDI-CHERIF, M., KAINUMA, M. AND EDENHOFER,O. 2015. Locked into Copenhagen pledges — Implications of short-term emission targets for the cost and feasibility of long-term climate goals. *Technological Forecasting and Social Change,Volume 90, Part A*, 8-23,

RICHARDS, K.A.R. & HEMPHILL, M.A. 2018. A practical guide to collaborative qualitative data analysis. *Journal of Teaching in Physical Education,* 37(2):225-231.

ROGELJ, J., ELZEN, M., HOHNE, N., FRANSEN, T., FEKETE, H., WINKLER, H., SCHAEFFER, R., SHA, F., RIAHI, K. & MEINSHAUSEN, M. 2016. Paris agreement climate proposals need a boost to keep warming below 2oC. *Nature,* 534:631- 639.

ROGELJ, J., CHEN, C., NABEL, J., MACEY, K., HARE, W., SCHEFFER, M., MARKMANN, K., HOHNE, N., ANDERSEN, K.K. & MEINSHAUSEN, M. 2010. Analysis of the Copenhagen Accord pledges and its global climatic impacts- a snapshot of dissonant ambitions. *Environmental Research Letters,* 1-9.

ROSE, J. & SCHEEPERS, R. 2001. *Structuration theory and information system development-frameworks for practice*. Paper presented at 9th European Conference on Information Systems, global Co-operation in the New Millennium, Bled, Slovenia, 27-29 June 2001.

RUIZ-MERCADO, I., MASERA, O., ZAMORA, H. & SMITH, K.R. 2011. Adoption and sustained used of improved cook stoves. *Energy Policy,* 39(12):7557-7566.

RUPF, G.V., BAHRI, P.A., DE BOER, K. & MCHENRY, 2015. Barriers and opportunities of biogas dissemination in sub-Saharan Africa and lessons learned from Rwanda, Tanzania, China, India and Nepal. *Renewable and Sustainable Energy Reviews,* 52:468-476.

SAIDI, K. & HAMMAMI, S. 2015 The impact of CO2 emissions and economic growth on energy consumption in 58 countries. *Energy Reports,* 1:62-70.

SALKIND, N.J. 2014. *Statistics for people who (think they) hate statistics*. Thousand Oaks, California, USA: Sage.

SALKIND, N.J. (ed). 2010. *Encyclopaedia of research design*. Thousand Oaks, California, USA: Sage.

SAKA, J.D.K., SIABLE, P., HACHIGONTA, S., SIBANDA, L.M. & THOMAS, T.S. **2012**. *Southern African agriculture and climate change*: Malawi. Summary note. Washington, DC, USA.

SANDELOWSKI, M. 2000. Focus on research methods combining qualitative and quantitative sampling, data collection, and analysis techniques in mixed-method studies. *Research in Nursing and Health,* 23:246–255.

SARKODIE, S.A. & STREZOV, V. 2019. Effect of foreign direct investments, economic development and energy consumption on greenhouse gas emissions in developing countries. *Science of the Total Environment,* 646:862-871.

SATO, G.J., JOSHUA, M.K., NGONGONDO, C., CHIPUNGU, F., MALIDADI,C. & MONJEREZI, M. 2020. Evaluation of different tillage systems for improved agricultural production in drought-prone areas of Malawi (book chapter): 157-167. In *Climate Variability and Change in Africa*. Sustainable development in MATONDO, J., ALEMAN,B. & SANDWIDI, W.(eds).

SATTERTHWAITE, D. 2009. The implications of population growth and urbanization for climate change. *Environment and Urbanization,* 21(2):545–567.

SCHAEFFER, R., SZKLO, A.S., LUCENA, A.F.P., BORBA, B.S.M.C., NOGUEIRA, L.P.P., FLEMING, F.P., TROCCOLI, A., HARRISON, M. & BOULAHYA, M.S. 2012. Energy sector vulnerability to climate change: A review. *Energy,* 38(1):1-12.

SCHAFER, M., KEBIR, N. & NEUMANN, K. 2011. Research needs for meeting the challenge of decentralized energy supply in developing countries. *Energy for Sustainable Development,* 15:324-329.

SCHEBA, A. & MUSTALAHTI, I. 2015. Rethinking 'expert' knowledge in community forest management in Tanzania. *Forest Policy and Economics,* 60:7-18.

SCHEURLEN, E. 2015. *Time allocation to energy resource collection in rural Ethiopia gender-disaggregated household responses to changes in fuelwood availability*. Paper presented at International Food Policy Institute Conference (IFPRI), Washington DC, USA, 18 November 2015. [Online] Available from: http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/128986/filename/129197.pdf [Accessed: 2017-10-24].

SCHIFFMAN, L.G. & KANUK, L.L. 2007. *Reference groups and family influence in consumer behaviour.* 10th ed. London, UK: Prentice-Hall.

SCHIFFMAN, L.G. & KANUK, L.L. 2010. *Consumer Behaviour.* Englewood Cliffs, New Jersey, USA: Prentice Hall.

SCHLAG, N. & ZUZARITE, F. 2008. *Marketing barriers to clean cooking fuels in sub-Saharan Africa. A review of literature.* Stockholm, Sweden: Stockholm Environment Institute.

SCHOOR, T. & SCHOLTENS, B. 2015. Power to the people: local community initiatives and the transition to sustainable energy. *Renewable and Sustainable Energy Reviews,* 43:666-675.

SCHRADER, U. & THOGERSEN, J. 2011. Putting sustainable consumption into practice. *Journal of Consumer Policy,* 34(1):3-8.

SCHUENEMANN, F., MSANGI, S. & ZELLER, M. 2018. Policies for sustainable biomass energy sector in Malawi: Enhancing energy and food security simultaneously. *World Development,* 103:14-26.

SCHUENEMANN, F., THURLOW, J., MEYER, S., ROBERTSON, R. & RODRIGUES, J. 2018. Evaluating irrigation investments in Malawi: economy-wide impacts under uncertainty and labour constraints. *Agricultural economics,* 49(2):237-250.

SCHWERHOFF, G. & SY, M. 2017. Financing renewable energy in Africa: Key challenge of the Sustainable development goalsSustainable development goalsSustainable development goalsSustainable development goals. *Renewable and Sustainable Energy Reviews,* 75:393-401.

SCOTT, G. & GARNER, R. 2013. *Doing qualitative research.* Boston, USA: Pearson.

SCOTT, K., BAKKER, C. & QUIST, J. 2012. Designing change by living change. *Design Studies,* 33(3):279-297.

SEAMAN, J., CLARKE P., BOUDREAU, T. & HOLT, J. 2000. *The household economy approach: a resource manual for practitioners*. London, UK: Save the Children.

SEBITOSI, A.B. & PILLAY, P. 2005. Renewable energy and the environment in South Africa: A way forward. *Energy Policy,* 36:3312-3316.

SEIM, B. & ROBINSON, A.L. 2019. Coethnicity and corruption: Field experimental evidence from public officials in Malawi. *Journal of Experimental Political Science,* 1-6.

SENGANIMALUNJE, T.C., CHIRWA, P.W., BABALOLA, F.D. & GRAHAM, M.A. 2016. Does participatory forest management programme lead to efficient forest resource use and improved rural livelihoods? Experiences from Mua-Livulezi forest reserve, Malawi. *Agroforestry Systems,* 90(4):691-710.

SERDECZNY, O., ADAMS, S., BAARSCH, F., COUMOU, D., ROBINSON, A., HARE, W., SCHAEFFER, M., PERRETTE, M. & REINHARDT, J. 2016. *Climate change impacts in sub-Saharan Africa: from physical changes to their social repercussions*. Regional Environmental Change DOI 10.1007/s10113-015-0910-2 [Accessed: 2019-12-09].

SHACKLETON, C.M., MAHONYA, S. & SCHRECKENBERG, K. 2019. Non-timber forest product use and market chains along a deforestation gradient in Southwest Malawi. Frontiers in *Forests and Global Change,* 2:71.

SHACKLETON, C.M., SHACKLETON, S.E. & COUSINS, B. 2001. The role of land-based strategies in rural livelihoods: the contribution of arable production, animal husbandry and natural resource harvesting in communal areas in South Africa. *Development Southern Africa*, 18,581–604.

SHALIZI, Z. & LECOCQ, F. 2009. *Climate change and the economics of targeted mitigation in sectors with long-lived capital stock*. Policy Research Working Paper. No. WPS 5063. Washington, DC, USA: World Bank.

SHARMA, B.P. 2018. Household fuel transition and determinants of fuelwood demand in Nepal. Economic *Journal of Development Issues,* 83-95.

SHELLIE-DESSERT, K.C. & HOSFIELD, G.L. 1990. Implications of genetic variability for dry beans cooking time and novel cooking methods for fuelwood conservation in Rwanda. *Ecology of Food and Nutrition,* 23(3):195-211.

SHETH, J.N., SETHIA, N.K. & SRINIVAS, S. 2011. Mindful consumption: a customer-centric approach to sustainability. *Journal of the Academy of Marketing Science,* 39:21-39.

SMIT, B. & WANDEL, J. 2006. Adaptation, adaptive capacity and vulnerability. *Global Environmental Change,* 16(3):282-292. [Online] Available from: http://dx.org/10.10161/j.gloenvcha.2006.03.008 [Accessed: 2015-04-10].

SMITH, H.E. 2016. *The charcoal sector in Southern Malawi: a livelihoods perspective*. PhD Thesis, University of Southampton.

SMITH, H.E., EIGENBROD, F., KAFUMBATA, D., HUDSON, M.D. & SCHRECKENBERG, K. 2015. Criminals by necessity: the risky life of charcoal transporters in Malawi. *Forests, Trees and Livelihoods,* 24(4):259-274.

SKJÆRSETH, J.B., BANG, G. & SCHREURS, M.A. 2013. Explaining growing climate policy differences between European Union and the United States. *Global Environmental Politicism,* 13(4):61-80.

SKINNER, E. 2011. *Gender and climate change: overview report*: *1-91*. Sussex, UK: Institute of Development Studies.

SOLA, P., OCHIENG, C., YILA, J. & IIYAMA. M. 2016. Links between energy access and food security in sub-Saharan Africa: An exploratory review. *Food Security,* 8:635-642.

SOLA, P., CERUTTI, P.O., ZHOU, W., GAUTIER, D., IIYAMA, M., SCHURE, J., CHENEVOY, A., YILA, J., DUFE, V., NASI, R., PETROKOFSKY, G. & SHEPHERD, G. 2017. The environmental, socioeconomic, and health impacts of woodfuel value chains in sub-Saharan Africa: a systematic map. *Environmental Evidence,* 6(1):4.

SOLA, P., SCHURE, J., ATYI, R.E., GUMBO, D., OKEYO, I., & AWONO, A. 2019. Woodfuel policies and practices in selected countries in sub-Saharan Africa: a critical review. *Bois et Forets des Tropiques, 3*40:5-19.

SOLA, P., OCHIENG, C., YILA, J. & IIYAMA, M. 2016. Links between energy access and food security in sub-Saharan Africa: an exploratory review. *Food Security,* 8(3):635-642.

SOLBERG, B. 1997. Forest biomass as carbon sink – economic value and forest management/policy implications. *Critical Reviews in Environmental Science and Technology,* 27(special edition):323-333.

SOLBERG, B., BROOKS, D., PAJUOJA, H., PECK, T.J. & WARDLE, P.A. 1996. Factors affecting the demand and supply of wood. In: SOLBERG, B. (ed). *Long term trends and prospects in world supply and demand for wood and implications for sustainable forest management*. Research Report No 6. Joensuu, Finland: European Forest Institute.

SOLOMON, M. 2004. *Consumer behaviour - buying, having and being.* Englewood Cliffs, New Jersey: Prentice Hall.

SOKONA, Y., MULUGETTA, Y. & GUJBA, H. 2012. Widening access in Africa: Towards energy transition. *Energy Policy,* 47(1):3-10.

SOVACOOL, B.K., BAZILIAN, M. & TOMAN, M. 2016. Paradigms and poverty in global energy policy: research needs for achieving universal energy access. *Environmental Research Letters,* 11:064014.

SOVACOOL, B.K., HEFFRON, R.J., MCCAULEY, D. & GOLDTHAU, A. 2016. Energy decisions reframed as justice and ethical concerns. *Nature Energy,* 1(5):16024.

SOVACOOL, B.K. 2012. An international assessment of energy security performance. *Ecological Economics*, 83:148-158.

SOVACOOL, B.K. 2012. The political economy of energy poverty: a review of key challenges. *Energy for Sustainable Development,* 16(3):272-282.

SPAARGAREN, G. 2011. Theories of practices: Agency, technology and culture: Exploring the relevance of practice theories for the governance of sustainable consumption practices in the new world-order. *Global Environmental Change,* 21(3):813-822.

SPAARGAREN, G. 2003. Sustainable consumption: a theoretical and environmental policy perspective*. Society and Natural Resources,* 16(8):687-701.

SPAARGAREN, G. & VAN VLIET, B. 2000. Lifestyles, consumption and the environment; the ecological modernization of domestic consumption. *Environmental Politics,* 9(1):50-76.

SPAARGAREN, G. & OOSTERVEER, P. 2010. Citizen-consumers as agents of change in globalizing modernity: The case of sustainable consumption. *Sustainability, 2*:1887-1908.

SPALDING-FLETCHER, R., JOYCE, B. & WINKLER, H. 2017. Climate change and hydropower in the Southern African power pool and Zambezi River Basin system wide and policy implications. *Energy Policy,* 103:84-97.

SPARREVIK, M., ADAM, C., MARTINSEN, V. & CORNELISSEN, G. 2015. Emissions of gases and particles from charcoal/biochar production in rural areas using medium-sized traditional and improved “retort” kilns. *Biomass and Bioenergy,* 72:65-73.

STEG, L., SHWOM, R. & DIETZ, T. 2018. What drives energy consumers? *IEEE Power and Energy Magazine*, 1540-7977/18:20-28.

STEG, L. & VLEK, C. 2009. Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology,* 29:309-317.

STERN, P.C., JANDA, K.B., BROWN, M.A., STEG, L., VINE, E.L. & LUTZENHISER, L. 2016. Opportunities and insights for reducing fossil fuel consumption by households and organizations. *Nature Energy*, 1:16043.

STERN, N. 2007. *The economics of climate change: the Stern review*. Cambridge, UK: Cambridge University Press.

STONES, R. 2017. *Structuration theory*. The Wiley-Blackwell Encyclopedia of Social Theory 1-3

STOPPOK, M., JESS, A., FREITAG, R. & ALBER, E. 2018. Of culture, consumption and cost: a comparative analysis of household energy consumption in Kenya, Germany and Spain. *Energy Research and Social Scienc,* 40:127-139.

STRENGERS, Y. 2010. *Conceptualizing everyday practices: composition, reproduction and change*. Working paper # 6. Carbon Neutral Communities. Adelaide, Australia: Centre for design, RMIT University and University of South Australia.

STRINGER, L.C., SALLU, S.M., DOUGILL, A.J., WOOD, B.T. & FICKLIN, L. 2017. Reconsidering climate compatible development as a new development landscape in southern Africa. *Making Climate Compatible Development Happen,* 22-43.

STRINGER, L.C., AKHTAR-SCHUSTER, M., MARQUES, M.J., AMIRASLANI, F., QUATRINI, S. & ABRAHAM, E.M. 2012. Combating land degradation and desertification and enhancing food security: Toward integrated solution. *Annals of Arid Zones,* 50(3 and 4):1-23.

STRINGER, L.C., DOUGILL, A.J., MKWAMBISI, D.D., DYER, J.C., KALABA, F.K. & MNGOLI, M. 2012. Challenges and opportunities for carbon management in Malawi and Zambia. *Carbon Management,* 3(2):159-173.

STRINGER, L.C., DYER, J.C., REED, M.S., DOUGILL, A.J., TWYMAN, C. & MKWAMBISI, D. 2009. Adaptations to climate change, drought and desertification: Local insights to enhance policy in Southern Africa. *Environmental Science and Policy,* 12(7):748-765.

SUBERU, M.Y., MUSTAFA, M.W., BASHIR, N., MUHAMMAD, N.A. & MOKHTAR, A.S. 2013. Power sector renewable energy integration for expanding access to electricity in sub-Saharan Africa. *Renewable and Sustainable Energy Reviews,* 25:630-642.

SUCKALL, N., FRASER, E., FOSTER, P. & MKWAMBISI, D. 2015.Using a migration systems approach to understand the link between climate change and urbanization in Malawi. *Applied Geography,* 63:244-252.

SUCKALL, N., STRINGER, L.C. & TOMKINS, E.L. 2015. Presenting triple-wins? Assessing projects that deliver adaptation, mitigation and development co-benefits in rural sub-Saharan Africa. *AMBIO,* 44:34-41.

SULAIMAN, C., ABDUL-RAHIM, A.S., MOHD-SHAHWAHID, H.O. & CHIN, L. 2017. Wood fuel consumption, institutional quality, and forest degradation in sub-Saharan Africa: Evidence from a dynamic panel framework. *Ecological indicator*s, 74:414-419.

SULEIMAN, S. & BUGAJE, I.M. 2016. Biomass consumption in Nigeria: Trends and policy issues. *Journal of Agriculture and Sustainability,* 9:127-157.

SYAMPUNGANI, S., CHIRWA, P.W., AKINNIFESI, F.K., SILESHI, G. & ATAYI, O.C. 2009. The Miombo woodlands at the crossroads: Potential threats, sustainable livelihoods, policy gaps and challenges. *Natural Resources Forum,* 33:150-159.

TALJAARD, H. 2015. *Male consumers' pro-environmental motivation and intent to acquire eco-friendly apparel in South Africa*. Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria.

TASHAKKORI, A. & CRESWELL, J.W. 2007. Editorial: The new era of mixed methods. *Journal of Mixed Methods Research*, 1(1):3-7.

TAULO, J.L. & SEBITOSI, A.B. 2015. *Energy consumption analysis for the Malawian tea industry*. International Conference on the industrial and Commercial Use of Energy (ICUE): 191-198.

TAULO, J.L., GONDWE, K.J. & SEBITOSI, A.B. 2015. Energy supply in Malawi: Options and issues. *Journal of Energy in Southern Africa,* 26(2):19-32.

TAWNEY, L., MILLER, M. & BAZILIAN, M. 2015. Innovation for sustainable energy from a pro-poor perspective. *Climate Policy, 15(1*):146-162.

TIMKO, J.A. & KOZAK, R.A. 2016. The influence of an improved fuelwood cookstove, Chitedzo mbaula, on tree species preference in Malawi. *Energy for Sustainable Development,* 33:53-60.

TO, L.S., MASALA, L., NAVARRO, V.A., BATCHELOR, S., MULUGETTA, Y., BARNETT, A., & KAREKEZI, S. 2017; Policy perspectives on expanding cogeneration from bagasse in Malawi. *Journal of Energy in Southern Africa,* 28(1):45-53.

TOL, R.S.J. 2009. The economic effects of climate change. *Journal of Economic Perspectives,* 23(2):29- 51

TOMPKINS, E.L. & EAKIN, H. 2011. Managing private and public adaptation to climate change. *Global Environmental Change,* (in press).

TOTH, G.G., RAMACHANDRAN-NAIR, P.K., JACOBSON, M., WIDYANINGSIH, Y., & DUFFY, C.P. 2019. Malawi's energy needs and agroforestry: impacts of woodlots on fuelwood sales. *Energy for sustainable development,* 50:101-108.

TOTH, G.G., RAMACHANDRAN-NAIR, P.K., JACOBSON, M., WIDYANINGSIH, Y., & DUFFY, C.P. 2017. Malawi's energy needs and agroforestry: adoption potential of woodlots. *Human Ecology*, 45:735-746.

THIERFELDER, C., RUSINAMHODZI, L., NGWIRA, A.R., MUPANGWA, W., NYAGUMBO, I., GIRMA, T., KASSIE, G.T. & CAIRNS, J.E. Conservation agriculture in Southern Africa: Advances in knowledge. *Renewable Agriculture and Food Systems,* 30(4):328–3480.

