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Towards the achievement of SDG 7 in sub-Saharan Africa: Creating synergies between Power Africa, Sustainable Energy for All and climate finance in-order to achieve universal energy access before 2030

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ABSTRACT

Improved access to energy in sub-Saharan Africa (SSA) has the potential to alleviate poverty, promote industrialisation, facilitate gender equality and reduce the region's vulnerability to climate change. Consequently, the current low rates of electrification in many SSA countries has been identified as the most pressing obstacle to economic growth, more important than access to finance, red tape or corruption. Despite the presence of numerous initiatives for promoting energy access in Africa, and the Sustainable Development Goals (SDGs) calling for universal access to energy by 2030, Africa might still not be able to achieve universal energy access by 2030. Through an analysis of case studies, research articles, policy briefs and project reports this paper sought to investigate the policies, strategies and innovations that could help expedite SSA's progress towards universal energy access before 2030. This investigation revealed that an emphasis on rural electrification and linking energy access to agriculture and irrigation development as the case was in Viet Nam, could successfully diversify African economies and mitigate the negative perceptions about Africa's growth prospects and energy sectors that global economic shocks instigate. Additionally, the operations of Power Africa, the Sustainable Energy for All (SE4All) Initiative and the China South-South Climate Cooperation Fund can either significantly improve the financing and regulatory frameworks for SSA's energy sectors or constrain economic development in SSA by promoting rent-seeking and corruption which culminates into a 'climate finance curse'. Consequently, these initiatives can only facilitate inclusive growth as envisioned in the SDGs if SSA develops or strengthens institutions to coordinate and harmonise investments and aid from such autonomous diverse sources.

1. Introduction

Africa's low access to electricity and high vulnerability to climate change can be anticipated to constrain the continent's future human and economic development prospects. Electricity is an essential enabler of economic development that can lift people out of poverty and support sustainable urbanisation and industrialisation [1]. However, approximately 1.2 billion people (constituting 17% of the global population) live without electricity, with the vast majority in the Asia-Pacific region and sub-Saharan Africa (SSA) [1–3]. Whilst North Africa has an electrification rate of almost 100%, in SSA, the electrification rate is only about 32–35% and this translates into about 635 million people living without electricity and 80% of the population relying on traditional use of biomass for their energy requirements [1,4]. It has therefore been reported that up to 600,000 people in Africa die due to air pollution caused by the use of firewood and charcoal for cooking [79]. Consequently, the current low rates of electrification in many African countries has been identified as the most pressing obstacle to economic growth, more important than access to finance, red tape or corruption [1]. Additionally, the low levels of development in SSA make the region highly vulnerable to climate change [5,6], hence climate change and environmental degradation will likely lead to a 12% decline in the Global Human Development Index (HDI) in South Asia and SSA, in contrast to a global HDI decline of 8% [7].

From as early as the 1990s various interventions were initiated with the aim of improving electricity access, renewable energy programme delivery and energy market development in SSA [8–10]. For example, the Power Sector Reform Programme was initiated in Africa with the aim of providing energy sector regulatory and institutional reforms that could make various African countries to improve the financial and technical efficiency of their utilities [8]. Additionally, the United Nations Framework Convention on Climate Change (UNFCCC) initiated the Clean Development Mechanism (CDM) as a means to facilitate climate change mitigation whilst promoting sustainable development and

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the enhanced deployment of renewable energy technologies in developing countries [11–13]. Arguably, such interventions produced marginal positive results as the electrification rate of SSA is below that of the World and the average for developing countries (i.e. the overall electrification rates are World 82%; Developing Asia 83%; North Africa 99%; SSA 32%; Africa 43%; and Developing countries 76%) [4].

The Sustainable Development Goals (SDGs) have ambitious global targets related to increasing energy access; and enhancing climate change planning, management, mitigation and adaptation. The ambition in SDG 7 is that by 2030 there should be universal access to affordable, reliable and modern energy services; and SDG 13 encourages countries to integrate climate change measures into national policies, strategies and planning, and promote mechanisms for raising capacity for effective climate change-related planning and management in Least Developed Countries (LDCs) and Small Island Developing States (SIDS) [14]. With regard to energy access, even though electricity access between 2010 and 2012 in SSA rose from 32% to 35%, a significant number of countries in SSA are not improving electricity access at a pace that is compatible with universal energy access in 2030 [15]. Africa spends about US$8 billion annually on energy investments and infrastructure but the region requires to spend US$41 billion to US$55 billion annually until 2030 to ensure that universal access can be attained [16,17]. Additionally, Africa will also require about US$100 billion a year in investments in-order to cope with its projected climate change impacts [18] and over US$600 billion to cover the costs for implementing the SDGs [19]. Whilst mobilising all the financial and non-financial resources necessary to achieve the ambitions of the SDGs could be challenging, particularly since traditional aid and public finance cannot cover the full implementation costs for the SDGs, the challenge is arguably even greater in Africa and Africa's energy sector because achieving universal access in Africa ahead of 2030 is a precondition to achieving most of the SDGs by 2030 [15].