THOMAS, D.S.G. & TWYMAN, C. 2005. Equity and justice in climate change adaptation amongst natural-resource-dependent societies. *Global Environmental Change,* 15(2):115-124.

THORNLEY, P., GILBERT, P., SHACKLEY, S. & HAMMOND, J. 2015. Maximizing the greenhouse gas reductions from biomass: the role of life cycle assessment. *Biomass and Bioenergy,* 81:35-43.

THORNTON, P.K. & HERRERO, M. 2015. Adapting to climate change in the mixed crop and livestock farming systems in sub-Saharan Africa. *Nature Climate change,* 5(9):830.

TORRE-ROJAS, D., LEHMANN, J., HOBBS, P., JOSEPH, S., & NEUFELDT, H. 2011. *Biomass availability energy consumption and biochar production: a rural household study of Western Kenya.* Nairobi, Kenya: World Agroforestry Centre.

TREIBER, M.U., GRIMSBY, L.K. & AUNE, J.B. 2015. Reducing energy poverty through increasing choice of fuels and stoves in Kenya: Complementing the multiple fuel model. *Energy for Sustainable Development,* 27:54-62.

TROTTER, P.A., MCMANUS, M.C. & MACONACHIE, R. 2017. Electricity planning and implementation in sub-Saharan Africa: A systematic review. *Renewable and Sustainable Energy Review,* 74:1189-1209.

TSUSAKA, T., ORR, A., MSERE, H., HARRIS, D, RAO, N & GANGA, V. 2018. Fuelwood or grain: a conjoint analysis of trait preferences for pigeonpea among smallholders in southern Malawi. Conference paper/presentation. International Association of Agricultural Economists (AAE) conference, 28 July – 2August. Vancouver, British Columbia.

TUKKER, A., COHEN, M.J., HUBACEK, K. & MONT, O. 2010. The impacts of household consumption and options for change. *Journal of Industrial Ecology,* 14(1):13-30.

QUANDT, A., NEUFELDT, H. & MCCABE, J.T. 2019. Building livelihood resilence: what role does agroforestry play? *Climate and Development,* 11(6):485-500.

URGE-VORSATZ, D. & HERRERO, S.T. 2012. Building synergies between climate change mitigation and energy poverty alleviation. *Energy Policy,* 49:83-90.

URRY, J. 2015. Climate change and society. *Why the Social Sciences Matter,* 45-59.

VAN BELKUM, M. 2016. *Male consumers' evaluation of apparel assortments in South African speciality stores.* Unpublished masters dissertation. Pretoria, South Africa: University of Pretoria.

VAN DER KROON, B. 2016. "Climbing the African energy ladder: internal and external factors influencing household demand for improved cook stoves and modern fuels in sub-Saharan Africa" PhD, Vrije Universiteit, Amsterdam

VAN GEVELT, T., HOLZEIS, C.C., JONES, B. & SAFDAR, M.T. 2016. Insights from an energy poor Rwandan village. *Energy for Sustainable Development,* 32:121-129.

VAN VLIET, E.D.S., KINNEY, P.L., OWUSU-AGYEI, S., SCHLUGER, N.W., WHYATT, R.M., JACK, D.W., CHILLRUD, S.N., BOAMAH, E.A., MUJTABA, M. & ASANTE, K.P. 2019. Current respiratory symptoms and risk factors in pregnant women cooking with biomass fuels in rural Ghana. *Enviroment International,* 124:533-540.

VASSILEVA, I., WALLIN, F. & DAHLQUIST, E. 2012. Understanding energy consumption behaviour for future demand response strategy development. *Energy,* 46(1):94-100.

VIJAYAVENKATARAMAN, S., INIYAN, S. & GOIC, R. 2012. A review of climate change, mitigation and adaptation. *Renewable and Sustainable Energy Reviews,* 16(1):878-897.

WAITT, G., CAPUTI, P., GIBSON, C., FARBOTKO, C., HEAD, L., GILL, N. & STANES, E. 2012. Sustainable household capability: Which households are doing the work of environmental sustainability? *Australian Geographer,* 43(1):51-74.

WALLIMAN, N. 2017. *Research methods. The basics*. Routledge.

WARNATZSCH, E.A. & REAY, D.S. 2019. Temperature and precipation change in Malawi: Evaluation of CORDEX-Africa climate simulations for climate change impact assessments and adaptation planning. *Science for the Total Environ*ment 654: 378-392

WATHORE, R., MORTIMER, K. & GRIESHOP, A.P. 2017. In-use emissions and estimated impacts of traditional, natural-and forced-draft cookstoves in rural Malawi. *Environmental Science and Technology,* 51(3):1929-1938.

WEAVER, C. & PERATSAKIS, C. (eds). *Climate change and development in Africa.* Austin, Texas: The Robert S. Strauss Centre for International Security and Law.

WEI, Y.M., LIU, L.C., FAN, Y. & WU, G. 2007. The impact of lifestyle on energy use and CO_2 emission: an empirical analysis of China's residents. *Energy Policy,* 247-257.

WEI, T., DONG, W., YAN, Q., CHOU, J., YANG, Z. & TIAN, D. 2017. The global commons and environmental justice- climate change. *Environmental Justice,* 171-199.

WELLS, V.K., PONTING, C.A. & PEATTLE, K. 2011. Behaviour and climate change: Consumer perceptions of responsibility. *Journal of Marketing Management,* 27(7)8:808-833.

WELMAN, J.C., KRUGER, S.J. & MITCHELL, B. 2005. *Research methodology*. 3rd ed. Cape Town, South Africa: Oxford University Press.

WICKER, P. & BECKEN, S. 2013. Conscientious vs ambivalent consumers: Do concerns about energy availability and CC influence consumer behaviour. *Ecological Economics*, 88:41-48.

WIGLEY, T.M.L. 1998. The Kyoto Protocol: CO2CH4 and climate implications. *Geophysical Research Letters,* 25(13):2285-2288.

WILSON, V. 2014. Research methods: triangulation. *Evidence Based Library and Information Practice,* 9(1):74-75. [Online] Available from: https://journals.library.ualberta.ca/eblip/index.php/EBLIP/article/view/21469/16225 [Accessed: 2017-05-18].

WINKLER, H., BOYD, A., GUNFAUS, M.T. & RAUBENHEIMER, E.S. 2015. Reconsidering development by reflecting on climate change. *International Environ Agreements,* 15:369-387.

WINTER, G. 2000. *A comparative discussion of the notion of "validity" in qualitative and quantitative research*. The qualitative Report 4 (3and4). [Online] Available from: http://0-www.nova.edu.innopac.up.ac.za/ssss/QR/QR4-3/winter.html [Accessed: 2014-10-18].

WIYO, K.A., FIWA, L. & MWASE, W. 2015. Solving deforestation, protecting and managing key water catchments in Malawi using smart public and private partnerships. *Journal of Sustainable Development Archives,* 8(8):251-261.

WOLF, J. & MOSER, S.C. 2011. Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. *Wiley Interdisciplinary Reviews,* 2:547-569.

WOOD, L. & MORINIERE, L. 2013. *Malawi climate change vulnerability assessment*. Washington DC, USA: USAID. [Online] Available from: https://www.researchgate.net/publication/276206741 [Accessed 2016-10-09].

WOOD, B., NELSON, C., KILIC, T. & MURRAY, S. 2013. *Up in smoke? Agricultural commercialization, rising food prices and stunting in Malawi.* Washington DC, USA: The World Bank. Research Development Group. Poverty and Inequality Team.

WOOLLEN, E., BAUMERT, S., RYAN, C.M. & VOLLMER, F. 2016. *Charcoal production in the Mopane woodlands of Mozambique: what are the trade-offs with other ecosystem services*. London, UK: Philosophical Transactions of the Royal Society and Biological Sciences.

WORLD BANK. 2018. *The World Bank in Malawi*. [Online] Available from: https://www.worldbank.org/en/country/malawi/overview accessed 10/08/2019 [Accessed: 2019-08-10].

WORLD BANK. 2016. *Vulnerability to poverty in rural Malawi*. Policy Research working Papers https://doi.org/10.1596/1813-9450-7769

WORLD HEALTH ORGANISATION. 2006. *Fuel for life: household energy and health*. Geneva, Switzerland: World Health Organisation.

WORLD HEALTH ORGANIZATION, 1999. World Health Report. Available at: https://www.who.int/whr/1999/en/whr99_en.pdf?ua=1 (Accessed: 2016-06-15).

WORLD WILDLIFE FUND (WWF). 2019. *Southern Miombo woodlands*. [Online] Available from: https:www.worldwildlife.org/ecoregions/at0719 [Accessed: 2019-07-12].

WORLD WILDLIFE FUND (WWF). 2012. *Living planet report 2*012. Geneva, Switzerland: WWF International Gland.

WORLDOMETER, 2019. [Online] Available from: https://www.worldometers.info/world-population/ [Accessed: 2019-08-10].

WU, X., LU, Y., ZHOU, S., CHEN, L. & XU, B. 2016. Impact of climate change on human infectious diseases: empirical evidence and human adaptation. *Environment International,* 86:14-23.

YADOO, A. & CRUICKSHANK, H. 2012. The role of carbon electrification technologies in poverty reduction and climate change strategies: A focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya. *Energy Policy*, 42: 591-602.

YOHANNES, G.H., MULUGETTA, Y., NILSSON, L.J., GUJBA, H., KAHSAI, M.S., ATAKLT, T. & SOKONA, Y. 2011. *Integrating renewable energy and climate change policies: Exploring policy options for Africa.* African Climate Policy Centre Working Paper 10. Addis Ababa, Ethiopia: UN Economic Commission for Africa. United Nations Economic Commission for Africa.

YOUNG, W. & MIDDLEMISS, L. 2012. A rethink of how policy and social science approach changing individuals' actions on greenhouse gas emissions. *Energy Policy,* 41:742-747. [Online] Available from: http://dx.doi.org/10.1016/;.enpol.2011.11.040 [Accessed: 2014-10-22].

YOUNG, W., HWANG, K., MCDONALD, S. & OATES, C.J. 2010. Sustainable consumption: Green consumer behaviour when purchasing products. *Sustainable Development,* 18(1):20-31.

ZALENGERA, C., BLANCHARD, R.E., EAMES, P.C., JUMA, A.M., CHITAWO, M.L. & GONDWE, K.T. 2014. Overview of the Malawi energy situation and pestle analysis of sustainable development of renewable energy. *Renewable and Sustainable Energy Reviews,* 38:335-347.

ZEYRINGER, M., PACHAURI, S., SCHMID, E., SCHMIDT, J., WORRELL, E. & MORAWER, V.B. 2015. Analysing grid extension and stand-alone photovoltaic systems for the cost-effective electrification in Kenya. *Energy for Sustainable Development,* 25:75-86.

ZHANG, X., KUCHINKE, L., WOUD, M.L., VELTEN, J. & MARGRAF, J. 2017. Survey methods matters: online/offline questionnaires and face-to-face or telephone interviews differ. *Computers in Human Behaviour,* 71:172-180.

ZHANG, J. & SMITH, K.R. 2007. Household Air Pollution from Coal and Biomass Fuels in China: Measurements, Health Impacts, and Interventions. *Environmental Health Perspective,* 115(6):848-855.

ZHANG, J. & SMITH, K.R. 1999. Emissions of carbonyl compounds from various cook stoves in China. *Environmental Science Technology,* 33:2311–2320.

ZHENGEN, R., ZHENGDONG, C. & XIAOMING, W. 2011. Climate change adaptation pathways for Australian residential buildings. *Fuel and Energy Abstract,* 46(11):2398-2412.

ZHOU, Y. & LIU, Y. 2016. Does population have a larger impact on carbon dioxide emissions than income? Evidence from a cross-regional panel analysis in China. *Applied Energy*, 180:800-809.

ZHOU, K. & YANG, S. 2016. Understanding household energy consumption behaviour: The contribution of energy big data analytics. *Renewable and Sustainable Energy Reviews,* 56:810-819.

ADDENDUM A

QUESTIONNAIRE

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

Questionnaire

Dear respondent,

I am currently enrolled for my PhD at the University of Pretoria, under guidance of Professor Alet Erasmus and Dr Nadine Sonnenberg. The focus of my study is on households' acquisition and consumption of fuelwood and charcoal in rural areas in Malawi. You would be of great assistance to me if you complete the following questionnaire (answer the questions).

At no time will any attempt be made to identify you. Please answer the questionnaire anonymously and honestly. Your answers will be bulked with those obtained from other people and appropriate statistical analyses will be performed on the bulked data, which makes it impossible to identify an individual participant's contribution.

The questionnaire consists of a number of sections. Please follow the instructions in each section. It will take approximately 25 minutes to complete. Should you wish to discontinue your participation, please feel free to do so at any point.

Your input and time is greatly appreciated.

Kind regards,
Mphatso Mchakulu (Mrs.)
(Cell number: +265 888 553 387)
July 2015

QUESTIONNAIRE

For Office Use

Respondent Number | | | | V0 | | | |

Section A: Demographics

Please answer the questions in the following sections by circling a number in a shaded box appropriate to your answer or by writing your answer into the shaded box provided.

1. What is your gender?

Male	**1**
Female	**2**

V1 |

2. What was your age at your most recent birthday?

		years

V2 | | |

3. What is your highest level of education?

Std 8 or lower	**1**
Form 2 or lower	**2**
Form 4 or lower	**3**
Diploma or certificate	**4**
Degree	**5**
Other (please specify)	**6**

V3 |

4. Please indicate your marital status:

Single	**1**
Separated	**2**
Divorced	**3**
Widowed	**4**
Married/ Couple	**5**

V4 |

5. How many members, including yourself, are in your household?

		Members

V5 | | |

6. Please indicate your area of residence:

Balaka	**1**
Phalombe	**2**
Other (please specify)	**3**

V6 |

7. What is your approximate total monthly household income, therefore as contributed by all members of the household ?

V7 | | | | |

For Office Use

8. Please indicate your current employment status:

Employed full time	**1**
Employed part time	**2**
Own Business	**3**
Not employed	**4**

V8 ☐

9. Do you live in a private residential free standing house?

Yes	**1**
No	**2**

V9 ☐

10. In what type of area do you live?

	Yes	No		
I live in a rural area	**1**	**2**	V10.1	☐
I live in a semi-rural area	**1**	**2**	V10.2	☐
Other (specify)	**1**	**2**	V10.3	☐

Section B: Lifestyle

For Office Use

The following section aims to identify the household's lifestyle regarding its acquisition and consumption of fuelwood and charcoal (and energy in general).

11. How long does it take you to walk from your dwelling/household to where you usually go to collect fuelwood?

Less than one hour		1
One hour		2
Two hours		3
Other (please specify)		4

V11 ☐

12. How many bundles of fuelwood do you use in a month?

Two bundles	1
Three bundles	2
Four bundles	3
Other (please specify)	4

V12 ☐

13. How much money do you spend per month on the following energy sources?

Energy Source	Amount in MK		
ESCOM electricity		V13.1	☐
Fuelwood		V13.2	☐
Solar		V13.3	☐
Charcoal		V13.4	☐
Paraffin		V13.5	☐
Saw dust		V13.6	☐

14. Which forms of energy do you use for the following?

	ESCOM	Solar	Fuelwood	Paraffin	Charcoal	Saw Dust	Crop Residue	Not applicable
Cooking	1	2	3	4	5	6	7	8
Lighting	9	10	11	12	13	14`	15	16
Space heating	17	18	19	20	21	22	23	24
Water heating	25	26	27	28	29	30	31	32
Beer brewing	33	34	35	36	37	38	39	40
Other (please specify)	41	42	43	44	45	46	47	48

V14.1-24 ☐☐☐☐

For Office Use

16. What is your main source of lighting fuel?

Collected fuelwood	**1**
Purchased fuelwood	**2**
Grass	**3**
Paraffin	**4**
Electricity	**5**
Gas	**6**
Battery/Dry cell (Torch)	**7**
Candles	**8**
Other (please specify)	**9**

V16 ☐

17. What is your main source of cooking fuel?

Collected fuelwood	**1**
Purchased fuelwood	**2**
Paraffin	**3**
Electricity	**4**
Gas	**5**
Charcoal	**6**
Crop residue	**7**
Saw dust	**8**
Animal waste	**9**
Other (please specify)	**10**

V17 ☐

18. What is your main source of energy for space heating?

Collected fuelwood	**1**
Purchased fuelwood	**2**
Paraffin	**3**
Electricity	**4**
Gas	**5**
Charcoal	**6**
Crop residue	**7**
Animal waste	**8**
Other (please specify)	**10**

V18 ☐

19. What is your main source of energy for water heating?

Collected fuelwood	**1**
Purchased fuelwood	**2**
Paraffin	**3**
Electricity	**4**
Gas	**5**
Charcoal	**6**
Crop residue	**7**
Animal waste	**8**
Other (please specify)	**10**

V19 ☐

For Office Use

20. What is your main source of energy for beer brewing?

Collected fuelwood	**1**
Purchased fuelwood	**2**
Paraffin	**3**
Electricity	**4**
Gas	**5**
Charcoal	**6**
Crop residue	**7**
Animal waste	**8**
Other (please specify)	**10**

V20 ☐

21. Do you ever collect fuelwood for household use?

Yes	**1**
No	**2**

V21 ☐

22. Where do you collect fuelwood?

Own woodlot	**1**
Community woodlot	**2**
Forest reserve	**3**
Unfarmed areas of community	**4**
Other (please specify)	**5**

V22 ☐

23. How often do you collect fuelwood?

Daily	**1**
Weekly	**2**
Fortnightly	**3**
Monthly	**4**
Other (please specify)	**5**

V23 ☐

24. How much fuelwood do you collect?

One bundle	**1**
Two bundles	**2**
Three bundles	**3**
Other (please specify)	**4**

V24 ☐

25. Who collects the fuelwood?

Women	**1**
Men	**2**
Children	**3**
Other (please specify)	**4**

V25 ☐

For Office Use

26. Of the fuelwood you used in the past week, how much of it did you purchase?

All	1
Almost all	2
More than half	3
Half	4
Less than half	5
A little	6
None	7

V26 ☐

27. Do you have electricity working in your dwelling/household?

Yes	1
No	2

V27 ☐

28. In the event of an electricity blackout, what source of energy do you use for Lighting?

Fuelwood	1
Paraffin	2
Candles	3
Solar	4
Other (please specify)	5

V28 ☐

29. In the event of an electricity blackout, what source of energy do you use for Cooking?

Charcoal	1
Fuelwood	2
Gas	3
Paraffin	4
Other (please specify)	5

V29 ☐

30. Do you get electricity via ESCOM?

Yes	1
No	2

V30 ☐

32. In the last 12 months, how frequently did you experience blackouts in your area?

Never	1
Everyday	2
Several times a week	3
Several times a month	4

V32 ☐

33. Although you do not have electricity in your dwelling/household, does your village/ neighbourhood have access to electricity provided by ESCOM?

Yes	1
No	2

V33 ☐

34. What is the main reason for your household not to have access to electricity?

Connection/wiring fee unaffordable	1
No need for electricity	2
Dwelling inappropriate for connection	3
Application pending	4
Line was disconnected	5
Other (please specify)	6

V34 ☐

Section C: Environmental Knowledge

For Office Use

Please read each statement below and answer by circling the appropriate number in the adjacent columns.

		True	False	Don't know		
35.1	Climate change is currently one of the most critical problems that Malawi is facing	1	2	3	V35.1	
35.2	Climate change causes flooding	1	2	3	V35.2	
35.3	Climate change causes dry spells	1	2	3	V35.3	
35.4	Climate change does not affect me personally to the same extent that it affects fellow citizens in Malawi	1	2	3	V35.4	
35.5	An increase in the Malawi population will put further strain on our natural resources	1	2	3	V35.5	
35.6	The economic growth of Malawi is influenced by environmental problems	1	2	3	V35.6	
35.7	The amount of energy used by the household has a significant impact on the environment	1	2	3	V35.7	
35.8	The average citizen can do much to reduce climate change	1	2	3	V35.8	
35.9	Environmental pollution taking place in South Africa has an impact on Malawi	1	2	3	V35.9 V35.10	
35.10	Saving energy in our everyday living will contribute to saving our planet	1	2	3	V35.11	
35.11	Brick baking causes deforestation	1	2	3		
35.12	Tobacco curing causes deforestation	1	2	3	V35.12	

Section C2: Practical consciousness manifesting in actual practices

For Office Use

Please read each statement below and answer by circling the appropriate number in the adjacent columns.