Various commentators have put forward suggestions of how the SDGs and universal access to energy can be successfully implemented and financed. For example, Brew-Hammond [20] argued that achieving between 50% and 100% access to modern energy services by 2030 in Africa would require (i) more effective mobilisation and use of both domestic and external funding, (ii) the development and implementation of innovative policy frameworks, and (iii) the need for significant increases in the numbers of various actors involved together with more effective institutions in the energy sector. Chirambo [21] highlighted that emerging countries such as China have the potential to support Africa to achieve the SDGs by (i) making South-South Climate Finance (SSCF) modalities to focus on improving financial inclusion and (ii) directing more SSCF flows towards climate change adaptation activities in Africa. Clark et al. [22] tried to highlight the measures that government agencies and the research community could undertake in-order to incentivise private investment in the global south to facilitate low carbon sustainable development, and they concluded that it was unrealistic to initiate effective transformational change for enhanced investment in low carbon development if the existing institutional and political frameworks were not changed. On the other hand, there are also many discrete or fragmented global initiatives aiming to promote increased prosperity and economic development in Africa by improving electricity security such as the Power Africa initiative by the United States of America (U.S.), the Africa-EU Millennium Development Goals initiative, the Tokyo International Conference on African Development (TICAD) process by Japan, the Sustainable Energy for All initiative (SE4All) by the United Nations, and the India-Africa Forum Summit (IAFS) [1]. Arguably, since there could be many synergies between various discrete SDGs programmes and energy access programmes, there is potential that the harmonised implementation of such initiatives and programmes could lead to a faster pace of electrification in SSA and an overall cost reduction in the projected cost for climate change mitigation and universal electrification. However, there are knowledge gaps on what synergies can be created between various SDGs initiatives and programmes and energy access initiatives and programmes in-order to foster a faster pace towards universal electrification in SSA. In-order to address this knowledge gap, an exploratory study based on analyses of research articles, project reports and policy briefs on Power Africa, SE4All and climate finance was undertaken so as to determine the policies, strategies and innovations that could help expedite SSA's progress towards universal energy access before 2030. The study also included an assessment of the impacts of China's climate change commitments and renewable energy investments in SSA's energy sector. This follows the assertions that 30% of new capacity additions in SSA in 2010–15 were undertaken by Chinese companies operating as the main contractors; and Chinese contractors have built or are contracted to build 17 gigawatts (GW) of generation capacity in SSA from 2010 to 2020, equivalent to 10% of existing installed capacity in SSA [1].

The paper is arranged as follows. In the following section, the role of climate finance in enhancing climate change mitigation is highlighted. The section analyses how Intended Nationally Determined Contributions (INDCs) can enhance renewable energy deployment and create new job opportunities in SSA. Section 3 focuses on the impact of Chinese investments in SSA's energy sector. The section sheds more light on how the China South-South Climate Cooperation Fund for Climate Change can supplement conventional investments in the energy sector to improve climate change mitigation and access to renewable energy. Section 4 provides two case studies on global initiatives aiming to improve energy access in Africa. This section analyses the planning and implementation modalities of Power Africa and SE4All to determine the factors that are leading to their progress or regress. The discussion in Section 5 highlights how the presence of financial inflows from different renewable energy and climate change centred global initiatives can actually hamper economic growth in Africa by perpetuating a climate finance curse. Section 6 concludes with a narrative on the importance of promoting synergies between climate finance and energy access programmes since the SDGs do not have a “leave no one behind” energy framework to ensure that electrifying SSA's least electrified countries is prioritised.

2. Climate finance as a game changer for renewable energy investments and job creation SSA

In SSA, the average income per capita in real terms is currently lower than it was at the end of the 1960s, and life expectancy is lower now than 30 years ago as incomes, assets, and access to essential services are unequally distributed [23]. Consequently, there has been an increased impetus by African and global policy makers to improve energy access on the continent since reliable power can stimulate economic growth, industrialisation and productivity. However, energy related-activities account for approximately 68% of total anthropogenic greenhouse gas emissions [24]; and in a business as usual scenario, from now till 2030, energy-related carbon dioxide emissions are projected to increase by 55% due to a 53% increase in energy consumption [25]. Greenhouse gases are considered as principal contributors to climate change [26], hence such increases in energy use and anthropogenic greenhouse gas emissions can arguably exacerbate climate change globally and also increase climate change vulnerability in Africa. It has therefore been noted that, energy policies and strategies in both developed and developing countries are being guided by global ambitions to increase the diversification of energy sources, enhance the deployment of renewable energy and improve the implementation of the coordinated global efforts to address climate change [27]. Consequently, climate finance as provided through the global institutional frameworks and local mechanisms can now be considered as an integral factor that can influence the rates of renewable energy deployment nationally and globally, and more particularly in developing nations (Fig. 1).

An assessment of the global climate change ambitions as presented

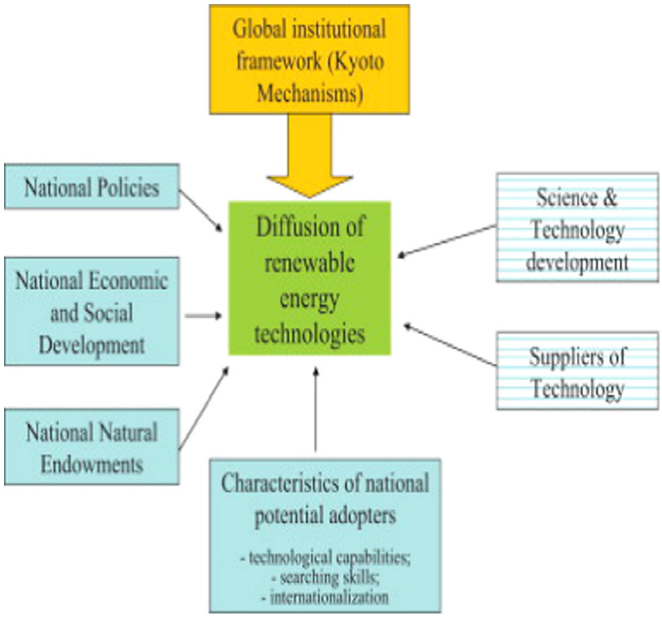

Fig. 1. The factors affecting the diffusion of renewable technologies.