		Never	Sometimes	Frequently	Always		
36.1.	Do you chop off/cut natural trees for cooking?	1	2	3	4	V36.1	
36.2.	Do you chop off/cut plantation/forest trees for cooking?	1	2	3	4	V36.2	
36.3	Do you cover pots with lids when cooking?	1	2	3	4	V36.3	
36.4	Do you add more charcoal to a burner although remaining charcoal is sufficient for cooking?	1	2	3	4	V36.4	
36.5	Do you add more fuelwood to the fire than what is required for cooking?	1	2	3	4	V36.5	
36.6	Do you use metal pots unlike clay pots in order to conserve energy?	1	2	3	4	V36.6	
36.7	Do you soak food such as beans to reduce cooking time?	1	2	3	4	V36.7	
36.8	Do you save fuelwood by extinguishing the fire when finishing cooking?	1	2	3	4	V36.8	
36.9.	Do you save charcoal by extinguishing the charcoal when finishing cooking?	1	2	3	4	V36.9	
36.10	Do you cook fewer meals in a day in order to save energy?	1	2	3	4	V36.10	
36.11	Do you shift to food that takes less time to cook in order to save energy?	1	2	3	4	V36.11	
36.12	Do you change cooking methods in order to save energy?	1	2	3	4	V36.12	
36.13	Do you reduce space heating in order to save energy?	1	2	3	4	V36.13	
36.14	Do you reduce water heating in order to save energy?	1	2	3	4	V36.14	
36.15	Do you bath cold water in order to save energy?	1	2	3	4	V36.15	
36.16	Do you heat water in the sun in order to save energy?	1	2	3	4	V36.16	
36.17	Do you dry clothes naturally in the sun in order to save energy?	1	2	3	4	V36.17	
36.18	Do you use a three-stone fireplace for cooking?	1	2	3	4	V36.18	
36.19	Do you use an energy saving cook-stove?	1	2	3	4	V36.19	
36.20	Do you plant trees to counter deforestation?	1	2	3	4	V36.20	
36.21	Do you switch off lamps when no one is in the room?	1	2	3	4	V36.21	
36.22	Do you switch off lamps when going to bed?	1	2	3	4	V36.22	
36.23	Do you open windows to allow natural light into the house to save energy by reduce the use of artificial light?	1	2	3	4	V36.23	
36.24	Do you closely tend and manage fire to reduce fuelwood consumption?	1	2	3	4	V36.24	
36.25	Do households cook together in a “shared pot” to reduce individual fuelwood consumption – communal cooking?	1	2	3	4	V36.25	

Thank you for your time and co-operation!!!

ADDENDUM B

FOCUS GROUP DISCUSSION WITH RURAL WOMEN

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

FOCUS GROUP DISCUSSION WITH RURAL WOMEN

Opening*(Establish Rapport) (Shake hands)*

My name is Mphatso Mchakulu. Currently, I am a PhD student in the Department of Consumer Sciences at the University of Pretoria in South Africa. I work at the Lilongwe University of Agriculture and Natural Resources (LUANAR) in the Faculty of Food and Human Sciences - the Department of Human Ecology. I am doing a research study on fuelwood acquisition and consumption by households in this area. I hope that you can spare some of your time to answer my questions. Will you allow me to record this discussion?

Purpose

I would like to find out what the community is experiencing in terms of household energy acquisition and consumption in Malawi in the wake of climate change. I will ask some questions that relate to household fuelwood and charcoal (energy in general) acquisition and consumption in this community.

Motivation

I am hoping to use this information for academic purposes. However, it is quite possible that my findings will help to inform policy-maker about some of the issues related to fuelwood acquisition and use especially in light of climate change.

Timeline

This focus group discussion should take about 80 minutes to complete. Are you available to respond to some questions at this time? You can stop this interview at any time that you want.

Body

1. Generally, what do you know about climate change in this area? What exactly has this area experienced in this area in terms of climate change? (Floods, droughts, dry spells)
2. Specifically, what do you know about fuelwood acquisition and consumption in this area with regard to climate change during times of such natural disasters? What do you think about fuelwood and charcoal consumption in this area in the wake of climate change?
3. What source of energy do you use for cooking? Why do you use this source of energy for cooking? How does this affect the environment? Are there better ways of cooking for the environment?

4. What source of energy do you use for lighting? Why do you use this source of energy for lighting? How does this affect the environment? What does lighting with this source of energy do to the environment? Are there better ways of lighting for the environment?
5. What source of energy do you use for water heating? Why do you use this source of energy for water heating? How does this affect the environment? What does using this source of energy do to the environment? Are there better ways for the environment?
6. What source of energy do you use for space heating? Why do you use this source of energy for space heating? How does this affect the environment? What does using this source of energy for pace heating do to the environment? Are there better ways for the environment?
7. What source of energy do you use for beer brewing? Why do you use this source of energy for beer brewing? How does this affect the environment? What does using this source of energy do to the environment? Are there better ways for the environment?
8. What effects do the practices i.e. cooking, lighting, water heating, space heating, and beer brewing, have on the environment? Who must do something about this? Must the Government do something about this this? What must communities do?

CLOSING

1. Summarize

    a. As a woman in your household, you are involved in…

    b. Your work in and around the household involves….

    c. The Government has so far done the following to curb the effects of climate change in terms of fuelwood acquisition and consumption …..

2. (Maintain rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know regarding household energy acquisition and consumption in the wake of climate change in this area?

3. (Action to be taken). I should have all the information I need. Should it be necessary, would it be alright to call you or indeed visit you again if I have any more question?

Thank you very much!

ADDENDUM C

INTERVIEW SCHEDULE FOR GOVERNMENT FORESTRY OFFICERS

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

INTERVIEW SCHEDULE FOR GOVERNMENT FORESTRY OFFICERS

Opening*(Establish Rapport) (Shake hands)*
My name is Mphatso Mchakulu. I work at the Lilongwe University of Agriculture and Natural Resources (LUANAR) in the Faculty of Food and Human Sciences, in the Department of Human Ecology. Currently, I am a PhD student at the University of Pretoria in South Africa.

Topic
Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

Purpose
I would like to find out what the Government is doing in relation to household energy acquisition and consumption in Malawi. I will ask some questions about Government policies, rules, regulations and penalties as they relate to household fuelwood acquisition and consumption.

Motivation
I am hoping to use this information for academic purposes

Timeline
This interview should take about 40 minutes. Are you available to respond to some questions at this time?

1. Do you have a small or big forest around Phalombe/Balaka?
2. How big is this forest?
3. What kinds of trees are found in this forest? Natural/Indigenous
4. Please describe the working relationship between the forestry department and the surrounding communities?
5. What type of activities does the forestry department involve the community with?
6. Briefly, what does the Malawi energy policy say? Does the Government have any policy specifically regarding fuelwood in this country?
7. How is this energy policy implemented at grassroots level? How is the energy policy ensured/enforced at the grassroots? Who makes sure that the policy is adhered to?
8. What is the role of the forestry department in ensuring that communities have access to fuelwood in this area?
9. What are the rules and regulations that are enforced by the forestry department when communities access fuelwood from the forest?
10. What kinds of penalties are enforced if any one violates the rules and regulations?
11. What is the Government doing to make sure that communities have enough sources of fuelwood/energy? How do you think this will help in mitigating the impact of climate change as communities acquire and consume fuelwood?
12. What kind of efforts/initiatives are there on the ground that would help to mitigate the impact of climate change specifically in terms of fuelwood acquisition and consumption? How well-spread are these initiatives?
13. What is the Government doing to ensure that households have access to sustainable sources of energy?

CLOSING

A. Summarize

You as a forestry officer are involved in….

Your work involves …..

To curb the effects of climate change in terms of fuelwood acquisition and consumption, the Government has so far done……

B. (Maintain rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know regarding household energy acquisition and consumption in the wake of climate change?

C. (Action to be taken). I should have all the information I need. Should it be necessary, would it be alright to call you or indeed visit you again if I have any more question?

Thank you very much!

ADDENDUM D

INTERVIEW SCHEDULE FOR GOVERNMENT AGRICULTURE AND DEVELOPMENT OFFICERS (DADO)

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

INTERVIEW SCHEDULE FOR GOVERNMENT AGRICULTURE AND DEVELOPMENT OFFICERS (DADO)

Opening*(Establish Rapport) (Shake hands)*
My name is Mphatso Mchakulu. Currently, I am a PhD student at the University of Pretoria in South Africa. I work at the Lilongwe University of Agriculture and Natural Resources (LUANAR) in the Faculty of Food and Human Sciences, in the Department of Human Ecology.

Purpose
My PhD topic is on "Household energy acquisition and consumption in rural areas in Balaka and Phalombe districts". I would like to find out what the Government is doing in relation to household energy acquisition and consumption in Malawi. I will ask some questions about rules, regulations and penalties as they relate to household fuelwood acquisition and consumption. Will you allow me to record the interview?

Timeline
This interview should take about 40 minutes. Are you available to respond to some questions at this time? You can stop the interview at any time that you want. (Transition: Let me begin by asking you some questions about your role as a leader in this community).

Body
1. Are there forests around the communities you work with?
2. How big are these forests?
3. What kinds of trees are found in these forests? Indigenous or Exotic? Or both?
4. Please describe the working relationship between the District Agriculture and Development Office and the surrounding communities? In what type of activities do the District Agriculture and Development Office involve the community?
5. How is the Malawi National Energy Policy implemented/ ensured at grassroots level i.e. household sector?
6. What are the rules and regulations that are enforced by the District Agriculture and Development Office (as representatives of government) when communities access fuelwood from the forest? **Probe further:** (i) What is the role of the District Agriculture and Development Office in ensuring that communities have access to fuelwood in this area? (ii) What kinds of penalties are enforced if any one violates the rules and regulations? (iii) What is the Government doing to make sure that communities have enough sources of fuelwood/energy?
7. What kind of efforts/initiatives are there on the ground that would help to mitigate the impact of climate change specifically in terms of fuelwood acquisition and consumption? (i) How well-spread are these initiatives? (ii) How do you think this will help in mitigating the impact of climate change as communities acquire and consume fuelwood? (iii) What is the Government doing to ensure that households have access to sustainable sources of energy?

CLOSING

D. Summarize

You as a forestry officer are involved in …

Your work involves …

In order to o curb the effects of climate change in terms of fuelwood acquisition and consumption, the government has so far done …

(Maintain rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know regarding household energy acquisition and consumption in the wake of climate change?

E. (Action to be taken). I should have all the information I need. Should it be necessary, would it be alright to call you or indeed visit you again if I have any more question?

Thank you very much!

ADDENDUM E

INTERVIEW SCHEDULE FOR OFFICER FROM CONCERN UNIVERSAL

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

Interview schedule for officer from Concern Universal

1. What was the objective of the project that Concern Universal carried out with the community in Manjanja village?
2. How was Manjanja village selected? What criteria were used?
3. What were the households of Manjanja village supposed to contribute towards the project? And what was Concern Universal supposed to provide for the project?
4. So the project was participatory? The community contributed something and Concern Universal also contributed something!
5. Was the project by Concern Universal in Manjanja village a success or a failure? Why?
6. What do you think is Concern Universal's lasting contribution to Manjanja village in terms of energy needs in the wake of climate change?
7. Does Concern Universal have any plans to provide support to the cook stove production group in Manjanja village?
8. How does the national social cash transfer work?
9. How does the national cook stoves project work?
10. As a country, are we trying to come up with alternatives to the three stone fireplaces?
11. What was the most important aspect of Concern Universal's project in Manjanja village? Was it about energy provision or environmental preservation? Why?
12. How did Concern Universal project help Manjanja village especially at household level?
13. What did the Manjanja community bring to the project?
14. Do you think that the community of Manjanja village is aware of the consequences of environmental degradation and its impact on energy consumption?
15. How was the Government involved in this project?
16. How does a village qualify for funding in the national social cash transfer?

ADDENDUM F

INTERVIEW SCHEDULE FOR MALAWI ENVIRONMENT ENDOWMENT TRUST (MEET) OFFICIAL OPENING

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

Interview schedule for Malawi Environment Endowment Trust (MEET) official

Opening*(Establish Rapport) (Shake hands)*
My name is Mphatso Mchakulu. I work at the Lilongwe University of Agriculture and Natural Resources (LUANAR) in the Faculty of Food and Human Sciences, in the Department of Human Ecology. Currently, I am a PhD student at the University of Pretoria in South Africa.

Topic
Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

Purpose
I would like to find out what the Malawi Environment Endowment trust is doing in relation to household energy acquisition and consumption in Malawi. I will ask some questions about your organization's work related to household fuelwood acquisition and consumption, more especially in Khamula village in Phalombe district.

Motivation
I am hoping to use this information for academic purposes

Timeline
This interview should take about 40 minutes. Are you available to respond to some questions at this time?

1. What was the objective of the project that MEET carried out in Khamula village in Phalombe district?
2. So you are a financing organization? You only finance activities?
3. Were the MEET personnel involved right on the ground or you were just funding the projects that are in Phalombe?
4. How were you monitoring the projects?
5. I would like to learn more about your MEET's involvement with the community in Phalombe. What kind of activities were you involved with in relation to fuelwood use?
6. Specifically the funding was towards the cook stoves?
7. Were you involved in any activities related to afforestation/reforestation or it was strictly about the cook stoves?
8. As MEET, did you provide funds for the cook stoves in Phalombe? Or the individual households had to mobilize themselves within their community? Or the community requested for funding from MEET towards the cook stoves?
9. You also mentioned the issue of vendors for the cook stoves, are they supposed to be within the community or they come from elsewhere?
10. Is MEET promoting existing cook stoves designs or they are new stove designs?
11. Do you have any plans to continue funding the project or this was a once-off project funding?
12. Are you working in other areas or it is only in MMCT (Mulanje Mountain Conservation Trust)?
13. Are all your projects related to energy or you also fund different project?
14. What else is there apart from the biogas projects?
15. Do you have anything to add concerning the energy project?
16. Apart from projects to do with fuelwood, was there any project to do with alternative sources of energy?
17. But there was a project involved with energy efficiency and environmental preservation?
18. Do you work with the government or you are an independent NGO?
19. Any last words?

ADDENDUM G

INTERVIEW SCHEDULE FOR COMMUNITY LEADERS(CHIEFS) IN MALAWI

Rural Malawi households' environmental concern and consciousness about appropriate energy consumption practices amidst prevailing socio-economic conditions

INTERVIEW SCHEDULE FOR COMMUNITY LEADERS(CHIEFS) IN MALAWI

Opening(Establish Rapport) (Shake hands)
My name is Mphatso Mchakulu. Currently, I am a PhD student at the University of Pretoria in South Africa. I work at the Lilongwe University of Agriculture and Natural Resources (LUANAR) (Faculty of Food and Human Sciences) in the Department of Human Ecology.

Purpose
My PhD topic is on implications of rural Malawi households' consciousness of climate change amidst global concern about African countries' energy consumption practices and demands for alternative resources: the case of Balaka and Phalombe districts. I would like to find out what you as a community leader are doing to ensure continued and sustainable access to fuelwood, charcoal and other energy sources for household in your community. I will ask some questions related to your role as a community leader in your community about fuelwood, charcoal and other sources of energy. I will also ask questions related to your role in the formulation and implementation of rules, regulations and penalties in the acquisition and consumption of household energy.

Motivation
I am hoping to use this information for academic purposes

Timeline
This interview should take about 40 minutes. Are you available to respond to some questions at this time? You can stop the interview at any time that you want. Will you allow me to record our meeting?

(Transition: Let me begin by asking you some questions about your role as a leader in this community).

Body
1. As a community leader, what is your role in the community?
2. Generally, what do you know about climate change in this area?
3. Specifically, what do you know about fuelwood acquisition and consumption in this area with regard to climate change?
4. What challenges is the area experiencing in terms of climate change? (Floods, droughts, dry spells etc.)
5. What are the rules and regulations that are enforced by the District Forestry Office (as representatives of Government) when communities access fuel wood from the forest? **Probe further:** (i) What is the role of the District Forestry Office in ensuring that communities have access to fuel wood in this area? (ii) What kinds of penalties are enforced if any one violates the rules and regulations? (iii) What is the Government doing to make sure that communities have enough sources of fuel wood/energy?
6. What kind of efforts/initiatives are there on the ground that would help to mitigate the impact of climate change specifically in terms of fuel wood acquisition and consumption? (i) How well-spread are these initiatives? (ii) How do you think this will help in mitigating the impact of climate change as communities acquire and consume fuel wood? (iii) What is the Government doing to ensure that households have access to sustainable sources of energy?
7. Please describe the working relationship between you as a community leadership and the District Forestry Office? How do you as a community leader work with both the District Forestry Office and the community in making sure that the community has access to fuelwood and charcoal?
8. How does the District Forest Office cooperate with you as a community leader to make sure that communities do not encroach on the forest?

9. As a community leader, what is your role in formulating these rules and regulations? What is your role in enforcing these rules and regulations? What kinds of penalties are imposed when someone violates the rules and regulations?
10. What is your role as a community leader in ensuring that your community has enough sources of fuelwood/energy? How do you think this will help in mitigating the impact of climate change as communities acquire and consume fuelwood and charcoal? What initiatives have you taken as a community leader to ensure that your community has continued access to sustainable sources of energy?

CLOSING

F. Summarize

You as a community leader are involved in…

You work involves…

The Government has so far done the following to curb the effects of climate change in terms of fuelwood acquisition and consumption…….

G. (Maintain rapport) I appreciate the time you took for this interview. Is there anything else you think would be helpful for me to know regarding household energy acquisition and consumption in the wake of climate change in this area?

H. (Action to be taken). I should have all the information I need. Should it be necessary, would it be alright to call you or indeed visit you again if I have any more question?

Thank you very much!

ADDENDUM H

TRANSCRIPITIONS FROM KEY INFORMANT INTERVIEW WITH OFFICER FROM MEET (MALAWI ENVIRONMENT ENDOWMENT TRUST) IN BLANTYRE

Researcher: What was the objective of the project the MEET carried out with the community of Khamula in Phalombe district?
MEET respondent: Let me explain what MEET does as a background.
We are a grant organization. We award grants to other organizations to implement projects. The project we are talking about in Phalombe was awarded a grant through Mulanje conservation trust, these are the ones doing the implementation we just awarded the funds.
Researcher: So you only finance projects
MEET Respondent: Yes. We were established as a funding mechanism. Our core business is that we review proposals (proposals that are in line with our award grant policy) through our committees and board; we award projects and then fund them
So this was a project that was funded through Mulanje mountain conservation trust. The site is in Mulanje and Phalombe.
Researcher: Were the personnel from MEET involved on the ground or you were just funding the projects that are in Phalombe?
MEET Respondent: We just do monitoring and evaluation of the project
Researcher: How was that working?
MEET Respondent: This has just been funded in the last three months. They are only in their first quarter of implementation. We visited the site 2 weeks ago; some training was being conducted to produce the energy saving stoves. We were there for a day, monitoring the activities.
Researcher: I would like to learn more about your involvement with the community or the organization. What kind of activities where you involved in in relation to fuel use?
MEET Respondent: We have been awarding grants since 2000. A lot of organizations know about us as an organization that supports environmental projects.
MMCT (Mulanje mountain conversation trust). This is also a conservational fund which works around Mulanje mountain.
We manage grant facility, grant policy and grant application procedures.
Organizations have to send us a proposal or concept paper which we then review in-house following our guidelines. If it's something that we can support, we will.
Fuel and energy issues are critical at the moment. It's an area that needs a lot of intervention.
We try and support priotised identified communities so that we can address the needs and challenges at community level.
This is why we thought that the project proposed by MMCT through community mobilization, we thought that it should be supported. We were primarily looking at training groups (especially women groups) in the production of efficient energy cook stoves and also assist them identify vendors and support marketing techniques because it's possible to produce the stoves but have nowhere to market them. This is a matter of building the capacity to identify markets and awareness campaigns in terms of the importance of the stoves (increase the uptake and adoption) which will reduce the amount of wood fuel that is being used especially for cooking purposes and at the same time create small scale businesses and generate some income.
The project was approved in July 2015. They were receiving first funding in August.
Researcher: Specifically, the funding was towards the cook stoves?
MEET Respondent: Yes
Researcher: Were you involved in any activities related to afforestation or it was just the cook stoves?
MEET Respondent: This project is only looking at the cook stoves.
Researcher: As MEET, were you providing funds for the cook stoves in these areas? Or the individual households have to mobilize themselves within the community? Or write proposal that was then sent to MEET for funding?
MEET Respondent: I think that this is an area that a lot of work has been done through other projects on cook stove issues. It's an area where GTZ (German Cooperation) and other previous programmes on fuel efficient cook stoves have been.
This is an area that has a lot of aware and sensitization have already been done. In the project done by MEET was to just build on already existing knowledge about cook stoves and target women groups as primary users of wood fuel.

Researcher: You also mentioned the issue of vendors, are they supposed to be within the community or they come from elsewhere?
MEET Respondent: According to the way the project was designed, there is an aspect of identifying vendors. This will look at what is the value chain, where are the vendors strategically located, aware of how they can use the stoves which will then relay proper to the consumers.
This is basically about basic skills and knowledge about stoves and what message are they communicating to the consumers.
Researcher: Are these new stoves or MEET is using already existing designs?
MEET Respondent: These are the stoves that are already in existence.
There is a small component of tree planting that will take place but the main objective of the project is to produce stoves. They will distribute tree seedlings just to promote tree planting and increase the sources of fuel wood.
Researcher: Do you have any plans to continue funding the project or it is just a once-off thing?
MEET Respondent: It's a little difficult to say because the project has just been funded. If anything, once we are mid-way into the project or coming towards the end, we will be able to make an assessment of whether there is an opportunity or gap that needs to be identified.
Researcher: Are you working in other areas as well or its with Mulanje MCT?
MEET Respondent: We are a national trust so we work from Nsanje to Chitipa in different projects.
Researcher: Are the projects related to energy or they are in different areas?
MEET Respondent: Our priority areas are broad when it comes to the environment (ranges from forestry, fisheries, wildlife, energy issues, climate change, and environmental education)
We do have another project that is happening in Rumphi, Chikhwawa, and Nsanje (building biogas plants) at community level
At the moment they are being demonstrated at CBCCs (Community based childcare centres). Cooking meals for children
Researcher: What else is there apart from the biogas projects?
MEET Respondent: This is a demand driven process. We do not initiate projects but the need or problem of proposal comes from the community or organization.
A lot of the projects being funded are identified by the community and the strategies of how to solve those problems come from the community. We are trying to promote a bottom up approach so that it can be sustainable to them.
Researcher: Do you have anything to add concerning the energy project?
MEET Respondent: Energy is a very critical issue, we are a small fund, we are trying to do our part, and we need to make an effort if we are to improve access to energy at household level in communities that mainly depend on fuelwood. We need to be looking at alternatives and support them and move up the energy ladder.
Researcher: Has there been any project that has suggested alternative sources of energy apart from fuelwood?
MEET Respondent: We have been looking at biogas. Our first biogas plant was built about 7 years ago and it was at CBCC. 7 years later, it is still operational.
We need to be talking to organization on downsizing the technology to reach household level and how we can best use the technologies that are available.
We have not received other energy specific projects, a lot of proposals received look/address afforestation issues so we are looking at how to address deforestation issues.
We also have a project that look into land resources (Land resource degradation), soil and water conservation, climate smart agriculture.
We also have rain water harvesting because water is also an issue. How can we harvest rain water and then the water can be used for other purposes after the rain stops.
So we have not really received a specific energy proposal apart from this one in Mulanje and Phalombe. I think this is because it is an area where a bit of work was already done by other organizations in terms of sensitizing the community about energy efficient cook stoves.
Researcher: The project has been involved with energy efficiency and environmental preservation
MEET Respondent: Yes
Researcher: As an organization, are you working with the government or it's just an independent NGO?
MEET Respondent: We also work with the government, as an environmental NGO we have to work within the policies of the government. We are working within the environmental management act, supporting government in trying to achieve policies and programmes that are put in place for the country.
Government is our partner and key when it comes to connecting the district authorities. This authority sometimes provides us with technical support e.g. in the forestry project we work with district forestry departments which can also provide training and supervision, even technical assistance in terms of trees to plant and how to treat seeds.

Government is an important partner, if it's a fisheries project; we work with the government fisheries department etc.
We are registered as an independent organization but government is an important partner. District forestry officers or land resource conservation officers have been beneficiaries of our grants.
Researcher: Any last words?
MEET Respondent: Energy is an important issue. As MEET we are doing our part to assist communities the best way we can.

ADDENDUM I

TRANSCRIPTIONS FROM KEY INFORMANT INTERVIEW WITH OFFICIAL FROM CONCERN UNIVERSAL IN BALAKA

Researcher: What was the objective of the project that Concern Universal carried out with the community of Manjanja village?
CU respondent: The main objective of the project was to try and enhance the adoption of sustainable energy practices at both institution and household level.
At institutional level, CU was working with schools and health centres. At health centres Concern Universal was mobilizing individuals to open forests where individuals could get fuelwood. But we also installed energy efficiency stoves in the guardian shelters at the health centres.
Still at institutional level, CU installed solar panels in schools (about 21 schools) across TA Nsamala and sub TAs of Sawali, Chanthunya and Mkaya. Manjanja village is in TA Chanthunya as a matter of fact Chanthunya is a sub TA of Nsamala.
At household level, we had two approaches; the communal access to energy and the individual household energy.
In the communal approach, CU focus on village forest areas and at household level the focus was on energy efficient stoves and afforestation.
(The idea was to instill energy planning to reflect the past and highlight how much of a burden access to cooking energy for cooking was.) **** The present and future will create a trend for maintaining the energy sources; this is used as a tool for mobilization of communities to be proactive in energy planning.
With regard to Manjanja village, this was a pilot site where the project started in 2009. (Nsamala sustainable energy project). The village does not have communal land that can be turned into a forest. The village leaders were asked to locate some gardens where they could plant some tree. At the same time CU mobilized a group of individuals to go into production of energy saving stoves. They sold the stoves at village level.
We had about 30 stove production groups and each production group was set up to service a group of villages. However, there were challenges of quality of clay and group dynamics.
Researcher: How was Manjanja village selected? What criteria was used?
CU Respondent: For the afforestation site, we were targeting every village. But for the stove production, the village had to have access to good quality clay. Manjanja had good quality clay for the production of the stoves.
Researcher: What were the households of Manjanja village supposed to provide for the project? What was Concern Universal supposed to provide for the project?
CU Respondent: With respect to afforestation, CU trained household in local seed collection. But in most cases CU would supplement with species that are not locally available.
The village was supposed to construct nursery shelter and also provide labour for pot filling, watering and general nursery work till completion of the project.
CU's role was to provide materials such as wheelbarrows, rakes; nursery tools such as polythene tubes and also provide supplementary seeds.
Researcher: The project was participatory?
CU Respondent: Yes it was participatory. We were bringing an opportunity to the villages to produce stoves to be sold in the area.
The households had to provide their own clay, treat the clay and CU would train them in the production of the stoves. The households were supposed to mobilize themselves to collect stones and bricks for building a kiln and also build a shelter.
The project also had some few resources for the construction of a permanent structure. This group was very proactive that's why we build a shelter for them. For instance, this group shared MK1, 000,000 among a group of 13 members from the proceeds of energy saving stoves.
Researcher: Was the project by CU at Manjanja village a success or a failure? Why was it a success or a failure?
CU Respondent: Given the fact that the project closed in 2012 but the group is still running, I think the project was a success. The reason being that we focused on sustainability; secondly it's an enterprise, a business and we had a conducive environment. (Experts, availability of labour, linkages to the wider market).
Researcher: What do you think is CU lasting contribution to Manjanja village in terms of energy needs in the wake of climate change?

CU Respondent: Climate change has brought about challenges to biomass fuel access because we are now talking of non-productive forests or cleared forests.
The lasting contribution or change is the mindset of energy efficiency of wanting to use less energy to achieve the same results i.e. cook the same food but with less energy
The energy stoves save almost 1.5 tonnes of fuelwood per household per year. On average a household uses 4 tonnes of fuelwood when they use three stone fireplaces. Therefore this is mitigation or adoption of needing less fuelwood
Researcher: Does CU have any plans to provide support to the stove production group now or in the future?
CU Respondent: The challenge is that the stove will last for 4 or more years. The group at Manjanja village has exhausted the market around, what they need now is to access markets beyond their areas. In the absence of external support, they cannot be able to meet the requirements unless there is a need for the external markets to demand their products.
Since the project ended in 2012, they were supposed to be doing maintenance works or supply to new households. There is a problem in the shift from high volume demand to the decrease in demand. However, we are rolling similar projects to new districts and we are able to link the Manjanja group with other buyers. Our role is to link the group with other outside markets whenever there is a need. We direct the new market to the group at Manjanja village.
Researcher: How does the national social cash transfer work?
CU Respondent: This is a government project whereby the government is targeting the most vulnerable 10% of the society. CU talked to donors that there are some 10% households who fail to buy the stoves on their own. CU does not give out the stoves for free, otherwise production will stop. There is a certain section of households that fail to buy because of income level; this is the group that the government is targeting.
This can be viewed as an opportunity in areas where these energy saving stoves have not been introduced yet. The ones from Manjanja village will act as demo stoves. They will then be introduced in such areas.
Researcher: How does the national cook stoves project work?
CU Respondent: This is just a steering committee aimed at activating players in different places in the country to promote energy saving stoves. The aim is that by 2020 2 million stoves will be distributed across the country.
Researcher: Are we trying to come up with alternatives to the three stone fireplace?
CU Respondent: Yes. The core mandate is to move from the three stone fireplace to new alternatives. The three stone fireplace is 20% efficient. The alternative can be any type of stove which has more than 20% efficiency.
Researcher: What was the most important aspect of CU project in Manjanja village? Was it about energy provision of environment preservation? Why?
CU Respondent: It was more about energy efficiency. But also about energy planning. Households need to think about energy because it has economic value. That is why CU mobilize then to start growing trees and adopt use of energy efficiency stoves. The core purpose of the village was to adopt stoves and raise trees.
As part of energy saving stove adoption, we provided pigeon peas to households. The idea was for the households to grow the pigeon peas and then use the pigeon peas stalks for cooking thereby reducing the burden on natural forests.
Researcher: How did CU project help Manjanja village especially at household level?
CU Respondent: It helped with the burden of collecting fuelwood which is a gender issue. And also by enhancing energy efficiency it means that we had an impact on gender/ energy burden. Secondly, with respect to money, those households that buy fuelwood now spend less on fuelwood; there is also a reduction in time spent when collecting fuelwood.
Researcher: What did the people of Manjanja village bring to the project?
CU Respondent: They brought bricks, stones and sand for the stove kiln and construction of the shelter. There was community mobilization.
The project supplied iron sheets and other things bought from the shops.
With respect to actual stove production, all the clay was collected by the households.
But we also brought expertise and training course.
Participants had to bring their own food during training. May be that is why the project was successful because the household showed willingness to acquire knowledge and skills.
With regard to the general community, CU support was polythene tubes and seeds. The rest were community driven
Researcher: Do you think the people of Manjanja are aware of the consequences of environmental degradation and its impact on energy consumption?

CU Respondent: I think they do, that's why they were collecting the clay; they also collected top soil from anthills.
The fuelwood used for curing the stoves, we mobilized them to construct a fuel efficient kiln which uses just 1 cubic meter of fuelwood to cure 150 stoves. The selling of the stoves pays back fuelwood used on the kilns.
The idea was to enhance the households to be environment stewards and also protect their environment. That is why the households were proactively planting trees.
Researcher: How was the government involved in this project?
CU Respondent: We were working with the government. We were using government extension workers. The partnership was with the district council locally and development sectors (forestry, community).
We also run an adult literacy project using reflect approach in which we form a circle which was being directed by community development because that is their main role.
We were using whichever sector has the core role to use the people of extension workers to run projects and activities. It was a matter of facilitating them with resources to be able to do something.
Researcher: Any last words concerning the Nsamala sustainable energy project? What would you say about the relationship between CU and government of Cu and the local people of Manjanja village?
CU Respondent: It's a multilateral relationship in the sense that CU is on one end, Government extension workers on the other, and community groups on the other.
We all had to function with a collective purpose to deliver the project and the partnership is still evident. Despite the fact the CU pulled out of the area but they are still able to access government services.
Its knowledge giving and an interface or enactment of access to government service.
It was a successful project. The genesis is because the project demonstrated that is doable; in TA Nsamala alone we reached 60% of households in a period of 3years. This is now the new baseline use rather than using three stones.
This makes them participate in climate change mitigation. It makes the responsive to climate change by just using the stoves.
To add to that, the households are saving fuelwood use, thereby reducing emission to the atmosphere. This is under carbon finance project such that the proceeds of the carbon finance project are being reinvested.
Carbon finance is a system that was created by UNFCC for individuals wanting to reduce their carbon footprint in the West, or can be from Malawi who do not have any obligation to reduce emission production (voluntary)
Researcher: How does a village qualify?
CU Respondent: They get money earned and are ranked in adoption levels per villages. The purpose is to stimulate usage of energy saving technology. It is not just adoption but usage as well.

ADDENDUM J

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH DISTRICT AGRICULTURE DEVELOPMENT OFFICER (DADO) IN PHALOMBE DISTRICT

Researcher: How long have you lived in Phalombe?
DADO: I have lived here for three years
Researcher: Are there any forests around the communities that you work with?
DADO: There are three forests around, namely: Chisengereni in Kasongo EPA and two others. One of the two other forests was rehabilitated with the assistance from MEET and the other forest is a section of a larger forest on Mulanje mountain. Measures have been put in place to rehabilitate these forests in order to discourage deforestation and encourage planting of alternative species such as pine trees rather than the more popular cider trees in these forests. This is because pine grows much faster than cider
Researcher: What is MEET?
DADO: MEET stands for Malawi Environment Endowment Trust. It is an organization that is based in Blantyre. It encourages afforestation by providing assistance in the afforestation programmes.
Researcher: How big are these forests in terms of area?
DADO: I do not have exact figures on the area that each forest occupies. However, the Chisengereni forest in Kasongo EPA is approximately 20 or so hectares. Furthermore, keen interest in area occupied by these forests will be explored in future projects.
Researcher: What tree species are generally found in these forests?
DADO: In Chisengereni forest, the most found trees are indigenous species rather than cider, pine or blue gum. (Did not specify for the other two forests). But cider, pine and blue gum were in the other 2 forests.
Researcher: What kind of working relationship exists between your office and the communities? E.g. between the office of the DADO and the Kasongo community?
DADO: Communities surrounding the hills are generally supportive in the sense that despite the fact that the project ended last year in 2014, the communities continue to look after the forest. For instance, they maintain the fire breaks that were setup. They also have committees that ensure that people do not cut down trees in the forest anyhow. They only cut down trees only when its necessary/ important purposes usually they prune the trees. The communities have not reverted to the wanton cutting down of trees which shows that they appreciate afforestation and also shows how much the communities value these forests nowadays.
Researcher: What is the governance structure in relation to the preservation of Chisengereni forest?
DADO: There is a main committee that governs the management of the forests. There are also smaller subsections of that committee. These subsections vary in purpose. The purpose of these sub-sections vary from managing firebreaks to providing regulations for would be intruders, to monitoring the forests, to replanting exercises where necessary. Some sub-committees provide manure for woodlots raised in these communities.
Researcher: Is there a link between a village headman and the committee or the committee and the village development committee?
DADO: Yes there are links. For instance, when an issue arises involving the forest and a community member, the committee does not have authority to punish the community member. The issue is handed over to the village headman and the village development committee who then impose some punishment to the offender.
Researcher: What type of punishment do culprits receive?
DADO: A forest management constitution is available for consultation in such instances. The constitution stipulates terms agreed upon and punishment befitting the offence committed. E.g. fines are paid and if a culprit fails to pay the fine, the case is referred to the Police.
Researcher: This study mainly focuses on how households use different forms of energy in Malawi; I would like to find out how the Malawi energy policy is implemented in this area?
DADO: Communities are encouraged to seek permission from forest personnel when community members want to source fuelwood from the forest. Government forest personnel guide the communities on how to harvest fuelwood from the forest e.g. communities are usually advised to harvest dry branches with the use of hooks to pull down the branches. Usually this is free of charge. However, in other case a charge is set up e.g. Forest personnel collect appropriate dried branches and sell these at an affordable price to those seeking fuelwood. Forest officers also patrol the forests to ensure that no one cuts down trees without authorization. If an individual is caught cutting down trees without permission, they are punished accordingly as already alluded to earlier.

However, there are also instances in which corporal punishment is used. Generally, people are aware of regulations of how the forest is managed and protected.
Researcher: Considering the fact that a large number of people complained about insufficient sources of fuelwood. What do you know about government's operations to ensure that communities have enough fuelwood or indeed adequate sources of energy?
DADO: Government is not helping the situation. It was expected that government would encourage afforestation through local development fund programmes (LDFs). Under LDF programmes, it was expected that government would pay civilians some money when they plant and manage trees in the forests or plant woodlots in their communities. The aim of this was to ensure that there is adequate source of fuelwood for community members. But this is not the case.
There is heavy reliance on Chisemphere forest as a source of fuelwood.
Women are usually the ones responsible for fuelwood collection at household level. This combined with other household responsibilities such as child rearing and food sourcing puts a strain on women's livelihood.
Researcher: Are there any initiatives or efforts done to mitigate the impact of climate change specifically in terms of fuelwood acquisition and consumption?
DADO: NGOs and LDFs are involved in efforts to build energy saving stoves.
Researcher: How well spread are these efforts?
DADO: They are not well spread. They are displayed at public functions but not a lot of interest has been generated towards them. At times people revert to old practices despite being introduced to the energy saving technologies.
Researcher: Why are they abandoning these energy saving technologies?
DADO: Use of energy saving stoves takes longer to cook. As a result, households are not adopting the energy saving stoves as a means of cooking. This is mainly because less fuelwood is used in the energy saving stoves as compared to conventional three stone fireplaces and hence less heat is produced in the energy saving stoves thereby lengthening the cooking process and time.
Researcher: What has been the impact of climate change especially around Kasongo EPA on the livelihood of communities in the area?
DADO: In the three years that I have been here, Kasongo area's total food production is consistently low compared to other surrounding areas in the district. The impact of floods on the Chisengereni river left it generally degraded, especially this year 2015. After the dry spell that followed the floods, Kasongo area was negatively affected. The effects of climate change are evident in Kasongo EPA.
Researcher: At district level, are there other means that are employed to mitigate the effect of climate change?
DADO: Conservation agriculture has been used in Kasongo EPA. Soil and water conservation activities are encouraged. As well as riverbank conservation through planting trees in order to reduce degradation. Soil is bound together when you plant trees along the riverbanks to control erosion.
Researcher: During the survey, it was noted that crop residues are the most commonly mentioned source of fuel, does this affect adoption of energy saving stoves?
DADO: It does affect the adoption of energy saving technologies significantly. As an alternative technology, households are being encouraged to grow legumes such as pigeon peas which fetch a high price, is drought tolerant and also provides a source of fuelwood after harvesting the peas. Pigeon pea stems/stalks suffice as a better fuel source than maize stem residues. Pigeon pea stems have more dense stems/stalks unlike maize stems/stalks as such they are preferred to maize stem residues. However in practising conservation agriculture, crop residues are left in the fields until the next growing season. But this is not the case in this area. Farmers collect the crop residues and store them throughout the year, as planting season approaches, farmers place back the crop residues into the fields. The residues are collected from the fields in order to prevent the residues from being stolen and used for cooking or indeed eaten by loitering livestock.
Researcher: How are you involved in the afforestation programme as district agriculture development office?
DADO: We work closely with government forest personnel in order to ensure an increase in the number of tree species available in the forests. Apart from that, we also encourage community members to plant trees of their choice such as fruit trees. The main aim is to encourage tree planting.
Researcher: Do you have any concluding remarks to what we have discussed so far?
DADO: It would be beneficial to plant more trees along the road in public works programmes. Hopefully, planting trees should start in October. This would be a source of income to the community members and also a means for reforestation. These trees would lessen soil erosion.