in the 156 INDCs that were submitted to the UNFCCC by the adoption of the Paris Agreement in December 2015 show that the current ambition of INDCs falls far short of reaching any of the goals in the Paris Agreement and the global goal to limit temperature increase to 2 °C [28,29]. This scenario has two significant implications for Africa's renewable energy sector. Firstly, even though SSA's per capita carbon dioxide emissions at 0.87 metric tonnes of CO_2 per capita is lower than the global average of 4.68 metric tonnes of CO_2 per capita [30], it still means that African policy makers need to revise upwards on their climate change ambitions (mitigation pledges) and possibly revise their commitments to utilise more renewable energy sources in-order to maintain Africa's low emissions per capita economic profile even with the advent of population growth and increased energy demand. Secondly, the need to scale-up on mitigation commitments could mean that many countries globally might increase their climate change mitigation, adaptation and financing targets hence there is a probability that this may increase the rates of renewable energy deployment globally, consequently reducing the costs of renewable energy technologies and improving their affordability. For example, the doubling of the cumulative installed solar photovoltaic capacity leads to a 22% price reduction for photovoltaic modules [31]. As it stands, the average cost of solar photovoltaic modules fell by nearly 80% between 2009 and 2014, while wind turbine average costs declined by nearly 33% over the same period, and such cost reductions are amongst the factors that led to more than 60% of all new power generation capacity in 2015 to come from renewable energy [27]. Therefore, intensifying INDC commitments and ambitions has the potential to indirectly lead to significant decreases in the prices of many renewable energy technologies. For African countries to capitalise on this, they arguably need to anticipate these cost reductions and plan early on how various renewable energy technologies can be utilised for grid and off grid applications since technical issues such as grid stability and integration [32] have also been noted to affect the use and adoption of renewable energy in cases where renewable energy has been scaled-up successfully.

The global architecture for climate finance provides more financial and technical support to mitigation activities in comparison to adaptation activities hence climate finance can significantly support Africa's efforts to attain universal electrification. For example, climate finance flows in 2015 and 2016 were dominated by mitigation activities as they accounted for an average of 93% of the total climate finance flows; and 74% of climate change mitigation flows in 2015 and 2016 were for renewable energy generation [33]. Furthermore, an estimated 12% of total climate finance flows or US$48 billion/year flowed from Organisation for Economic Cooperation and Development (OECD) countries to non-OECD countries on average during 2015/2016; US$3 billion/year on average of climate finance flowed from non-OECD to OECD countries; and US$8 billion of climate finance flowed between different developing countries [33]. Since some of the factors that have contributed to the slow pace of electrification in SSA include the dependence on (inefficient) public utilities for expanding energy access [34–36] and a lack of appropriate financial mechanisms to incentivise the private sector to invest in the energy sector [3,37], it may now be argued that climate finance now represents itself as a new viable mechanism to address these two issues. Firstly, various climate finance mechanisms provide an array of innovative financing instruments such as grants, equity, concessional loans, and risk mitigation instruments to scale-up private and public finance for renewable energy deployment. Secondly, new climate finance modalities such as SSCF modalities are also emerging as viable channels for promoting growth in the developing world. SSCF is financing that is instituted by developing countries (the Global South) to promote and support low-carbon, resilient development within and between developing countries [38]. According to Ha et al. [38], SSCF takes four major forms: (i) developing countries' contributions to established multilateral funds; (ii) bilateral initiatives; (iii) new Southern-led international organisations like the BRICS Bank and the Asian Infrastructure Investment Bank; and (iv) private sector investments in climate change mitigation programmes. Therefore, with the advent of SSCF, the private sector in SSA, international investors and project developers wishing to invest in SSA have additional financial channels to access concessional finance for renewable energy development. More importantly, with such an array of new concessional financial products and the development of new renewable energy services provision models and innovations that were arguably unavailable or primitive 15 years ago such as Pay as You Go Solar Systems, Feed-in Tariffs, Public-Private Partnerships, decentralised minigrids, energy demand aggregation, etc. [39–42], it therefore means that climate finance modalities cannot only be utilised for enhancing climate change mitigation and reducing the energy access gap, but can potentially also be utilised for promoting entrepreneurship and reducing youth unemployment in SSA. For example, Africa is fraught with high rates of youth unemployment which perpetuates poverty and climate change vulnerability. However, as compared to fossil-fuel power plants, renewable energy generates more jobs per unit of installed capacity, per unit of power generated and per dollar invested [43,44], and by doubling the share of renewable energy in the global energy mix from the current 18% to a projected 36%, the sector would generate jobs for over 24 million people in the sector [45]. This therefore means that focusing on the deployment of renewable energy technologies can also reduce poverty and climate change vulnerability by creating new renewable energy sector based jobs and new channels for creating livelihoods. However, since climate change vulnerability and socio-economic endowments significantly vary between various rural communities and cities [46,47], in-order for SSCF to simultaneously improve access to capital, enhance renewable energy deployment, promote entrepreneurship and reduce youth unemployment, there will be a need for local government systems to develop local plans that can highlight these opportunities with specific reference to the particular geographic and social context in which they are located.