ADDENDUM K

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH REPRESENTATIVE OF DISTRICT AGRICULTURE DEVELOPMENT OFFICER (DADO) IN BALAKA DISTRICT

Researcher: My study is about household energy consumption more especially about fuelwood and charcoal consumption at household level. I will be asking questions about how the DADO office works with the Forestry department and people at grass root level in the district
DADO: Our involvement is little because our department in a way is mostly concerned about the restoration of the environment.
We are involved in soil conservation. In the forestry section we are involved in the planting of trees especially nutrient recycling seedlings (forestry species)
We are involved in planting trees along the streams for river bank protection
We don't just plant trees, we also plant vetiver grass and other grasses that are meant to hold the soil together in order to control soil erosion
There are partners that are involved in promoting the use of cook stoves that save or use little fuelwood. These partners are Concern Universal, and also partly the Forestry department
Concern Universal started working in the area in 2009. They are still here up to date.
Concern Universal has trained communities about these cook stoves. Currently Concern Universal has 72 clusters in which they have promoters for these stoves. They have some beneficiaries of social cash transfer. These beneficiaries received the cook stoves free of charge.
6000 cook stoves free of charge
8229 cook stoves were also sold to those households who could afford to buy
14229 families
There is also another organization working in the district. Self Help Africa. They have trained 69 farm families. 6 males and 63 females. They have sold 1870 cook stoves to households in the communities
Researcher: Is this Self Help Africa also working in Rivirivi and Bazale EPAs?
DADO: Yes. In fact Self Help Africa is in Mpilisi EPA.
In Rivirivi 7400 farm families
In Bazale EPA, Concern Universal worked with 3450 households
Researcher: Just to take you back, I would like to find out if as a district, e.g. in Rivirivi EPA, do you have any forests that are managed by the government?
DADO: Village forests are managed by the communities
Researcher: How big are these forests?
DADO: In terms of area, I think it will be wrong to guess the measurements because area calculation has not been done.
There are 4 village forests in Rivirivi and 8 in Bazale
Researcher: What kind of trees are found in these forests? Is it both indigenous and exotic trees?
DADO: Both indigenous and exotic. They are also promoting natural regeneration of forests.
Chambe village has got big area covered by natural regeneration
Researcher: What is the relationship between the community and your office?
DADO: The relationship is very cordial because we encourage communities to promote natural wood regeneration because these other trees take time to grow and they also need watering.
Balaka is a dry area. Not many tree species would do well here. They would not survive. That's why we encourage natural regeneration.
There is a good relationship between this office and the communities.
Researcher: What happens for the communities to regenerate the trees?
DADO: In the communities we have natural resources management committees at village level.
They have their own bye laws. In their bye laws they protect the natural trees. They work as communities e.g. they weed around the forests to avoid bush fires
The relationship is good between our office and the communities
Researcher: How are these committees elected to take up positions?
DADO: In fact the election is done at village level. They convene a meeting where they choose members of these committees. They have the liberty to choose whoever they want to be in those committees
Researcher: What is the role of your office in ensuring that the bye laws are the right bye laws?
DADO: We encourage the communities to make bye laws in collaboration with the Forestry department. Yes we did that.

What is remaining is the giving of power to the adherence of these bye laws, making sure that the bye laws are indeed working
Researcher: When we went to Rivirivi, the village headman told us that they have bye laws. If anyone violates the bye laws the individual is brought to him and he is the one who enforces the bye laws.
DADO: In fact that is very true.
At community level they have the mandate to do that. But when it comes to address the bye laws, the DC and other authority have to give power to the bye laws, but this has not yet happened up to now
Researcher: Are you aware of the Malawi national energy policy?
DADO: In fact I am not aware of that. I have not read the policy
Researcher: What is the role of the DADO in ensuring that communities have access to fuelwood in their areas?
DADO: The role of this office is to ensure that the use of fuelwood is done sustainably. E.g. When an individual cuts down one tree they are supposed to plant ten trees
Our role is to advise the households how they can use the fuelwood sustainably
Researcher: Supposedly one cut down a tree but does not replace the tree with ten trees. What happens? Are there any penalties?
DADO: Not necessarily. Not in our office. But maybe this is left in the hands of local communities
Researcher: So the local communities are the ones who must ensure that if one tree is cut, then ten trees should be planted?
DADO: Of course yes
Researcher: Where do these trees come from? Are they supplied by the Forestry department?
DADO: Ourselves in collaboration with the department of forestry. We encourage the establishment of tree nurseries
As of now, there are 300 nurseries established
Researcher: In the district?
DADO: Yes entire district
Researcher: One of the complaints from villagers and forestry extension workers was that polythene tubes are no longer available. Trees are hard to find even when the villagers are willing to plant some trees. The problem is the tubes and trees. Is your office aware of this?
DADO: Yes. In fact our office is aware of this.
The forestry department and the ministry of agriculture work hand in hand.
As I said earlier we have these 300 tree nurseries together with forestry department. The department sources some materials. 250 000 polythene tubes and tree seeds. Under sustainable agriculture production. They have supported us with money for environmental management. We have done that 250 000 trees for planting in the district
Researcher: What kind of initiatives are on the ground to mitigate the impact of climate change?
DADO: in our department there are efforts that we are undertaking e.g. engaging in soil and water conservation. Where hotspots are being conserved.
Construction of ridges
Construction of shallow wells
Researcher: Before you go on, what do you mean by hotspots?
DADO: These are areas that are badly hit by climate change. We start by conserving such areas
Researcher: In Balaka district, in so far as climate change is concerned. Which are the hotspots?
DADO: 6 hotspots. These hotspots are in each EPA, in Ulongwe, Rivirivi, Utale, Bazale etc.
Researcher: So the hotspots are spread in all the EPAs?
DADO: Yes they are spread
Researcher: Go ahead to explain
DADO: The second initiative. We are also engaged in compost manure making and utilization. This effort is aimed at restoration of soil fertility
As well as agroforestry and reforestation as I have already mentioned
Gully control using stone check dams
We are also promoting conservation agriculture
Researcher: Related to conservation agriculture, when we spoke to the villagers in Rivirivi, they were saying that they use crop residues as fuelwood, which means that conservation agriculture is not working. Is your office aware of that?
DADO: Of course yes. Because of lack of fuelwood some of the areas in Rivirivi a lot of trees were cut. You can hardly find a tree which could be used as fuelwood so their only option is to use some of crop residues like maize stalks as fuelwood. So in the absence of maize stalks as soil cover for conservation agriculture, there are other options that farmers can use. There are several.
Researcher: The villagers were also talking a lot about Msangu trees. Can Msangu trees be used for conservation agriculture?
DADO: Msangu trees are nutrient recycling trees.

But farmers can use crop residues of groundnuts, pigeon pea biomass, Chimpakasa (in local language). It sheds a lot of leaves. Rice shells
There are several alternatives that farmers can use for conservation agriculture
Researcher: There are several alternatives that can use but looking at the dryness of the area, not all of these are readily available here
DADO: Not all these are available here
Researcher: In Rivirivi area they are also saying that they are using maize stalks as well as pigeon pea talks for fuelwood because the households are desperate. They need the alternatives but are limited. What do you think?
DADO: Of course they can also use something like some of the weeds that are found in their fields. However they can only use the weeds before they have flowered and also before they have produced seeds. They can slash then before they are mature.
Some of these grasses can also be used
Researcher: As DADO, how do you think Rivirivi EPA has been affected by climate change?
DADO: Yes
Researcher: In what ways have they been affected by climate change?
DADO: Rivirivi as an EPA has been affected by climate change e.g. late onset of rains. Rivirivi has not been spared.
Rivirivi has been constantly affected by floods that have hit Balaka as a district
There are several issues
Researcher: In that area you told us that there are no forests that are managed by the DADO. Rather the communities manage these forests. How do you ensure that the community forests are well managed? Does the DADO have any authority over these forests?
DADO: As an office we are constantly visiting the communities when we go there for supervisory visits. We take our time to see how the communities are taking care of the forests. We assist them e.g. we support them with materials such as polythene tubes and seeds for them to plant every year
So when we go there, we visit the forests and encourage then to continue managing the community forests
Researcher: Looking at the situation that we have in Rivirivi, I think it will be right and proper to say that the government has no forest in Rivirivi EPA. Would you know if there are any plans for government to establish forests in this EPA?
DADO: I think there are no plans because government does not have resources to manage the forests
VDC must do this. Village development committees must take part in this
Our role is to just provide other materials which are needed if the communities do not have
The other thing is to see that their forests are well managed
Researcher: Apart from the work that Concern Universal and Self Help Africa are doing, do we have any other stakeholders that are involved in this area especially when it comes to fuelwood and charcoal consumption?
DADO: In fact there is PCI (project concern international. They have just come. Mostly working in Njira project
Concern Universal has so many projects regarding natural resource management. They also look at cook stoves
Researcher: Apart from the energy saving cook stoves, do we have other initiatives that are there to curb the effects of climate change more specifically in terms of fuelwood or indeed any other sources of energy?
DADO: Apart from these, there is also electricity. But its only 5% of the population (nationally) that uses electricity because of high cost of electricity tariffs.
80% use fuelwood
15% are using charcoal
If you ask me if there is any other source of energy, I will tell you about electricity. But electricity is expensive. Even those people who have electricity in town, they avoid the use of electricity because its costly. That's thy are opting for the use of charcoal
Researcher: Don't we have government forestry officers who arrest people/vendors if they are selling charcoal in this district?
DADO: There are forestry officers in collaboration with Police. Sometimes they go round the district and where they find vendors selling charcoal, they confiscate the bags. This is done in an effort to deter others from selling charcoal.
Researcher: What else did you prepare for us?
DADO: In fact we want to share something with you: In Balaka we have 83 sections but only 53 field officers. It's difficult for one field officer to reach so many households. We sometimes rely on lead farmers
Energy sources that are used are fuelwood, charcoal and electricity
Most rural households use fuelwood

Thank you
Researcher: Thank you very much for your time.

ADDENDUM L

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH CHIEF KHAMULA IN PHALOMBE DISTRICT

Researcher: As a leader, what kind of activities are you engaged in?
Chief Khamula: My job is to incorporate development activities in the communities' everyday lives. I also look after a hill called Maphundo. I started looking after the community when my father passed on in 1997.
Researcher: As a community leader, briefly, what do you know about climate change in this area?
Chief Khamula: Climate change has greatly affected households in this area, e.g., where to find and collect fuelwood. With increase in population, the fixed source of fuelwood remains inadequate. In the 1980s President Kamuzu Banda brought about tree planting campaigns, with tree species such as blue gum.
Researcher: In relation to fuelwood and climate change, what activities are carried out to ensure that there is adequate fuelwood for consumption by the households?
Chief Khamula: We host meetings promoting the storage of crop residues such as pigeon peas, sunflower and maize stalks. We encourage cultivation of the legumes in order to reduce the demand for fuelwood from the forest. This acts as an alternative to cutting down trees from the forest.
Researcher: Is there a committee that you work with to manage and maintain the forest and also to discourage deforestation?
Chief Khamula: MEET helped us to establish a committee that we work closely with. We make sure that trees are not carelessly cut down. As we speak right now, the committee makes sure that forest personnel are consistently available in the forest. We are also doing bee keeping in the forest.
Researcher: What system is in place to ensure that there was mutual understanding between community members and the committee to discourage deforestation?
Chief Khamula: A meeting was scheduled where discussions about the unfavourable rainfall patterns within the area and also how best to conserve the available trees were held. A mutual decision was made to conserve trees in the forest on the hill and plant more trees was made
Researcher: What problems has this area experienced with regards to climate change?
Chief Khamula: This area has largely been affected by food shortages emanating from the impact of excessive rainfall experience in the previous rainfall season. These rains damaged most of the cultivated crops. Communities are experiencing problems in search of food. We also had drought.
Researcher: Is there a relationship between this year's reduced rainfall duration to food shortages?
Chief Khamula: I cannot be certain as to whether there is a relationship between the two or not. What we know is that rain falls from the sky
Researcher: How is the government through the forestry department working against deforestation?
Chief Khamula: Government has encouraged reforestation as well as discourage charcoal burning from trees in the forest.
Researcher: What punishment does an unauthorized tree cutter receive?
Chief Khamula: An offender is told to pay a fine. The fine is charged by the traditional authority (TA). This fine ranges from three thousand kwacha and upwards.
Researcher: Where do all the funds collected from paid funs finally end up?
Chief Khamula: I am not really sure where the funds end up. But offenders pay fines. The villages agreed not to cut down trees from the forest anyhow.
Researcher: How do households source fuelwood in your area considering the fact that households are prohibited from cutting down trees from the forest on the hill?
Chief Khamula: As I earlier mentioned, crop residues and tree branches from trees planted by community members are the major sources of fuelwood in this area, rather than cutting down trees from the forests in the hill/mountain.
Researcher: What role does the forestry department play in protecting the forest?
Chief Khamula: The forest department lays down rules on how to protect the forest on the hill. They also provide the village with seedlings
Researcher: Does the forestry department take part in planting new trees on the hill?
Chief Khamula: Yes they take part. They bring new species of trees to be planted on the hill.
Researcher: What sort of relationship exists between you and the forestry department?
Chief Khamula: We have a friendly relationship between the community and the forestry department. As I pointed out earlier, the forestry department supplies new tree species to the community.
Researcher: Do you take part in formulating rules and regulations for the protection of the forest?

Chief Khamula: The pre-existing rules and regulations were formulated by me as village headman and the department of forestry. For instance, when a culprit is caught, they are asked to pay a fine. We also have restrictions against livestock grazing within the forest.
Researcher: With regard to climate change and sources of energy, are there any alternatives such as charcoal that are used for cooking purposes?
Chief Khamula: Charcoal use is non-existent in the area because charcoal burning is restricted and hence the sourcing of charcoal would be problematic. We have a good relationship between the headman and the villagers and the forestry department.
Researcher: What do you use for lighting?
Chief Khamula: Torches are the most common lighting tool. Battery operated torches to be more specific.
Researcher: Thank you very much for your time village headman.
Chief Khamula: Thank you.

ADDENDUM M

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH CHIEF MANJANJA IN BALAKA, RIVIRIVI EPA

Researcher: As a leader in this area, what are you involved in?
Chief Manjanja: My work is centered on people's welfare
Researcher: What is the impact of climate change in your area?
Chief Manjanja: Climate change in the area has basically affected rainfall quantities. We have destroyed trees. We have even cut down trees along the river banks.
Researcher: From our research, we have found that last season's rainfall caused damaged to people's houses (2014-2015 rainy season).
Chief Manjanja: Indeed houses were damaged and we were assisted by Concern Malawi. We received a lot of rainfall within a short time
Researcher: How do households source fuel wood?
Chief Manjanja: Lately, households have been experiencing difficulties in sourcing fuelwood. Women have problems sourcing fuelwood. These days, its common practice in my community to buy fuel wood. Some households have also exploited the scarcity of fuelwood and made it their business to sell fuel wood to the other households.
Researcher: What kind of relationship exists between you and the forestry department in restricting the cutting down of trees?
Chief Manjanja: The community and the forestry department came up with rules and regulations restricting tree cutting activities in these forests. There is also a committee that monitors activities in the forest. As a headman, I gave some land for the establishment of the forest. We have trees around the houses. Even in the forest.
Researcher: What tree species are found in the forests?
Chief Manjanja: Misangu, Matowo, Miswaswa among others. Another organization also gave us some other species in 2002.
Researcher: Who is responsible for effecting punishment to offenders (those who are found cutting down trees)?
Chief Manjanja: All cases come to me. The offender is asked to pay a fine as punishment. The fine can be in a form of a goat or a chicken. The village knows what it means when they are told to pay a cow or goat. Usually they are asked to bring chickens. For example, MK3000 means 3 chickens.
Researcher: Do you discuss the rules and regulations with the committee and forestry department.
Chief Manjanja: Yes we do. The chief, committee and forestry department discuss issues concerning the governance of the forest. We formulate the rules and regulations.
Researcher: Is the community involved in the formulation of these rules and regulations
Chief Manjanja: The community is involved. The rules and regulations are formulated by the chief, committee and forestry department. The community is involved. They endorse the rules and regulations
Researcher: Who guards the forest daily?
Chief Manjanja: No one
Researcher: What is the government doing to make sure that the community has sources of energy such as fuelwood and charcoal or any alternative source of energy?
Chief Manjanja: We work with Concern Universal. They taught us how to use energy saving stoves. These stoves require only 3 pieces of fuelwood.
In Manjanja village we do not cure charcoal. Usually if households use charcoal in this area, it is bought from other areas.
Researcher: Did you ban charcoal curing?
Chief Manjanja: We have rules. Charcoal curing is strongly prohibited
Researcher: Do you have trees in this area that can be used for curing charcoal?
Chief Manjanja: Yes we have some Tsanya (hard wood). But people have cut down these trees
Researcher: Why don't people in this area cure charcoal?
Chief Manjanja: There are no trees. But we also have the rules.
Researcher: Would you be able to stop some people from outside this area, if they tried to cure charcoal in your area?
Chief Manjanja: We have Police forum and forestry personnel who will deal with those. We have good relationship with the government. They give us seedlings
Researcher: In our previous interactions with women in this area, they reported that they sometimes travel for 2 or 3 hours in search of fuelwood. What are you doing to ease these fuelwood challenges?

Chief Manjanja: To protect these women from travelling long distances, we agreed as a village that every household must plant trees. Around their houses or in the field. They can then cut down one tree and use it for cooking for a considerable time, even 3 months
Researcher: Does this area experience flooding?
Chief Manjanja: This year 2015 we had some floods. Some fields were badly affected. They had soil erosion.
Researcher: What did you say about drought?
Chief Manjanja: It comes and goes. Last year in 2014 we had drought. This year 2015 we had no drought but we had flooding
Researcher: What can you say about yields these days and in the past?
Chief Manjanja: There is a difference. In the past we could harvest enough yields to last the whole year even from a small piece of land.
We also had a lot of trees. People could easily get fuelwood.
Unlike these days, even when you have used 3 acres for growing maize but if you have not taken good care of your crops and have also not applied fertilizer, you cannot be able to get enough yield. That's the difference
In the past, things were better than these days. People had bumper yields. Households had granaries for different crops such as sorghum, groundnuts and beans.
Gradually, things changed. Because we have cut down a lot of trees. We are also not very careful how we plant our crops. People are opening fields even along the river banks. We have a population boom. There is a scramble for plots for farming. Many people but few plots for agriculture. Very subsistent farming. Girls as young as 10 years are giving birth, by the time they are 15, they have 3 children. So we don't have enough land for farming to take care of these children.
Even when agriculture extension workers advise us to leave at least 10 metres away from the river banks, we don't follow their advice because there are many of us.
Researcher: In conclusion, what would you like the government to do in terms of sources of energy such as fuelwood and charcoal or their alternatives that households use for cooking?
Chief Manjanja: I would like the government to continue supplying us with seedlings so that we have woodlots in the village. Women would not have to travel long distances in search of fuelwood. But they can use the trees around their houses or at least within the village.
They can cut down one or two trees. While they are using one tree the other none will be drying. That would be good.
Researcher: Some of the women we were talking to earlier mentioned electricity. Do you have access to electricity in this village? The women went as saying that they want the government to bring electricity to this village?
Chief Manjanja: Aaaaaaaaaah. We don't have electricity in this village. The closest we have electricity is at the Catholic mission, some kilometres away. The missionaries brought electricity close to this area that is why we also have maize mills at the nearby trading centre. Other people are also benefiting. They are opening business places around the area. Taking advantage of the electricity brought by the White missionaries
Researcher: Which means that access to electricity is important?
Chief Manjanja: Yes electricity is important. But the question remains – "can we afford electricity?"
Researcher: Most of the women who expressed interest to have electricity in their households, when asked if they can afford the electricity they also said that they cannot afford the electricity BUT they still want to have access to the electricity in this village.
Chief Manjanja: Yes we need the electricity. But we are skeptical because of cost implications e.g. How many poles do we need to get electricity from the mission to this place? Who will bear the cost? Government or households? We cannot afford electricity no matter how hard we want to have this electricity.
Researcher: Any closing remarks?
Chief Manjanja: I am very glad that you came to our Manjanja village, TA Chanthunya to talk to me as well as the whole village more especially women.
Researcher: Thank you very much for your time
Chief Manjanja: Thank you.