3. The Chinese dimension in Africa's renewable energy sector

China has risen in prominence as a major aid and investment partner for Africa. China is now Africa's largest trading partner as between 2003 and 2011, Foreign Direct Investment (FDI) from China to Africa increased thirty-fold, from US$491 million to US$14.7 billion [48], and as of end-2013, China had more Outward Direct Investment (ODI) in Africa (US$26 billion) than in the U.S. (US$22 billion) [49].

China has provided an estimated US$13 billion, or around one-fifth of all investments in the energy sector in SSA during the 2010–15 period; and renewable sources account for 56% of total capacity to be added by Chinese projects in the region between 2010 and 2020 [1]. Some notable renewable energy projects that have been promoted by Chinese investments include biomass projects in Ethiopia; the 400 megawatts (MW) Bui Dam in Ghana; and the 244 MW wind farm in South Africa (The De Aar phase 1 and 2 projects in the Northern Cape) [1]. The increased renewable energy investments through Chinese enterprises are therefore not only increasing energy access, but they are also demonstrating how various new renewable energy technologies can be utilised in different SSA socio-economic and resource contexts. These aspects are important as they are increasing the familiarity of various renewable energy technologies and reducing the risks for successive projects. This can particularly be important in the context of Africa as many renewable energy projects in Africa struggle to find financiers and fail or have problems being implemented due to the unfamiliarity of funders, financiers and investors to the use of a particular technology in a certain African context [50–52].

China is also stepping-up its efforts to become an instrumental environmental partner for African countries by providing climate change related financial and technical support to other developing countries. Historically, it has mostly been developed countries (Global North countries) that used to provide support to developing countries to help them with their climate change mitigation, adaptation, financing, research and development, and capacity building efforts [53]. However, other developing countries and emerging countries of the Global South such as China, India and Brazil are now providing climate change support to other developing countries and emerging countries through various SSCF modalities and South-South Climate Cooperation [21]. China's INDC incorporates a pledge to provide US$3.1 billion (CNY20 billion) to establish the China South-South Climate Cooperation Fund for Climate Change, which is in addition to more than US$2 billion that was already pledged for South-South Cooperation and climate-related activities before 2015 [54,55]. To put things in perspective, prior to 2015, China's annual budget for climate change South-South Cooperation amounted to approximately US$40–50 million (CNY254–318 million). With the recent pledges it therefore means that if spent over a five-year period, it would amount to an annual spending of US$620 million (CNY3.94 billion) or about twenty-one times the annual spending from 2005 to 2010 (US$30 million = CNY 191 million) and about nine times the annual spending (US$72 million = CNY458 million) for the 2011–2015 period announced in 2012. Moreover, even if the pledge were only spent over a period of ten or fifteen years, it would represent a significant increase, with respectively approximately four or three times the annual spending of the current period (Fig. 2) [46,54].

In addition to improving energy access, China's climate change South-South Cooperation pledges may also help with the achievement of SDG 10 which calls for reducing inequalities within and among countries [14]. Firstly, Chinese aid, investments and bilateral partnership agreements are underpinned by the Chinese principles of non-interference in the internal affairs of other countries and providing unconditional aid and support (even though this policy is sometimes considered as tantamount to China tolerating human rights abuses and allowing other international crimes to continue) [56]. Arguably, in contrast, many Global North countries are likely to provide aid and facilitate investments only to countries that respect individual human rights. In this case, it is plausible that the countries that were considered to be violating human rights and condoning international crimes to have been side-lined from some climate finance modalities and investments as provided by the Global North. However, with the financial and technical support that will be initiated through the China South-South Climate Cooperation Fund for Climate Change, any country in Africa may have access to the Fund and this may enable all countries regardless of their domestic policies to be in a better position to use climate finance modalities for renewable energy deployment and economic support thereby ultimately reducing the rates of poverty and inequality in the region. Secondly, even though not all the resources provided through South-South Climate Cooperation modalities are intended for climate change mitigation and renewable energy deployment, where the resources are utilised for climate change education, disaster risk management, weather forecasting, climate change adaptation through infrastructure development, etc., poverty traps and climate change vulnerability will be reduced thereby improving the prospects of some African countries to eradicate poverty and reduce inequality. However, unlike in the previous cases where access to some climate finance mechanisms for some African countries (especially the ones with poor human rights records) was at the benevolence or conditions of the Global North, currently, with the initiation of the China South-South Climate Cooperation Fund for Climate Change the onus for planning and implementing effective climate change projects and renewable energy projects will now be on the individual African countries and how they engage both local and Chinese stakeholders to access and utilise the various financial, technical and technological resources that are available through the Fund.

4. Global energy access initiatives

4.1. Power Africa

Power Africa is a U.S. Government-led initiative, coordinated by the U.S. Agency for International Development (USAID), that comprises of 12 U.S. Government agencies, and a diverse coalition of more than 130 public and private sector partners, including bilateral and multilateral partners (e.g. African Development Bank (AfDB), The Development Bank of Southern Africa (DBSA), etc.), as well as international organisations, civil society organisations, and private sector companies [57]. The current goal of Power Africa is to double access to power across SSA by adding 60 million new electricity connections, as well as increasing installed generation capacity by 30,000 MW by 2030 [58]. Power Africa was initiated in 2013 but may be considered to have been enshrined as a long-term foreign policy priority of the U.S. in February 2016 when President Obama signed the Electrify Africa Act of 2015 (S.2152) into law, institutionalising the work of Power Africa through legislation [57].

Power Africa interventions include on the ground support (in-country advisors that identify the technical, financial, and political solutions needed to facilitate faster access to power for local communities, major cities, and regional power pools); bridging financing gaps (de-risk investments to encourage international public and private investments in SSA's power sectors); promoting African-led reforms (facilitating energy sector policy reforms and governance); and supporting off-grid solutions [58]. Within three years, Power Africa can be credited for having mobilised 130 private and public sector partners who have committed more than US$52 billion, including more than US$40 billion in commitments from private sector partners alone [57]. This is in addition to helping facilitate the financial close of private sector power transactions that are expected to generate over 4,600 MW, and to be tracking approximately 60,000 MW of generation projects across the continent, of which an expected 18,000–21,000 MW of the 60,000 MW is projected to reach financial close and to be online by 2030 [49]. Power Africa supports both renewable energy projects and conventional energy projects. Some of the renewable energy projects and operations that have been facilitated with the support of Power Africa include: the 8.5 MW Rwamagana solar plant in Rwanda at a cost of US $23.7 million; technical support to 14 Independent Power Producers in Nigeria which will lead to the development of 1,125 MW of new solar power generation capacity in 9 Nigerian states and an investment of US $1.5 billion of combined domestic and foreign direct investment; and support to the grid extension into rural areas of Ghana under the Government of Ghana's Self-Help Electrification Programme (SHEP) (adding 2,000 rural villages and connecting more than 128,000 new

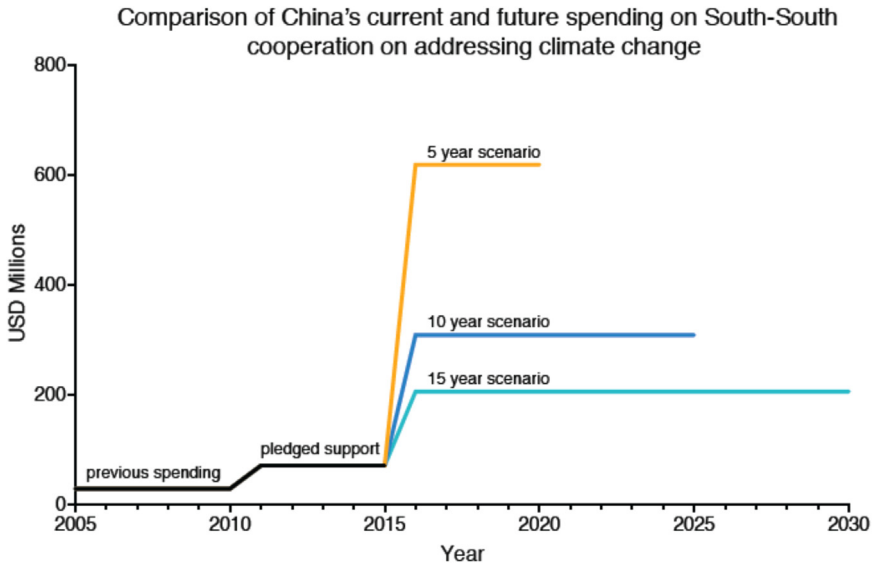

Fig. 2. China's past and current spending on South-South cooperation.

households and businesses to the power grid) [57,58]. The main actors for the Rwamagana solar plant included GigaWatt Global and the U.S. Overseas Private Investment Corporation; and Export-Import Bank (EXIM) and Weldy Lamont Associates for the SHEP project [57].

The implementation of Power Africa has also faced a few challenges. The original plan for Power Africa was to add 10,000 MW of power and supply electricity to 20 million new households in SSA within five years (2013–2018). However, by September 2016 (before changing to the current goal), the project had yielded less than 400 MW of new power translating into producing less than 5% of the new power generation envisaged [59]. Some of the factors that contributed to these challenges included changes in political leadership in host countries and global economic shocks which reduced the longer-term perceptions of the growth outcomes of African economies and energy sectors (i.e. these issues led to unpredictable and depreciated currencies, new currency control measures and credit agency downgrades for investment in certain countries thereby stalling the interest of investors to start new projects) [57,59]. Arguably, such an array of issues that have constrained the impact of Power Africa have highlighted that the energy sector in SSA is very sensitive to external (global) economic trends such as slowdowns in economic growth in China, the European Union and Brazil as this has led to some African governments to experience growing fiscal deficits and revise government spending plans on infrastructure development downwards due to falling revenues from the export of raw materials and falling commodity prices [30,57,60]. These issues have therefore resulted in fluctuating exchange rates and problems in energy pricing thereby constraining the rate of implementation of the Initiative's projects [57]. Arguably, these challenges and implementation bottlenecks augment the assertions that the presence of energy laws and policies, renewable energy sources and suitable renewable energy technologies are not sufficient to promote the deployment of renewable energy technologies if underlying economic forces in the country or community prevent the technologies from being adopted [61].