ADDENDUM N

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH FORESTRY OFFICER IN PHALOMBE

Researcher: (introductory remarks)
Forestry officer: Forestry officer ……..
Researcher: Are there any forests that you look after in this area?
Forestry officer: Yes we have Mapundo, Mikongeni and Teketeke hills. These have forests that we look after.
Researcher: What tree species are found in these forests?
Forestry officer: Nsangu, Mpakasa, Mafundu and Blue gum. Basically there are both indigenous and exotic tree in these forests
Researcher: What sort of relationship exists between forestry department and the communities in this area?
Forestry officer: A very healthy relationship exists between the office and the communities and the chiefs.
Researcher: What does the forestry department do to ensure protection of the forests?
Forestry officer: We provide advice in terms of how to conserve trees, use the trees and replanting the trees where they have been cut down.
Researcher: We have learnt that there is a committee that looks after the forest on Mapundo hill, how do you as forestry department select committee members?
Forestry officer: We work hand in hand with the chief in selecting committee members.
Researcher: What role exactly does this committee play?
Forestry officer: Generally the committee has two roles. Firstly, making sure that the trees are conserved in the forests, protected from harmful fires. Secondly, their role is to make sure that they are responsible for planting new indigenous trees hence expanding the forest area.
Researcher: What role do chiefs play in the management of the forests?
Forestry officer: Before forestry officials start working in the communities, chiefs communicate with their community members. Chiefs also promote cooperation between community members and forestry officials.
Researcher: What do forestry official do when the committee is not adequately carrying out their duties?
Forestry officer: We first approach the chiefs who later on communicate with the committee on their failure to carry out their duties.
Researcher: What do you do exactly as an office in terms of enlarging and conserving the existing forest?
Forest officer: We encourage planting of trees in woodlots as well as conserving trees that are already in the forests
Researcher: With the restriction on cutting down tree in the forest, surrounding households face problems with regard to acquiring fuelwood, what do community members use as an alternative?
Forestry officer: We encourage households to plant woodlots of fast growing tree species so that they can serve as a source of fuel wood.
Researcher: What is the forestry office doing in order to fulfill requirements in the Malawi national energy policy?
Forestry officer: We generally provide advice on how to fulfill the requirements in the policy.
Researcher: How is the area affected by changes in the climate?
Forestry officer: In the past four years, rainfall patterns have drastically changed and are highly inconsistent. We have times when in one year you receive a lot of rain for a short period or early cease of rainfall
Researcher: What role do you play in ensuring that households have a source of fuelwood?
Forestry officer: We may allow community members access into the forest so that they may collect dried up branches of trees from time to time
Researcher: What punishment does an individual get if they are found violating the rules and regulations governing the management of the forest?
Forestry officer: Fines are basically the main punishment given. All fines obtained are used as funds for running the committees. Fines are paid to the chiefs.
Researcher: Do household have adequate fuel wood?
Forestry officer: Considering that most households have woodlots, it seem that they have adequate fuel wood
Researcher: In conclusion, your role as a forestry official is to provide advice to community members on how to conserve trees in the forests and also provide tools for new trees such as polythene tubes

Forestry officer: Yes and also supply seedlings for reforestation

ADDENDUM O

TRANSCRIPTIONS FOR KEY INFORMANT INTERVIEW WITH FORESTRY OFFICER IN RIVIRIVI EPA BALAKA

Researcher: Please introduce yourself
FO: I am Mr. ……, forestry officer in Rivirivi EPA
Researcher: How long have you been working in this area?
FO: For a long time. I have been working in this area for 10 years. Many people know me in this area. They know me and I also know them. I concentrate on my work a lot.
Researcher: In this interview schedule, I would like to find data that I can use for my studies. I will start with routine questions. Is there a forest that you look after in this area as a forestry officer, more especially those forests that serve this area?
FO: We have 2 or 3 types of forests
Government forest which are usually protected areas
Plantation forests and community forests.
In this area we have individuals who manage these community forests. These forests are in customary land
Researcher: Do we have any forests that are in this customary land that serve this village?
FO: Yes we have some
Researcher: Where exactly
FO: (pointing to nearby forest) We have that forest there. I helped to plant trees in that forest
Researcher: What is the name of the forest?
FO: It has not been given a name. But because this is Manjanja village we just refer to it as that forest in Manjanja village
Researcher: We understand that there is another forest behind the village headman's house. What do you call that forest?
FO: Still we refer to it as the forest in Manjanja village. It has both indigenous and exotic trees. This nearby forest has mostly exotic trees
Researcher: Do you know the size of the forest behind the village headman's house in terms of acreage?
FO: 1 hectare
Researcher: What is your role in terms of taking care of these two forests?
FO: Our role is to teach the community the importance of having natural resources. As well as teaching them how to raise the trees, maintenance and management of trees
Otherwise it's the community's responsibility. We are here to offer advisory role/support
Researcher: We were talking to the women earlier on, who said that they convene a meeting where they select different committee members for the management of the forests? Is that true?
FO: No. What we do is that: As a group village headman, Chief Manjanja sits down with his sub-chiefs. In all these sub-sections we have committees that take care of natural resources in their areas. WE then select one member from each committee. Usually it's the chairperson. We then bring them to Manjanja village as an overarching headman. It is then this group of chairpersons that committee members are elected to look after the forests. This is then the committee that takes care of the management of the forests
Researcher: What is this committee known as?
FO: It is called village natural resource management committee
Researcher: Manjanja is a group village headman. What happens when they want to select a committee as village sub-section level?
FO: This committee is elected within the village. These committees are at sub-section level. They look after small forests within the villages. When they are selected in their respective villages, it is then that we pick chairpersons from these committees to form the group village headman natural resource management committee. It can have ten members. This group is the requested to choose a leader for their committee, to assist with taking care of the group village forest.
We do not want to have members from one village only. We don't want people to bring biases (to favour each other) because they are from the same village
Researcher: Apart from management, what other technical help do you provide to the village?
FO: We give them polythene tubes
Researcher: They told us that about the nearby forest
FO: Yes. Sometimes we give them seedlings.

We also advise them to plant trees that would do well in their area. They should concentrate on planting such trees. Because if they plant trees any how they may find that some tree species may not be able to survive
Researcher: What kind of trees are found here?
FO: We have acacia. We are also trying Mibawa. We want to see how they will perform in this area. We also have blue gum
Researcher: People were complaining that blue gum trees are being attacked by termites
FO: Yes that is true. That's why we are encouraging them to plant other species like acacia. Acacia is surviving in this area
Researcher: People also mentioned Nsangu. What do you know about these trees?
FO: In this area, Nsangu is a natural tree. Nsangu is indigenous.
When people were allocated fields in this area, they were encouraged to take care of the Nsangu trees in their field. They were allowed to use those trees in their fields. Nsangu trees are good. They help to add fertility to the soil. As a result, people see the importance of taking care of these trees.
Some Nsangu trees grow on their own when the people are taking good care of these trees in the fields. Despite cutting some down, other trees grow. They also regenerate. The people own these trees
Researcher: Are there any rules regulating the cutting down of the Nsangu trees?
FO: There is no established rules as such but people know the importance of these trees so they take care of them
Researcher: If I had a field in this area with Nsangu trees, can I cut down the trees?
FO: Nsangu trees help in improving fertility in the soil. So if you decide to cut down all the Nsangu trees from your field you are going to face problems with your agriculture. You won't have enough yields
Researcher: What type of relationship do you have with the community as you take care of the forests?
FO: We have a very good relationship between us because we are not here to confiscate things from the people but to change their mindset. To let them know that cutting down trees any how is bad. It's not helpful. Little by little things are changing. At first they were not cooperative. Slowly they are understanding the importance of taking care of the environment and natural resources.
Only a few households use charcoal in this area. Because of our advice and also what the area is experiencing. The community has realized the importance of planting trees. They take care of the trees themselves. They plant trees around their homes which shows that they know the value of having trees. They see us as advisors.
Researcher: We have seen some woodlots. A few of them around the households. Do you have anything to do with these woodlots?
FO: These woodlots are theirs. When we meet in a group we teach them to plant trees as well as how to take care of these trees. We encourage each household to have their own woodlot because the trees in the group forests are not easily accessible. It's not advisable for individuals to cut down trees from the community forests.
They need to follow procedures. They need to inform the committee first before cutting down the trees. The committee should then inform its members. It takes a lot of time
But if they have their own woodlots, it's very easy to access trees from such woodlots. No one will threaten them.
We can only advise them to plant more trees and also take care of the remaining trees for use later on.
Researcher: For example, 16 out of 20 households said that they do not use the trees around their homes for fuelwood. They said that these trees act as wind breaks. Is that what you tell them?
FO: Yes. They know the challenges. Last year 2014 we had problems. There was a lot of winds. Some roofs were damaged because the houses did not have trees around them. But those that had trees around them, they were protected. The trees protected the roofs
There are a lot of things that we advise them about. Of course these households use these trees for fuelwood sometimes
Researcher: What do you know about the Malawi national energy policy?
FO: Not really
Researcher: As forestry office, what bye laws do you enforce in this area?
FO: As forestry department we do not make bye laws on our own to protect the forests/natural resources. But we tell the committee and the village headman to come up with bye laws. They make these bye laws and we adhere to them
Where there is a problem, we offer advice to make sure that the bye laws are sound
Researcher: Are there any bye laws that you can share with us?
FO: Not cutting down trees anyhow. If one is found cutting down trees they are brought to the committee and village headman. They are asked to pay affine. The money goes to the committee. It is used for different developments within the village
Researcher: So you don't have the power to enforce bye laws. The bye laws that are formulated by the village committee, who enforces them?

FO: The community itself
Researcher: You just oversee the formulation of the bye laws, making sure that the bye laws are appropriate?
FO: Yes. We play an advisory role. Offering advice
Researcher: As forestry department, what are you doing to make sure that households have fuelwood for cooking or any source of energy?
FO: Right now we encourage the households to plant more trees around the homes and in their fields
Researcher: What is the government doing to make sure that households in Manjanja village have sustainable fuelwood for cooking or indeed any source of energy for cooking?
FO: Right now the government is encouraging communities to establish tree nurseries.
We also hold meetings where we advise households about the importance of taking care of the environment and natural resources.
We also taught households about energy saving stoves i.e. the ones that use less fuelwood unlike the three stone fireplace. This is helping around the whole Balaka district
We have energy serving stoves in this village. They are made here. Other people buy from this village.
Researcher: Are you aware of the oven that is built on the ground and is used for cooking? With two places for cooking, one for nsima and the other for relish?
FO: It is not very extensively used in this village. Many households here use energy saving stoves Chitetezo mbaula. Many people are not aware of the ground stoves
Researcher: How do you think the Chitetezo mbaula is helping to protect the environment in terms of challenges that come about because of climate change?
FO: What happens is that with this stove you use less fuelwood for cooking, for example, the amount of fuelwood that a household uses on the three stone fireplace for a week, they can use the same amount of fuelwood for three weeks when they are using the chitetezo stove. It is economical. It takes a longer period to finish fuelwood on the chitetezo stove
Researcher: As government agents, as forestry personnel, what does your work involve?
FO: Our job is to offer advice to households to take care of natural resources; to teach households how they can protect the environment; how they can plant trees; importance of natural resources to their well-being. That's what we do
Researcher: Do you think the government is creating a conducive environment for households to use natural resources sustainably?
FO: To say the truth we cannot say that the government is doing enough
Researcher: What do you want the government to do?
FO: The government must provide materials for planting trees e.g. polythene tubes. We have some challenges somehow
Researcher: What materials are not enough?
FO: Government stopped providing us with polythene tubes for planting trees in nurseries
We get some from NGOs
Researcher: What happens when you do not have enough polythene tubes?
FO: We have problems in handling of seedlings
If it gets very bad, we advise the community to do direct planting of trees so that when the rains comes, the seeds should just grow in their respective stations without any transplanting
As advisors we have to be creative. We try different ways
Researcher: Was your office involved in coming up with the tree nursery over there
FO: It was not our advice. But right now the villagers have delayed to come up with the nursery because of other development activities in the community. They have delayed with nursery establishment. Our office gave them watering canes. Some of the things they got through LDF local development fund
Researcher: If there are any seedlings in that nursery, the seeds did not come from your office
FO: We advise them to collect seedlings within the village
We ask elderly women, Agogo, to pick seeds while others are collecting soil. The community got used to that and they organized themselves. Within one hour they can accomplish a lot
Researcher: Do people burn charcoal in this village?
FO: Not really because we do not have trees
Communities cannot continue to cut down trees for charcoal. The trees are not there.
Some of the trees are also used for brick baking. They do not have any more trees for charcoal.
Researcher: Any concluding remarks
FO: No
Researcher: Thank you very much for your time
FO: Thank you for coming to Manjanja village. This encourages the community to take part in different activities. Thank you.

ADDENDUM P

FOCUS GROUP DISCUSSION 1 WITH WOMEN IN KHAMULA VILLAGE KASONGO EPA PHALOMBE

Researcher: What do you know about climate change in your area? How has this area been affected by climate change?
Respondents: We have experienced dry spells; heavy rainfall within a short period leading to floods; nature degradation
Researcher: What do you mean by nature degradation?
Respondents: We do not have a lot of trees
Researcher: What has happened to nature?
Respondents: The increase in number of people is destroying the nature. We are cutting down trees carelessly
Researcher: In the wake of climate change, how have been affected in terms of fuel wood? What do you use in place of fuel wood?
Respondents: We grow sunflower and then after harvesting the seeds, we use the sunflower stalks as fuelwood
Sometimes we also buy fuelwood when the sunflower stalks are depleted.
Researcher: Apart from using sunflower stalks as a source of energy, do you also use charcoal?
Respondents: Yes we do
Researcher: Where do you the charcoal from?
Respondents: We buy from vendors from Mocambique who bring the charcoal here.
Researcher: You don't cure charcoal here?
Respondents: No, we don't have enough trees
Researcher: How do you sustain the use of fuel wood and charcoal with regard to climate change?
Respondent: We plant trees.
Researcher: How many trees have you planted?
Respondents: We have bought 150 trees and we have planted them, Blue gum trees. Because blue gum trees grow fast
Researcher: Where do you plant these trees?
Respondents: In woodlots around the homesteads. Acting as fences around the homes. We also plant some in our fields.
Researcher: What do you use for cooking?
Respondent: Maize stocks
Respondent: Sometimes we use sacks for cooking in rainy season
Researcher: Why do you use sacks for cooking?
Respondent: Because fuelwood, maize stalks are not available during rainy season
Researcher: I thought you live near a hill/mountain that has trees
Respondents: The mountains are well protected. There are guards there. Trees are not cut down anyhow. We do not pick or cut trees from there
Researcher: What happens to you when you are found cutting down trees in the mountain?
Respondent: When are caught cutting down trees in the mountain, you answer a case against you. The mountain is protected.
Researcher: What happens?
Respondents: There is a committee set aside to manage the forest in the mountain. You start with the committee and then village leader finally you are taken to court.
Researcher: What other ways do you use to control the destruction of natural resources/ trees?
Respondents: We use paraffin, which we buy from Phalombe boma.
Apart from that we also use fuelwood sustainably by preserving their use through extinguishing the fire after cooking so that the fuelwood can be used another time.
Researcher: What do you use for lighting in your households?
Respondents: Torch or fuelwood
Researcher: How are these torches energized? (How are the torches recharged?)
Respondents: We charge the torches with batteries. We combine old and new batteries.
Researcher: If I ask you to show me these things, would you be able to show me?
Respondents: Yes we can
Researcher: Why do you use these torches for lighting?
Respondents: Because we do not have electricity in our area.

If we had electricity available, we would be using the electricity for lighting
Researcher: Some individuals were saying that you might not have electricity in your households, but there is electricity nearby in Nyezelera area.
Respondents: Khamula village is far from Nyezelera. It would require people with money to apply for electricity with ESCOM to extend the power line to supply electricity to our area.
Researcher: So you don't have electricity in Khamula village?
Respondents: No, we don't have electricity in Khamula village.
Researcher: I understand other nearby villages have electricity from the grid?
Respondents: Yes but even then, the electricity has not been fully supplied
Researcher: How much does each torch cost?
Respondents: MK500-700. It depends on the type of torch
Researcher: When you are using batteries, how long do they last?
Respondent: They can last for a month
Researcher: Apart from the torch, what else do you use for lighting?
Respondents: Candles, paraffin lamps
Researcher: Others claim that they use fuel wood for lighting, is that true?
Respondents: It might be true for some households especially the elderly
Researcher: How long does the light from the fuelwood last?
Respondents: They normally use it for a short time. It's just for them to be able to see and be able to prepare their sleeping places (beds)
Researcher: How true is it that some households cook early before the fall of darkness?
Respondents: Yes it is true. Some households cook early so that they can then sleep early before darkness fall and they are able to see properly their sleeping places
Researcher: How do you heat water?
Respondents: We collect maize stalk which we use for heating the water.
Sometimes we heat water in the sun especially in summer.
Researcher: Why do you use these methods (Sun heating, maize stalks?)
Respondent: We need to save on energy (fuelwood)
Researcher: Does using maize stalk for cooking help or destroy the environment?
Respondent: Collecting maize stalks after harvesting is much better than cutting down trees
We also use pigeon peas stalks for cooking
Researcher: Do you also use maize stalks for conservation agriculture?
Respondent: Yes we use maize stalks for conservation agriculture
Researcher: Are there other better ways of protecting the environment?
Respondent: Yes use of electricity. Other ways of protecting the environment is through the use of energy saving charcoal stoves
Researcher: Do you use energy saving stoves here?
Respondents: Some household have, others don't. Some households manufacture energy saving stoves.
Researcher: How do these energy saving stoves help?
Respondents: They use less fuelwood for cooking. We also have some that are made from bricks and we make an oven. They are also fuel efficient
Researcher: Do you want to have electricity in your households?
Respondents: Yes we do
Researcher: What restricts you from having electricity?
Respondents: Financial problems
Researcher: How do you heat the space in winter? (To keep warm)
Respondents: No we don't
Researcher: Why don't you do space heating?
Respondents: Because we don't have enough fuelwood.
Researcher: Do people brew beer in this area?
Respondents: Yes they do
Researcher: How is beer brewed in this area?
Respondents: We use sorghum and dry cassava. These are soaked in water for a few days for fermentation. Other individuals brew the beer differently in different areas.
Researcher: What source of energy is use for brewing the beer?
Respondents: Fuelwood obtained from blue gum, we usually buy the fuelwood.
Researcher: Is this fuelwood use not detrimental to the environment?
Respondents: Yes it affects the environment negatively. But some individuals cut down the trees and replace them. Further to that, the blue gum trees grow fast. They make sure that they do not clear all the trees, some trees are not cut down
Researcher: How does cutting down trees damage the environment?