A possible remedy to get Power Africa back on track to reach its ambitious goal might entail urging African policymakers to continue strengthening regulatory frameworks and prioritising the development of human capital to enable African countries to weather external shocks and build more sustainable energy sectors over the long-term [57]. However, a more holistic and long-term solution could be to emphasise on closely linking Power Africa projects to rural development, agriculture and irrigation policies and strategies. Even with increased generation capacity, electrification in Africa is noted to be biased towards promoting urban electrification and facilitating household energy access and consumption, consequently the urban-rural divide in access to electricity in Africa is as high as 450% (69% urban compared to 15% rural access) [62]. For example, between 2010 and 2012 the electricity access in SSA rose from 32% to 35%, however the increases were concentrated in urban areas where energy access growth exceeded population increase by 25 million, while in rural areas it fell short by 23 million [15]. Consequently, the potential to which renewable energy electrification could have on food security, rural development and industrialisation is not fully realised. To illustrate this point, it is estimated that only 4% of the cropland in SSA is irrigated, and approximately 40 million hm^2 of its land are suitable for irrigation, but only 7.3 million hm^2 are actually irrigated [63,64]. The low utilisation of irrigation technologies leads to food insecurity and increased climate change vulnerability since the majority of the farm production depends on rain-fed agriculture which is now more erratic due to climate change. Additionally, reducing agricultural risks and enhancing agricultural productivity through irrigation can potentially stimulate job creation, reduce youth unemployment and reduce poverty since in Africa a 10% increase in crop yields translates to approximately a 7% reduction in poverty and Gross Domestic Product (GDP) growth generated by agriculture has been shown to be eleven times more effective in reducing poverty than GDP growth in other sectors [63,65]. More importantly, an agro-rural production centred approach to development can enable many African countries to diversify their economies hence minimise the impacts of commodity price crashes on their economies and national budgets. Reference can be made to the electrification programme in Viet Nam which improved rural electricity access rates whilst also facilitating the country's transition to a major global rice exporter.

Viet Nam had a low electrification rate of no more than 2.5% in 1975 but in 2009 the country's electrification rate was as high as 96% [66]. Key to achieving this was an energy access programme that provided the establishment of irrigation systems first priority, small rural industries, second, so that electricity was not only flowing to major cities, but countrywide, and in support of rice production and economic development at the local level (i.e. the prioritisation of electrification for rural income-generating sectors created the stable base of taxation that gave Viet Nam the resources for nationwide development) [66]. Similarly, African energy planners can also ensure that their energy access programmes and policies are more closely aligned to potential agricultural economic hubs so that agricultural productivity and rural development can be enhanced to successfully

diversify economies and reduce a dependence on a few commodities.

4.2. Sustainable Energy for All (SE4All)

The SE4All initiative is a multi-stakeholder partnership between governments, the private sector, and civil society. Launched by the United Nations Secretary-General in 2011 and anticipated to conclude in 2030, the SE4All has three energy related ambitions namely: (i) ensuring universal access to modern energy services, (ii) doubling the share of renewable energy in the global energy mix and (iii) doubling the global rate of improvement in energy efficiency [67]. The SE4All initiative is based on the principle of voluntary actions and national commitments hence its activities are undertaken through various co-ordination structures at the national, regional and global level. 44 African countries joined the SE4All initiative hence are eligible to receive support in diverse areas such as technical assistance, advisory services, policy dialogue and advocacy [68]. The SE4All envisages that its success can enable African countries to be able to reduce energy demand; reduce greenhouse gas emissions and local pollution; insulate countries from fuel price volatility; improve those countries' balance of payments; and reduce deaths associated with inhaling toxic smoke from wood, coal and charcoal [67,68].

The SE4All planning, implementation and evaluation framework is principally composed of a country firstly undertaking a Rapid Assessment and Gap Analysis (RAGA), followed by producing an Action Agenda and lastly producing an Investment Prospectus. RAGAs are assessments of the energy sector in a particular country that identify barriers to achieve the 2030 objectives. Action Agendas define the national SE4All objectives and determines how the three goals of SE4All can be achieved in a particular country. The Investment Prospectuses provide a set of implementable programmes and projects, including their investment requirements, which can be presented to potential private and public investors. Approximately 25 SSA countries have completed their Action Agendas and only 4 countries have completed their Investment Prospectuses (i.e. The Gambia, Kenya, Tanzania and Angola) [15,68]. Arguably, the inter-country discrepancies in the stages of accomplishment and the varying pace to which different countries have completed their Investment Prospectuses and Action Agendas arguably does not only signify the problems that some countries could be having to push the SE4All agenda forward in their respective countries but may also be an indicator that at project implementation some countries will have more problems than others in attracting investments and engaging various local and international stakeholders to accomplish their SE4All objectives.

Power Africa and SE4All may be considered to be complementary as they are both working towards addressing similar renewable energy challenges but using different planning and implementation modalities. Both initiatives are trying to significantly improve access to energy in Africa by improving energy sector policy, regulation and financing. Both initiatives are therefore trying to create an environment that is conducive to private sector investment and participation so that public institutions should not be over-burdened with implementing energy projects. The main difference between the two initiatives is that the SE4All initiative has a detailed planning process and rigid implementation criteria whereby all countries that are part of the initiative start by undertaking the initiative's specific assessments in-order to identify the specific barriers to achieving the initiatives objectives. All SE4All partner countries in Africa are anticipated to firstly undertake a RAGA in-order to highlight the status quo of the energy sector in their national development context, providing the political, economic, social and environmental background for the subsequent drafting of plans and Investment Prospectuses to promote SE4All in a particular country [15]. The SE4All initiative can therefore be seen to be operating in a compartmented framework since it will only be projects prescribed in the Investment Prospectuses that will be implemented under the auspices of SE4All partners and stakeholders. On the other hand, Power Africa is more focused on facilitating the identification and completion of viable energy sector projects and investments across Africa and strengthening of legal and regulatory environments and mechanisms to increase long-term confidence in the energy sectors, hence does not have restrictions such as working with pre-selected projects. Power Africa's private sector partners therefore have the liberty to develop their own projects and then engage U.S. government agencies and development partners to support them with leveraging financing, insurance, technical assistance and grant tools. Interestingly, Power Africa is amongst the partners for SE4All so Power Africa resources may also be utilised by various stakeholders to facilitate the success of SE4All.

5. Discussion

The increased investments in renewable energy and the enhanced deployment of renewable energy technologies has meant that globally solar photovoltaic module prices have fallen more than 75% since 2009, and residential solar photovoltaic systems in 2016 were 65% cheaper than in 2008 [45]. Additionally, with the incorporation of energy access in the SDGs, the presence of numerous energy access programmes, and the initiation of many climate change mitigation programmes, there are now more possibilities that Africa will manage to increase its energy sector investments from the current US$8 billion per annum to somewhere closer to the targeted US$55 billion per annum to ensure that universal access can be attained [16,17]. What is already encouraging is that there are notable technological transitions in the energy sector as the world now adds more renewable power capacity annually than it adds (net) capacity from all fossil fuels combined [2,69]. Whilst this might seem as encouraging news, caution has to be taken as in the case of Africa – a region characterised by poor institutional quality [70,71]– there is a likelihood, or threat that increasing energy access financial flows to Africa can potentially generate negative outcomes since aid (or other concessional development assistance) is considered to be effective or more likely to generate a positive outcome when provided in the correct ‘dosage’ but is ineffective if the level is too high or too low [72]. Arguably, with various private and public sector actors now involved in Africa's energy sector, there are arguably now more funds or pledges geared towards providing more financial and technical support, and aid towards improving energy access in SSA. Moreover, with China pledging to provide an additional aid commitment of an estimated US$3.1 billion (CNY20 billion) to Africa through the South-South Cooperation Climate Fund, it might be anticipated that this gesture will increase aid and other financial flows to SSA to support and incentivise various stakeholders in accelerating the development of many renewable energy projects for climate change mitigation. However, since the new pledges are coming after initiatives such as the SE4All and Power Africa have already progressed and will be implemented independent of many existing energy access programmes, caution needs to be undertaken so that the South-South Cooperation Climate Fund should not saturate the aid domain, or worse still perpetuate a ‘climate finance curse’. According to Jakob et al. [73] climate finance could result in sizable financial inflows to developing countries which could subsequently lead to adverse impacts on the receiving countries’ development prospects by exposing the economy to aid volatility, inciting Dutch disease, and promoting rent-seeking and corruption, hence the term ‘climate finance curse’. This issue is a particularly significant consideration as many African countries are noted to have a low absorptive capacity to effectively deploy climate funds [5] and are yet to develop good policies, adequate institutional framework and regulations when strategising for development and engaging with China [48]. Averting the climate finance curse and improving the effectiveness of aid will call for designing appropriate policies and strengthening domestic political institutions to improve aid management as caused by an influx of climate finance and other financial flows [72,73]. This could therefore entail that Africa needs to develop a

comprehensive continental plan or integrated regional plans with specific details of what sort of projects (e.g. renewable energy, climate change monitoring, etc.) and where such projects should be implemented using South-South Cooperation Climate Funds. A failure to do this might lead the new climate finance monetary flows to actually hamper economic development by engendering the possibilities of volatility of financial flows, rent-seeking activities, corruption, dependency on aid, donor volatility; and for projects to be poorly connected to the recipient countries' national programmes thereby having slim chances of scaling-up nationally or regionally [21,72,74]. Additionally, having such detailed plans or provisions will also make it easy for South-South Cooperation Climate Fund resources to easily be channelled towards developing renewable energy projects in countries and areas that could be underserved and underinvested by Global North climate finance modalities, SE4All, Power Africa and other energy related international initiatives.

An area for further research could be investigations focusing on how SSA can create specialised renewable energy focused development banks and financing mechanisms to facilitate the financing of small-scale renewable energy projects directly. As it stands, bottlenecks in the global financial system are noted to cause many climate finance modalities and other funding architectures to struggle to reach the local level. Consequently, global funds for climate change and investment strategies of many funds prioritise large-scale projects with large results thereby de-prioritising services to the local level; and traditional financing intermediaries, such as the Multilateral Development Banks, are less able to finance small-scale projects directly, given the higher transaction costs [62,75,76]. It has therefore been suggested that if financiers and the global financial system gave greater weight to the potential numbers of people different renewable energy technologies would provide rather than ease of disbursing funds and the value of private co-finance that a project can mobilise, decentralised energy programmes could gain greater investment and provide poor communities with access to energy faster [62,75,76]. It is with these considerations in mind that some commentators consider that creating new financial vehicles, such as developing specialised national development banks, could be more effective at enhancing renewable energy access and promoting sustainable development than the provision of international climate aid [77]. This therefore means that Africa still requires more energy access financing and service delivery strategies.