Respondents: Cutting down trees damage the environment. When we plant trees around the houses, the houses are protected from blowing winds.
If we cut down trees, rainfall patterns are disturbed and this delays the onset of rains.
If trees are not cut down, they bring some fresh air.
When trees are cut down, we get a lot of diseases.
Researcher: Who is supposed to take part in the protection of the environment?
Respondents: Ourselves as owners of the environment. We need to protect the environment
Researcher: What can we do to protect the environment?
Respondents: We need to plant more trees to protect the environment
Researcher: What can the government do to protect the environment?
Respondents: Punish individuals who are damaging the environment. Send extension workers to teach villagers how to preserve the environment
Researcher: What should households of this area do in in terms of protecting the environment?
Respondents: We are supposed to take part in managing the environment, for example, taking part in caring of trees
Researcher: Do you really do this?
Respondents: Yes we do. We protect natural indigenous trees by not cutting them down
Researcher: Does anyone have anything to say about fuelwood, charcoal and maize stalks (pigeon peas) that are used for cooking, heating water?
Respondents: We have to be planting more trees and also make sure that everyone protects the environment
Researcher: How about preserving fuelwood? What are we supposed to do?
Respondents: We need to learn from those who know about preserving fuelwood and also use the energy saving methods/technology
Researcher: You talked about what you know about climate change. Who taught you this?
Respondents: Radio
Agriculture extension workers
Through observation
Researcher: What happened in the last rainy season?
Respondents: We had no rains at the beginning; then we had lots of rains but for a short period of time. Crops did not grow well (retardation, wilting)
Researcher: You also mentioned about the managing and restrictions on cutting down of trees.
Respondents: There was an establishment of an organization (committee).
Researcher: Who are the owners of the organization (Committee)? Did they just decided by themselves to form this organization?
Respondents: The organization was called chilimuthaka i.e. literally meaning what is in the soil. Other organizations within the village joined. The mountain had lost most of its natural trees. Then people thought of establishing a group to protect the mountain (replanting trees)
Researcher: How does the committee work? More especially in terms of restricting individuals from gaining access to the forest in the mountain?
Respondents: There was an agreement between individuals and the committee
Researcher: How did you receive this agreement?
Respondents: The decision was received with open arms. People were happy with it.
Researcher: Were there any challenges after the establishment of this committee when it comes to restricting entry into the mountain?
Respondents: There were no problems because before the committee was in place, the mountain was almost bare. People had cut down the trees.
There was also no problem in the establishment of the committee because the committee was in place to rejuvenate the mountain. The mountain had lost its trees. The committee was encouraging reforestation.
Researcher: Now we can see that the mountain has some trees, are you not tempted to cut down trees from it again?
Respondents: No, not like before. We are protecting the environment
Researcher: Do you have woodlots around your homes?
Respondents: Yes we do. The trees surround the homes.
Researcher: Apart from the mountain, do you have other places where trees are planted at village level?
Respondents: No we don't have. We had some other places but individuals would cut the trees anyhow because they were not guarded. We have a few trees left in such areas. Not all trees were cut down.
Researchers: In terms of weather patterns, how can you differentiate the old days and the modern times?
Respondents: Its different, the rainfall patterns used to predictable in the old days but now it's very unpredictable
Researcher: How can you compare the lifestyle lived now and the old days?

Respondent: Life is very difficult now. For example back then it was easy to find fuelwood as compared to nowadays. This is because of the increase in population
Researcher: As you recall, how populated were you back then (20-30 years ago)?
Respondents: The population was scattered. Nowadays the population is dense and follows a linear pattern (settlements in trading centres along the main roads).
Nowadays we buy fuelwood which was not the case back then.
Researcher: Why is it that individuals nowadays are not afraid as compared to old days?
Respondents: Increase in population. Individuals invade other people's field without fear. In the old days, individuals would protect their fields with magic charms but nowadays individual do not care
Researcher: Why are you not cutting down trees from the mountain?
Respondents: Because there is strong protection. There is also a penalty of a fine.
Researcher: How are members of the committee elected and how do villagers associate with them?
Respondents: Everybody guards the mountain. There is good improvement in terms of trees. Any suspicious activities are also reported to the committee. In addition, there are also patrols done in the mountain to report anyone found cutting down trees even at night. Villagers report to the committee any suspicious activities.
Researcher: How are members of the committee elected?
Respondent: Villagers and leaders of the village elect the committee. This committee serves the village
Researcher: Why is it that fuelwood collection is done by females only?
Respondents: Males provide the money for buying the fuelwood. (Males can also look for fuelwood when money is available to buy the fuelwood)
Researcher: If the male is seen with the fuelwood, are they not suspected to have gotten the fuelwood from the mountain?
Respondents: No. we use the fuelwood. Sometimes we resell the fuelwood if it's a lot.
Researcher: do you ask for permission to sell the fuelwood from the men
Respondents: yes we ask them if we can sell some of the fuelwood
Researcher: Are you able to recover your money after selling the fuelwood?
Respondents: Yes we are
Researcher: Are you aware that where the men collect/buy the fuelwood, they are also damaging the environment
Respondent: Yes we know
Researcher: Do you know that individuals cut down trees in the mountain right here in Phalombe?
Respondents: Yes we know that it is happening
Researcher: Do you know that when the environment is destroyed in Salima, that can also affect your village in Phalombe
Respondents: Yes
Researcher: How does it affect you?
Respondents: Rain does not fall.
Rainfall in the northern region is available due to the presence of forests. These days their rainfall patterns are irregular because forests have been cleared
Researcher: How does this affects us, how does this affect the world?
Respondents: There is a decrease in finances. Low rainfall will lead to low yield. The people are affected negatively
Researcher: Which is cheaper, paraffin lamps or batteries in torches?
Respondents: Using batteries is cheaper than using paraffin lamps
Researcher: What kind of accidents occur when people are using paraffin?
Respondents: When the paraffin lamp is left unattended it can cause fire
Reckless husbands who drink can also cause accidents
Researcher: Who earns money in your households?
Respondents: Husbands or males. Money is earned through piece work
However, wives or females can also earn some money. If married, females help the husband to earn some money but if they are nor married, the females earn the money individually
Researcher: What is contract farming?
Respondents: This is when individuals ask for piecework in someone's field and then negotiate for a price. The field owners can be from this village.
Mostly, men work in Mocambique because work in this village is not enough or may not be available.
Researcher: Where do trees used for burning bricks come from?
Respondents: We buy blue gum trees
Researcher: At what point did households realise the importance of planting trees around the home in this village?
Respondents: It started with advice from agriculture extension workers and another organization that came to this village.

Researcher: Who uses hot water for bathing? Husbands? Wives? Children?
Respondents: Husbands. However some husbands have stopped using hot water for bathing because we just do not have enough fuelwood.
Researcher: What have you learnt about climate change at household level?
Respondents: Reduction in water heating
Avoid the use of paraffin lamps
Maize stalks and pigeon stalks are replacing fuelwood
Husbands are looking for piece work a lot more often than in the past
Researcher: Apart from Mocambique, where else do men go to work?
Respondents: Mocambique is the most reliable place. However some go to the northern region because there is work in farms there. The rainfall has also changed because of environmental degradation
Researcher: In the past, Phalombe and Mulanje were well known for cold weather especially in winter. Is that still the case?
Respondents: That was in the past, it has since stopped.
Researcher: How has the method of cooking changed with the lack of fuelwood nowadays?
Respondents: Yes it has changed in the sense that we have changed the sizes of pots used. We use smaller pots
Researcher: Are you more careful that the available fuelwood and food to be cooked match?
Respondents: Yes we make sure that there is enough fuelwood for cooking. Sometimes we make sure that the fuelwood is ready in advance. Preparing fuelwood today for cooking tomorrow.
Researcher: Are there any other issues to add?
Respondents: The issues should come from you; you should be the ones teaching us. We have told you what we think
Researcher: Any last words?
Respondents: Lets preserve the environment
Researcher: Thank you very much
Respondents: Thank you

ADDENDUM Q

FOCUS GROUP DISCUSSION 2 WITH WOMEN IN KHAMULA VILLAGE KASONGO EPA PHALOMBE

Researcher: What do you know about climate change?
Respondents: Climate changes, its either cold or hot
Change in planting patterns due to eratic rainfall. The change is what is called climate change
Researcher: Has the rainfall pattern changed in comparison to the old days?
Respondents: The rainfall pattern has changed
Researcher: How has it changed?
Respondent: The time in which rain starts has changed. This year has been the worst. 2015. We had dry spells. Rain stopped before the crops matured which led to low yields
Back in the day, rainfall would come adequately and this lead to higher crop harvest
Climate change is about change in weather pattern. It is man- made. Seasonal changes natural weather cycle that cannot be changed by man
Researcher: The seasonal weather cycle has changed. How has man interfered with the seasons?
Respondents: Man is taking part in destroying the environment by cutting down trees
Researcher: When you were in teenagers, did that mountain have trees? (Now in their 50s)
Respondents: Yes it had indigenous tree. We used to collect some fuelwood from there. But now we cannot go there. As a coping strategy we started planting our own trees in woodlots for fuelwood
Researcher: What indicators do you have that show that climate has changed?
Respondents: There is increase in population which leads into the degradation of the environment
Researcher: You mentioned that rainfall pattern is unreliable in this area. Why do you think this is the case?
Respondents: Others say its climate change
Others say it's because of careless cutting down of trees
Researcher: In terms of weather, is Phalombe a hot area?
Respondents: October temperatures are the same as previous few years (the discussion was held in October). It's generally hot
Researcher: What do you use for cooking?
Respondents: Maize stalks
Researcher: Has this been the case from previous years
Respondents: From the previous few years
Researcher: Lets categorize the years, which other years did you not use or need to use maize stalks?
Respondents: We used to go to the forest to collect fuelwood. We would cut down trees during the past years. But nowadays the forest department has set up restrictions on cutting down of trees. Because of these restrictions we now use maize stalks
Researcher: Why has the forest department set these restrictions?
Respondents: Because the forest department wants to have forests that have trees
Researcher: Did we have a lot of trees in the forests?
Respondents: The forest department is protecting the environment. It does not want degradation.
Researcher: What are trees used for? Why is it a challenge to cut down trees anyhow?
Respondents: Forest department wants to maintain the trees in the forest.
This is because trees are decreasing due to reckless cutting down which then leads to irregular rainfall patterns. If the trees are not cut down, they help to bring some rain. Trees also control soil erosion.
The restrictions imposed by the forest department are because they want to maintain regular rainfall patterns.
Researcher: What is the relationship between rainfall and trees?
Respondents: When we have cut down trees, rain does not fall well.
Researcher: How do you find fuelwood?
Respondent: In the past we used to collect fuelwood from the hills. We had indigenous trees in the hills. But nowadays we have woodlots around our homes. We have planted blue gum trees
Researcher: This is what you know (younger respondents)?
Respondents: Yes we do not know that people used indigenous trees for cooking.
Back in the days, fields used to have tree trunks which were used for fuelwood
Researcher: How many times do you go searching for maize or pigeon stalks for cooking per week?
Respondents: Once a day
Researcher: Do you all go once per day?

Respondents: Yes, the collection of fuelwood is done once one is finished with working in the fields. Others steal fuelwood due to the unavailability of trees. Therefore after harvest, the stalks are transferred to the households for safekeeping.
Researchers: Do husbands help out with the collection of fuelwood?
Respondents: Yes they do.
The stalks have to be transferred while they are still fresh. This means that later on you only go to work in the field.
The transferring of stalks is to protect them from theft. It can also be to reduce the number of days spent on looking for stalks per day or week.
The dry stalks are then kept at a secure place in the household. Getting them out in the rainy season
Researcher: You do not find fuelwood?
Respondents: It is not easily found. We mostly use crop residues. Sadly the stalks do not heat up for a longer period as compared to fuelwood.
Researcher: So you make sure that the food to be cooked matches with the available stalks?
Respondents: Yes. If we need to heat water as well, we make sure that we collect more stalks
If the household is using fuelwood, it means that they have bought the fuelwood from Phalombe boma. Sometimes we do not know where the fuelwood comes from.
Researcher: What do you use for lighting in your households?
Respondents: Old bulbs and torches
Researcher: How do you power these bulbs and torches?
Respondents: We use batteries
Researcher: How much are the torches and the batteries?
Respondents: MK70-120 for batteries, the price depends on the distributors. MK500-700 for the torches. In addition, I have a child in the house who when he notices that the batteries are not working properly he boils them and then we use the boiled batteries for lighting.
Researcher: In the past we used paraffin lamps for lighting our homes, what happened to paraffin lamps?
Respondents: Paraffin is no longer available that is why we are using the torches.
Researcher: Are we adopting different ways of lighting?
Respondents: Adoption of new methods is because paraffin is not available
This new method was taught by the younger generation. The bulb from the touch is extended with the use of wires. Children do this. It the child is away then maintenance of these bulbs becomes a problem.
Researcher: If we ask you to us these torches, will you be able to show us?
Respondents: Yes we can get them and show you.
Researcher: Are you cautious of the food you cook due to the unavailability of fuelwood or also the fact that the stalks do not heat up for a long time?
Respondents: We just cook regardless of how long it will stay on the fire. The cooking will depend on the available stalks or fuelwood.
For example, beans require a lot of stalks. This means that we have to monitor the fire closely in order to maintain the cooking.
Researcher: Do you cover up all your cooking?
Respondents: Yes we do. This is done to keep dust/ dirt away from the food.
Another reason for closing with the lid is to keep the heat in the pan/pot so that food is cooked faster.
Researcher: Do you still heat water for bathing.
Respondents: Others heat their water for bathing while others do not.
Researcher: Why do others bath cold water? Is it because the temperatures are generally high or fuelwood or stalks are not readily available?
Respondents: It depends on the individual. Regardless of the high temperatures others still bath hot water, while others use cold water.
Researcher: Do you heat water in the sun?
Respondents: Yes we do especially in hot season
Researcher: Do you heat space especially in cold season? To keep warm
Respondents: Yes we do this in winter. We use stalks
Researcher: Do people brew beer in this area?
Respondent: Yes. We use blue gum trees. These trees are from our fields and around our homes.
Other brew sweet beer (thobwa) using fuelwood obtained from the fields. Others brew beer using stalks, a lot of stalks combined with fuelwood.
Researcher: What type of sweet beer do you brew?
Respondents: We first of all make porridge and let it cool. After cooling we add sorghum flour
Researcher: How often do you plant blue gum trees?
Respondents: This happens often because we lack trees in this area and also because use the trees for constructing houses.
Researcher: Who encourages reforestation?

Respondents: There was a group in the past that encouraged planting of trees. This practice is now transferred to the younger generation.
Researcher: Why do you plant blue gum trees instead of other type of trees?
Respondents: Other types of trees are prone to diseases infestations. Blue gum is more resistant to diseases and blue gum trees also grow faster.
Researcher: How many people are planting these trees in this village?
Respondents: A lot of people
In addition, agriculture extension workers provide us with seedlings of different trees that we can plant. But blue gum tree is the one that grows faster.
Researcher: How does the planting of blue gum trees help the village?
Respondents: The trees help us a lot. If other fuelwood is not available, we use blue gum trees as fuelwood.
Further to that, the blue gum trees are also used for constructing houses or burning bricks
The trees also protect us from blowing winds.
Researcher: Do villagers cut down trees from the forest in the mountain?
Respondents: The mountain now is a protected area. It is protected by the forest department.
If anyone is caught cutting down trees, they are issued a fine or are answerable to a court case.
Researcher: Who protects the trees in the forest in the mountain?
Respondents: MEET. We don't know the meaning of MEET. There is a committee.
Researcher: How are members elected in this committee?
Respondents: We the villagers of this area. We don't know the meaning of MEET
Researcher: How does the committee work?
Respondents: An offender is sent to the village headman where he is charged a fine.
Researcher: Who came up with these rules and regulations?
Respondents: We are the ones who drafted these rules and regulations. We collectively came up with rules and regulations concerning the cutting down of trees of the forest on the mountain.
Researcher: How are members selected into the committee?
Respondent: They are selected from each village
Researcher: Apart from the mountain, where else are you planting trees?
Respondents: In wetlands. But the problem is that the wetlands are not well protected. Sometimes people uproot the trees from the wetlands
Researcher: How are these trees helpful to you as a village?
Respondents: The government is planning to introduce bee farming in the forest in the mountain.
The protecting of the mountain will bring back regular rainfall patterns. It will also protect the land from soil erosion.
Researcher: What type of cooking utensils do you use?
Respondents: We use metal pots because they heat up quickly
Clay pots are difficult to use for cooking because they do not heat up quickly even though they retain heat.
Researcher: How can the government help the village in terms of preserving the environment and hence control climate change?
Respondents: When the environment is protected, the government appreciates. They show their gratitude by providing us with seminars so that they can teach us more and better ways of preserving the environment.
Researcher: What can you say about fuelwood and cooking, water heating and beer brewing in this area?
Respondents: If we are to continue using fuelwood, then everyone must plant trees around their homes as well as replacing the cut down trees
Researcher: What is the role of the government in terms of preservation of the environment?
Respondents: Committee members and individuals from the government must visit villages and encourage individuals to take good care of their environment
Apart from that they must also provide seeds for planting by agriculture extension workers.
Researcher: What roles are the villagers supposed to take in the preservation of the environment?
Respondent: They must use stalks for cooking to avoid damaging the environment. That way they will also not be fined for cutting down trees
Researcher: Are you able to harvest enough produce in your household when you use the stalks for cooking? The stalks are supposed to be used for conservation agriculture?
Respondents: We do not keep stalks in the field to maintain nutrients in the soil
Researcher: Any burning issues?
Respondents: It is a question, are you going to teach us other methods of preservation of the environment from what we already know?
Researcher: We came to collect information from you. We want to tap into your knowledge base. We did not come here to teach you. We came to learn from you. Thank you

Respondents: Thank you.

ADDENDUM R

FOCUS GROUP DISCUSSIONS 1 WITH WOMEN IN MANJANJA VILLAGE RIVIRIVI EPA BALAKA

Researcher: How has climate change affected your area?
Respondents: The climate has changed. We now have frequent floods as compared to the past. This is because of lack of trees
Researcher: Did you have floods in the previous rainy season?
Respondents: Yes. There was an increase in water level in Mulunguzi river; people were swept away by rain water.
Rainfall pattern has also changed. We used to plant crops in October but due to change in climate we now plant in December
Researcher: How has your life been impacted by climate change?
Respondents: Due to the change in rainfall patterns, we have not done enough in terms of solving our hunger problems.
Rainfall erodes the soil in our fields and this makes it difficult to prepare land for planting.
Researcher: Is this true? Do others agree to this?
Respondents: Yes we do.
Researcher: What do you use for cooking?
Respondents: We use fuelwood for cooking.
Researcher: Why do you use fuelwood instead of other sources of energy for cooking? Why not charcoal?
Respondents: When it comes to charcoal, we do not use it because of lack of money. We cannot afford charcoal.
Researcher: Do people produce charcoal here?
Respondents: Yes they produce some charcoal from trees.
Researcher: If charcoal is produced in this area, where is it sold?
Respondents: Charcoal is produced in this area and it cooks faster than fuelwood.
In our area, producing charcoal does not happen a lot. But there are other particular areas where charcoal production takes place. We cannot afford charcoal because we just do not have the money.
Researcher: In that case then, charcoal is not produced in this village?
Respondents: No they don't
Researcher: A lot of households in this village use fuelwood?
Respondents: Yes
Researcher: Nowadays, how long does it take to collect fuelwood?
Respondents: It is now difficult because we have to travel long distances. People have cleared trees from their fields.
Researcher: How did this project of manufacturing energy saving stoves start?
Respondents: The project started because of high levels of environmental degradation in this area. The project started with Concern Universal because they wanted the villagers to use less fuelwood when cooking.
Researcher: Are these stoves helpful? How helpful are they?
Respondents: We use less fuelwood when using these stoves
Researcher: Are you aware of other methods of cooking apart from these stoves?
Respondents: There is no other method apart from using these stoves.
Researcher: What do you use for lighting in your households?
Respondents: Bulbs and torches
Researcher: How much is a torch?
Respondents: MK1000. But it also depends on the size. It can cost from MKI000-1200
Researcher: How long do they last?
Respondents: Almost 1 month. If it has rust it means that it is damaged
Researcher: Where do you buy these torches from?
Respondents: At the nearby market
Researcher: Do you heat water for bathing?
Respondents: It depends on the individuals. Other individuals use hot water all the time regardless of the weather.
Researcher: Who still wants to use hot water even in this heat? (October is very hot in Malawi)

Respondents: Like we said, it depends on the individuals. Others have just gotten used to using hot water even in hot weather.
If you have been working in the field for long hours, taking a hot bath “lightens” up your body i.e. you feel lighter and better
Researcher: That’s why you use hot water for bathing
Respondents: Yes
Researcher: Do you know that this practice damages the environment?
Respondents: Yes we know
Researcher: But you still continue to destroy the environment?
Respondents: It’s our culture. We learnt this behavior from our ancestors
Researcher: Is there another way of heating the water?
Respondents: By putting the water in the sun. Then the husbands agree to bath such water because the water is at least warm
Researcher: Do you know that heating water with fuelwood destroys nature/environment?
Respondents: Yes we know. This method of putting water in the sun happens during hot season. We cannot put water outside to be heated up during rainy nor cold season.
Researcher: Do you heat your space in cold season?
Respondents: Yes we do
Researcher: What do you use for space heating?
Respondents: We use fuelwood. We sit around open fires
Researcher: What else do you use for space heating apart from fuelwood in this area?
Respondents: We use maize stalks for warming up our bodies. We also use other crop residues.
Researcher: What type of crop residues do you use?
Respondents: Pigeon peas, sugar cane remains and dry grass
Researcher: How many households have the energy saving stoves in this group?
Respondents: 4 out of 12. There are a few households that use the energy saving stoves in this village
Researcher: Do you use these energy saving stoves?
Respondents: Yes we do
Researcher: Who brews beer in this group?
Respondents: None
Researcher: Do other households brew beer in this village?
Respondents: Yes local beer known as kachasu (a local spirit) and masese
Researcher: What source of energy do they use when brewing these beers?
Respondents: Fuelwood
Researcher: Do people in this area grow tobacco?
Respondents: There are some that grow tobacco in this village. Their tobacco is dried under shades
Researcher: What do people use for brick baking?
Respondents: Fuelwood.
Researcher: You use a lot of fuelwood in this area?
Respondents: Yes. For example, brick makers have to buy trees such as Misangu for burning the bricks
Researcher: Apart from Misangu, what other trees are present in this area
Respondents: Mithethe, Swaswa
Researcher: Do you plant trees in this village.
Respondents: Yes we do. But the fast growing Blue gum cannot survive here because we have a lot of termites
Researcher: Do you have any plantation forest in this village?
Respondents: Yes we have a forest
Researcher: Who takes care of this forest?
Respondents: Agriculture extension workers
Researcher: What happens to someone if they are found cutting down trees in this forest?
Respondents: There is a committee that takes care of this forest who deal with such people. No one can cut down trees from the forest any how
Researcher: Is there a time when individuals are allowed to cut down trees from the forest?
Respondents: The individual seeks permission first from the committee. For example, when a house has collapsed only then are individuals allowed cutting down some trees. They seek permission for trees to reconstruct their house
Researcher: Cutting down of trees from the forest is only permitted during an emergency?
Respondents: Yes
Researcher: How does this work?
Respondents: There is a committee that manages emergency events in this village. That committee report to the village headman for permission
Researcher: So you have an emergency committee?

Respondents: Yes we have an emergency committee
Researcher: Is there a fee attached to the trees that are cut during such emergencies?
Respondents: No one pays a fee because it is an accident
Researcher: When do you plant trees in the forest?
Respondents: Months like this one (October)
Everybody plants trees in the forest
Researcher: Is there a committee that looks after the forest?
Respondents: Yes
Researcher: Where does the energy saving stoves project obtain its fuelwood?
Respondents: Everyone involved in the venture cuts down trees from their field. Others buy if they do not have some in their fields
Researcher: Where do you buy the fuelwood?
Respondents: Some household with trees sell their trees
Researcher: How much is 1 Msangu tree?
Respondents: The price range from MK3000 -7000. It depends on the number of branches that the tree has
Researcher: Has anybody cut a msangu tree and charged for cutting the tree?
Respondents: Nobody dares cut a tree that is not theirs
Researcher: Do you all have your own trees
Respondents: Some have, some don't. They finished cutting down their trees
Researcher: How did you finish your trees?
Respondents: It depends on how they have grown.
Researcher: So you did not plant more msangu trees?
Respondents: Msangu trees are natural trees. We do not plant these trees
Researcher: What do you use these Msangu trees for?
Respondents: Cooking, burning bricks. Sometimes we cut the trees before rainy season and keep them. We then use them during rainy season.
Researcher: Do you have a lot of Msangu trees? Why are individuals selling these trees?
Respondents: No, we do not have a lot of Msangu trees. Some households sell the tree because of domestic problems e.g. hunger
Researcher: How long does it take for the tree to dry?
Respondents: Even with cutting, the tree regrows. The branches grow back.
Researcher: What do you think the government should do in terms of environment preservation?
Respondents: We urge the government to help reclaim the environment so that rainfall pattern should be restored in order to increase our yield in the field
Researcher: What would you say to someone if they said that the government cannot help you because you are the ones who are cutting down the tree?
Respondents: We cut down the trees because of domestic problems.
We don't have anything else to use for cooking.
Government should know that we are cutting down the trees because we have problems. It should then assist us.
Researcher: How should the Government assist then?
Respondent: Government should assist with business ventures, providing capital as well as with job opportunities
Researcher: What do you mean when you say household problems?
Respondent: Individuals cut down trees for sale. They need some money for different family needs
Researcher: What do you use for cooking?
Respondents: Fuelwood
Researcher: What do you use for space heating (to keep your bodies warm?)
Respondents: Maize stalks, pigeon pea stalks, crop residues
Researcher: What do you use for beer brewing?
Respondents: Fuelwood
Researcher: How do people heat their water for bathing?
Respondents: Fuelwood and putting water in the sun
Researcher: What do you use for lighting in your households?
Respondents: Torches and bulbs
Researcher: What do you use for charging your torches?
Respondents: We use batteries
Researcher: Do you have solar panels in this village?
Respondents: No body uses that type of energy
Of course there are a few households that have solar panels
Researcher: What is the solar energy used for?

Respondents: The solar energy is used for lighting their homes. Charging cellphones and batteries
Researcher: How much does it cost to charge a phone?
Respondents: MK50 until the phone is fully charged
Researcher: Do you have other ways of lighting the homes apart from using the torches?
Respondents: We use paraffin lamps. Sometimes candles. Paraffin is not readily available these days. In the past it was easy to use paraffin lamps
Researcher: Do you leave candles on while you are sleeping?
Respondents: No we switch them off to avoid accidents.
Researcher: Do you leave candle burning in the house even when no one is in the house?
Respondents: No, we switch them off. At times we forget to switch them off while we are outside
Researcher: Why do you leave the candle burning while you are outside?
Respondents: We want lighting in the house when we are coming back. We want to see things without difficulties
Researcher: Why do you pour water over fire after you have finished cooking?
Respondents: We want to save the fuelwood so that we can use it again tomorrow
Researcher: Do you save fuelwood in stocks?
Respondents: We save fuelwood in stocks in preparation for rainy season
Researcher: Do these stocks last the whole rainy season?
Respondents: It's possible to last the whole rainy season for some. But for others it's not possible.
It is possible for those that have Msangu.
Researcher: It looks like Msangu trees are important in this village?
Respondents: Yes its important because it also improves soil structure
Researcher: Is this tree is very important, why do you still cut it down?
Respondents: Because of the domestic challenges faced
Researcher: Apart from Msangu, do you also have Tsanya in this village?
Respondents: We do not have Tsanya but there are there in another village
Researcher: What different methods of coking are practiced nowadays compared to the past?
Respondents: Things are different. If fuelwood is not available, households use crop stalks for cooking.
Researcher: Do you practice conservation agriculture? (ntaya khasu)
Respondents: No, we do not practice that
Researcher: Do females take an active role in planting trees in this village? Reforestation
Respondents: Yes we do
Researcher: Are female taking a more active role than the males?
Respondents: Yes we do.
That fence over there is going to be used for planting trees
Researcher: Who organizes these activities?
Respondents: Forestry committee
Researcher: Are there any members of this forestry committee among us?
Respondents: No we don't have
Researcher: You talked about flooding, soil erosion and lack of fuelwood, who told you that this is a result of climate change?
Respondents: Own observation when we compare between the past and the modern times.
In mountainous areas, rainfall is high
Agriculture extension workers also advise us.
We also listen to the Radio
Researcher: What is the relationship between rainfall and climate change?
Respondents: Heavy rainfall comes because of increased number of trees
Researcher: Any last words or burning issues?
Respondents: We need to change our practices by preserving natural resources/environment.
We need to listen and practise things that agriculture extension workers teach us
We need to encourage the government to help us reclaim the environment that we had in the past
Government should provide us with different types of trees that we can plant in our area
Researcher: How much do you buy the energy saving stove?
Respondents: MK700
Researcher: How much fuelwood does it use at once?
Respondents. 3. With 3 pieces of fuelwood we can cook nsima and vegetable relish

ADDENDUM S

FOCUS GROUP DISCUSSIONS 2 WITH WOMEN IN MANJANJA VILLAGE RIVIRIVI EPA BALAKA

Researcher: What do you know about climate change in this area?
Respondents: Lack of food, low rainfall
Researcher: How do you know that the climate has changed?
Respondents: Because we have not been able to harvest enough yields
Researcher: Apart from low rainfall, what else has changed?
Respondents: Fields are difficult to prepare because water has eroded the top soil
Researcher: What can you say about rainfall patterns between now and in the past?
Respondents: Rain used to start early in the past, in October or November but these days it starts in December
Researcher: Is this area experiencing any dry spells?
Respondents: Yes we have dry spells. This means that we do not get enough rainfall and this leads to low yields
Researcher: What crops do you grow around this area?
Respondents: Maize, pigeon peas, sweet potato, tobacco, cotton etc.
Researcher: If there is a dry spell or floods, where do you obtain fuelwood?
Respondents: We collect fuelwood from our fields
Researcher: Do you walk long distances during rainy season in search of fuelwood?
Respondents: No we do not. Everyone fetches fuelwood from their own fields
Researcher: How is it possible that you do not travel long distances in rainy season?
Respondents: The natural resources have been destroyed
Researcher: Apart from fuelwood, what else do you use for cooking?
Respondents: Sometimes we use charcoal
Researcher: How much is a bag of charcoal?
Respondents: MK1000 -1500. Most expensive bag is MK 3000, during rainy season
Researcher: What do you use for cooking?
Respondents: Fuelwood and charcoal
Researcher: Why do you use fuelwood?
Respondents: Because we still have trees. Fuelwood is available. Some households do not have charcoal burners or the energy saving stoves so they still use fuelwood
Researcher: How much is the energy saving stove?
Respondents: MK700
Researcher: How is the continued reliance on fuelwood affecting the environment?
Respondents: The three stone fireplace uses a lot of fuelwood.
The energy saving stoves do not require a lot of fuelwood
Researcher: Apart from the three stone fireplace, the energy saving stoves, what other ways are used for cooking?
Respondents: We build a structure on the ground which is used for cooking. It is known as a ground stove (Chimbaula cha pansi).
Researcher: Do households have these structures for cooking?
Respondents: At the moment they are not there. They were destroyed with the rains
Researcher: What do you use for lighting?
Respondents: Torch
Researcher: How long does a torch last?
Respondents: It depends on the type of torch. Others may last one month or more
Researcher: Do you have these torches in your households?
Respondents: Yes we have
Researcher: Why do you use these torches for lighting?
Respondents: Because nowadays paraffin is not available.
Torches also save money unlike paraffin lamps
These days it is difficult to find paraffin and when you are using paraffin lamps you are required to buy paraffin more frequently
Researcher: Apart from paraffin lamps and torches, what other sources of energy do you use for lighting?
Respondents: Candles
Researcher: Do you leave candles burning even when there is no one in the house?

Respondents: No we don't
Only where there is a person in the house
Researcher: Do you keep the torch on even when you are sleeping in the night?
Respondents: Others keep the torch on
Especially when there is a nursing mother
Others do not keep the torches on at night when they are sleeping
Researcher: Why don't they switch off the torch?
Respondents: Because of the children
Children are scared of darkness
Sometimes other parents keep the torch on in order to see crawling insects that might bite their children
Researcher: Do you heat your water for bathing?
Respondents: Yes
Researcher: What do you use for heating the water?
Respondents: Fuelwood
Researcher: Apart from the fuelwood, what else do you use as a source of energy for heating the water?
Respondents: Charcoal
Researcher: Apart from fuelwood and charcoal, how else do you heat the water?
Respondents: We put the water on the sun
Researcher: Do you think using fuelwood destroys the environment?
Respondents: Natural resources are destroyed
There is no any other source of energy available apart from fuelwood
We cut down trees for fuelwood because of the challenges faced
Researcher: Are there other ways of protecting the natural resources?
Respondents: Yes, by planting more trees
Researcher: Are you planting more trees in your area?
Respondents: Yes. We plant trees for the community first and then plant others around our homes or in the field
Researcher: Do you have a committee that is responsible for planting trees in this area?
Respondents: Yes. There is a committee
Researcher: Who is in that committee among the participants in this discussion?
Respondents: Yes there are some. The committee is responsible for taking care of the trees in the forest
Researcher: What are the rules and regulation for cutting down trees in this community forest?
Respondents: Individuals are not allowed to cut down trees from the forest
The forest is a protected area
Trees are only cut down when there is an emergency among the village members e.g. when homes collapse
Permission to cut down trees has to be granted by the village headman
Researcher: How are members elected into the committee?
Respondents: Every village around the forest has a representative in the committee
Researcher: Who gave you the seeds or seedlings for the trees?
Respondents: Agriculture extension workers (Government)
Researcher: Did you pay any money for the seedlings?
Respondents: We don't pay for seedlings
If the seedlings are not available from the extension workers, we collect seeds and plant them ourselves
Researcher: Do you have other protected forests apart from the mentioned one?
Respondents: There is another one at the group village headman
Researcher: When do you plant these trees?
Respondents: Once the seedlings have grown we transplant them to the forest, we also plant once the rains come
Researcher: Who is responsible for planting the trees?
Respondents: The whole village. Both males and females
Researcher: Do you have any official from the forestry department whom you work with?
Respondents: Yes. Agriculture extension worker Mr. Kamwendo
Researcher: How else do these extension workers help the community?
Respondents: They teach the community how to manage the trees
They also provide seeds and seedlings
Researcher: Do households in this village have their own woodlots?
Respondents: Yes we have trees around our homes
We also have forests for the local Church
Researcher: Do you brew beer in this village?
Respondents: Other people in the village brew beer but no one in this group brews beer
Researcher: For those that brew beer, what source of energy do they use?

Respondents: Fuelwood
Researcher: What type of beer is brewed in this village?
Respondents: Wa masese and Kachasu
Researcher: Do you also brew sweet beer (Thobwa)
Respondents: We do
Researcher: What source of energy do you use for brewing thobwa?
Respondents: Fuelwood
Researcher: What methods are there to protect the environment?
Respondents: When we cut down trees we need to replace them
We need to plant more trees
Researcher: Are you planting more trees?
Respondents: Yes we do.
The good thing about Msangu tree is that once the branches have been cut, they tend to regrow
Researcher: Is this Msangu tree protected?
Respondents: It is protected tree in this area
Researcher: What happens to an individual if they are found d cutting down Msangu tree?
Respondents: They have a case to answer
Researcher: Even when the tree is in their field?
Respondents: Yes. They need to explain why they are cutting the tree
Researcher: Is it possible to buy a whole msangu tree?
Respondents: That is a lie. People buy branches
Researcher: How much do they sale a branch or branches?
Respondents: They sell between MK3000 and Mk5000
Researcher: That means the tree grows very big?
Respondents: Yes. The branches produced by this tree are very big and wide
If it is in a field, usually the field gives very high yields
Researcher: I understand that the tree improves soil fertility?
Respondents: Once the leaves from Msangu tree drops to the soil, it maintains nutrients in the soil
Researcher: Do you practice conservation agriculture in this area (ntaya khasu)
Respondents: We use the stalks from maize, pigeon peas, tobacco stems and cotton as fuelwood
Researcher: What do you use for space heating? (Warming up your body)
Respondents: We use fuelwood
Researcher: You don't use these stalks for warming your bodies?
Respondents: These stalks are specially used for space heating in cold season. During the months of June, July and August
Researcher: Are there any other issues that you want to tell me with regard to fuelwood, charcoal and torches in this area?
Respondents: We want the government to help us with access to electricity energy in our villages
Researcher: You do not have electricity in this area? Off grid
Respondents: We do not have
Researcher: Do you have an idea how much it costs to have electricity?
Respondents: A lot of money.
But it also depends on individuals. If the electricity is supplied some would be able to afford the electricity
Researcher: You want to have electricity in your area?
Respondents: Yes. A lot
Researcher: What are you going to use this electricity for?
Respondents: We will stop cooking with fuelwood
Researcher: Do you have solar panels here?
Respondents: Yes. Some households have solar panels
Researcher: What do they use the solar energy for?
Respondents: They are used for lighting the homes
Charging cellphone batteries
Researcher: How much does it cost to have your cellphone battery charged?
Respondents: Mk 30 -50
You can also watch television using energy generated from solar panels
Researcher: Do you have entertainment television centres around here?
Respondents: No. the only entertainment television centres are in markets or trading centres
Researcher: What do you use for cooking?
Respondents: We use fuelwood
Charcoal. Crop stalks from maize, pigeon peas, cotton and tobacco)
Researcher: What do you use for lighting in your homes?
Respondents: Torch

Researcher: Apart from torches, what else is used for lighting?
Respondents: Paraffin lamps, candles
We use paraffin lamps and candles depending on the availability of cash in the home
Researcher: How is climate change related to trees?
Respondents: We have observed what is happening around us. Rainfall patterns are affected by the cutting down of trees
Agriculture extension workers also tell us to plant more trees. They also provide us with seedlings for planting.
The rainfall pattern has changed. Back in the day we had a lot of trees which led to good rainfall
Researcher: What do you know about climate change? E.g. Does climate change happening in another country affect us as a country?
Respondents: Wind blowing from different countries affects our weather
Researcher: Do you close lids when cooking
Respondents: Yes we do. In order to cook faster
Researcher: Do you soak beans in water before cooking to reduce amount of energy used for cooking?
Respondents: No we don't
Researcher: Why don't you soak beans before cooking?
Respondents: The soaking removes taste and flavor
Researcher: What crops do you grow in this area?
Respondents: Maize
Pigeon peas
Sweet potato
Cotton
Sorghum
Tobacco
Researcher: Do you buy fuelwood?
Respondents: Yes MK200 per headload/bundle
Researcher: How much is a bag of charcoal?
Respondents: MK1500
Researcher: How long does this bag of charcoal last?
Respondents: One month
Researcher: How long does a bundle of fuelwood last?
Respondents: The bundle does not last long. May be a week
An individual can sell branches from Msangu tree for fuelwood
Researcher: Who has Msangu tree in this group?
Respondents: 4 individuals
I have 8 trees
I have 3 trees
I have 2 trees
I have more than 10 trees
Researcher: Do you sell branches from these trees
Respondents: No we don't
We use them for domestic purposes
Researcher: What do you use the msangu tree for?
Respondents: We use the branches as fuelwood during rainy season
Researcher: What would you like the government to do for you in terms of the environment/natural resources?
Respondents: Government should send us seeds, seedlings.
Government should provide capital for business ventures so that we should stop cutting down trees/selling trees
Researcher: What business can you do here?
Respondents: Sell beans
Sell rice
Sell potatoes
Researcher: Where do you think your market would be?
Respondents: at the trading centre
Researcher: Do you have a lot of markets here? For beans
Respondents: Yes we can buy beans from Ntcheu.
The households in this village can also buy from us. A bag of beans cannot last for a week. It will be all sold within a week
Researcher: Any last words?
Respondents: Government should supply electricity to the village

Researcher: Do you have an idea how much it would cost to supply electricity to an area?
Respondents: No. But the cost cannot be covered by one person. But as a group
Researcher: Do you have cooperatives here? Do you know what cooperatives are?
Respondents: Yes
Researcher: What crops are grown here?
Respondents: Cotton
Tobacco
Sorghum
Groundnuts
Researcher: Any concluding remarks
Respondents: This area has been affected by dry spells and heavy rainfall that comes within a short period
Researcher: Thank you very much for your time
Respondents: Thank you