6. Conclusion

SSA has very low rates of access to energy hence for the region to stand a good chance of achieving the SDGs, the continent has to reach universal energy access ideally before 2030. Improved electrification rates can stimulate economic growth, reduce food insecurity, reduce youth unemployment, reduce inequality and alleviate poverty thereby catalysing SDGs related activities in other sectors like health, gender equality, food security and education. However, for SSA to be able to significantly improve its energy access rates, significant financial resources have to be deployed. Some estimates point out that Africa requires between US$510 billion and US$675 billion to pursue a low-carbon development trajectory [5] and US$41 billion to US$55 billion annually until 2030 to ensure that universal access can be attained [16,17]. Arguably, with such significant amounts of investments and resources required, African policy makers need to develop effective policies that can ensure that domestic resources can easily be leveraged with other funds and resources from the international community and also policies that can optimise funds sourced from different sources in-order to facilitate a swift progress towards universal energy access and low-carbon development.

Power Africa, SE4All and climate change mitigation focused financing modalities have objectives related to increasing SSA's electrification rates and improving the deployment of renewable energy technologies in SSA. One possible way to which such initiatives can increase their developmental impact in SSA through synergies could be for these initiatives to have special consideration for enhancing rural electrification rather than a focus on merely increasing generation capacity. This follows that, Africa arguably needs more projects that can improve rural electrification and link energy access to agriculture development, but in the status quo most projects just focus on increasing generation capacity and national electrification rates, thereby inadvertently leading to higher electrification rates in urban areas and higher levels of vulnerability in rural areas. Additionally, even though Paragraph 4 of the SDGs requires policymakers to prioritise reaching the furthest behind first/addressing the needs of the most vulnerable societies first [14], there is no “leave no one behind” energy framework to ensure that policymakers and project developers in the energy sector can prioritise electrifying the most challenging regions or countries first. As it stands, there is already a large disparity in electricity access rates between various SSA countries where at the lower end countries such as South Sudan and Liberia have electricity access rates of 1% and 2% respectively, and at the higher end countries such as Ghana and Seychelles have electricity access rates of 72% and 97% respectively [4]. Therefore, with countries such as South Sudan and Liberia not having any special dispensations or additional support mechanisms under the SE4All and Power Africa programmes to fast-track projects, it means that such countries might still lag behind in attracting private investors in their energy sectors and fall further behind in trying to achieve universal energy access. A possible way to overcome this might be to urge policy makers in the global south to make provisions for climate change mitigation focused programmes to have special consideration to divert more resources to the least electrified and least attractive energy sector investment countries. Arguably, by creating this synergy or harmonisation between climate finance and energy access programmes, there will be a greater possibility of closing the electrification gaps even amongst SSA countries.

On the other hand, the proliferation of various energy access initiatives and climate change mitigation focused financing modalities, and the increased financial flows to SSA that these initiatives could bring can potentially constrain development in SSA rather that have synergistic positive impacts on development. To avert this, policy makers in SSA may consider establishing an institution or mechanism that can successfully monitor how effectively climate funds are being utilised in the energy sector simultaneously with how various energy access programmes are being developed and funded regionally and locally. A failure to put in place such an institution or mechanism will open up new possibilities for climate finance and energy access projects to be new avenues for perpetuating rent-seeking behaviour and corruption in SSA hence undermine the ideals of sustainable development.

Noting that there are numerous international programmes and initiatives aimed at increasing energy access and climate change mitigation through the deployment of renewable energy technologies in SSA, it can be argued that SSA now has various new avenues of additional financial and technical support to enable project developers and policymakers to improve the management and operations of utilities and provide capital for new renewable energy projects. Consequently, this paper attempted to determine the synergies that may be created in-order for these programmes and initiatives to operate in a complimentary and harmonised manner even though they are created and managed by different local and international stakeholders. Similar to the findings of Clark et al. [22] who concluded that Africa requires fiscal and policy reforms in-order for low carbon sustainable development to be permissible, this paper also acknowledges that SSA requires energy policy formulation and implementation reforms, and institutional reforms so that the region can have a regional institution or mechanism to monitor and harmonise the implementation of international renewable energy access and climate change mitigation projects. Additionally, the paper's findings are also similar to those of Bazilian et al. [78] who considered that universal energy access was not constrained by technical obstacles but rather the lack of effective

institutions, good business models, and appropriate legal and regulatory frameworks. This follows that this investigation discovered that some other countries are more favourable for implementing Power Africa and SE4All projects, whilst other countries still have challenges in attracting private investments through such initiatives because the characteristics of these countries do not conform to the business models and electrification strategies that presently exist through Power Africa and SE4All. Arguably, this demonstrates the need for more business models and strategies to incentivise project developers to these slow performing countries. So, whilst SSA may not yet be on a trajectory that can lead to the region attaining universal energy access before 2030, what might be encouraging is that by harmonising the implementation of energy access programmes with climate change programmes, SSA's trajectory to transition towards more use of renewable energy technologies, especially in rural areas, might be improved.

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