Delivering Clean and Affordable Energy for All

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Abstract

Energy is considered to be an important component of social and economic needs of any society. Indeed, the integral role of energy is recognised under Sustainable Development Goal 7 of the United Nations 2030 Agenda for Sustainable Development Goals which seeks to 'ensure access to affordable, reliable, sustainable and modern energy for all'. The United Nations has observed that while 'energy is central to social and economic well-being, 1.1 billion people have no access to electricity, while 2.9 billion have to cook with polluting, inefficient fuels such as firewood'. This is despite the fact that Affordable and Clean Energy is seen as an important means towards achieving many of the SDGs – from poverty eradication via advancements in health, education, water supply, and industrialization to mitigating climate change'. Most of the people without access to affordable and clean energy are within the African continent. These people still rely on non-renewable sources of energy which are not only inefficient but also a danger to their health. This paper explores the ways through which the Government of Kenya can work with other stakeholders to ensure that there is a transition to cleaner and affordable energy sources for all its population, as a step towards achieving sustainable development agenda.

1. Introduction

It has been observed that energy and more precisely, inequitable access to energy—represents one of Africa's greatest obstacles to social and economic development.[2] Notably, the Continent is largely divided into three regions

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namely: North Africa, which is heavily dependent on oil and gas, South Africa, which depends on coal and the rest of Sub-Saharan Africa, which is largely reliant on biomass.[3] Kenya falls within the Sub-Saharan Africa which also means that most of its citizens especially within the rural regions rely mainly on biomass, (unprocessed wood, charcoal, agricultural residues and animal waste), with adverse effects on their health.[4] Thus, while the UN Secretary-General Ban Ki-Moon launched the Sustainable Energy for All Initiative (SE4All) in 2011 where he also declared 2012 the year for sustainable energy for all[5], this has largely remained a mirage especially for the African region.

The *Kenya Sustainable Energy for All (SE4All) Action Plan*, was launched by the Ministry of Energy and Petroleum as an Action Agenda (AA) with an energy sector-wide long-term vision spanning the period 2015 to 2030, which outlines how Kenya will achieve her SE4All goals of 100% universal access to modern energy services, increase the rate of energy efficiency and increase to 80% the share of renewable energy in her energy mix, by 2030.[6] In addition, the updated *Least cost power development plan 2017-2037* developed by the Ministry of Energy and Petroleum, which is an update of the 2015-2035 electricity Sector Master plan estimated peak demand for the period 2017-2037 ranges from 1,754MW to 6,638MW in the reference case scenario, 1,754MW to 9,790MW in the high case and between 1754MW in 2017 to 4,763MW in 2037 in the low case scenario.[7] The energy sources

[2] Hafner M, Tagliapietra S and de Strasser L, 'The Challenge of Energy Access in Africa' in Manfred Hafner, Simone Tagliapietra and Lucia de Strasser (eds), *Energy in Africa: Challenges and Opportunities* (Springer International Publishing 2018) <https://doi.org/10.1007/978-3-319-92219-5_1> accessed 19 April 2021.

[3] Karekezi, S., Kithyoma, W., & Energy Initiative, "Renewable energy development." In *workshop on African Energy Experts on Operationalizing the NEPAD Energy Initiative, June*, pp. 2-4. 2003, 2.

[4] See Christine W Njiru and Sammy C Letema, 'Energy Poverty and Its Implication on Standard of Living in Kirinyaga, Kenya' (2018) 2018 Journal of Energy.

[5] Republic of Kenya, *Kenya Sustainable Energy for All (SE4All) Action Plan*, January 2016 <https://www.seforall.org/sites/default/files/Kenya_AA_EN_Released.pdf> accessed 18 April 2021.

[6] Ibid.

[7] Republic of Kenya, *Least cost power development plan 2017-2037*, p. xv < http://gak.co.ke/wp-content/uploads/2019/02/Updated-Least-Cost-Power-Development-Plan-2017-2022-min.pdf> accessed 18 April 2021.

considered in the system expansion plan for the different cases in the report included: Geothermal, nuclear, Wind, Solar, Import, Petrol-thermal plants, Hydropower, Coal and Natural gas.[8] However, while Kenya has made significant steps towards increasing the power production, sustainability of some of these sources as well as affordability remains a challenge.[9] The challenges facing Kenya's energy sector have been summarized as including: low electrification rate, reliance on imported fossil fuels, transmission inefficiencies, frequent power outages, high cost of rural electrification, demand for electricity outstripping generation capacity, and inability of the power utility agency to connect all customers who apply for connection to the national grid.[10] It has been noted that the energy use of human societies has historically been marked by four broad trends: Rising consumption as societies industrialize, gain wealth and shift from traditional sources of energy (mostly biomass-based fuels such as wood, dung and charcoal) to commercial forms of energy (primarily fossil fuels); steady increases in both the power and efficiency of energy-producing and energy-using technologies; de-carbonization and diversification of fuels, especially for the production of electricity, throughout most of the 20th century; and a reduction in the quantities of conventional pollutants associated with energy use.[11] Arguably, Kenya's energy sector is still struggling with problems that hinder the smooth transition through the stated trends, thus exposing its people to poverty and the potential adverse health effects.

This paper explores how Kenya can fast-track its efforts towards ensuring that it achieves sustainable and affordable energy for all its people in line with the United Nations 2030 Agenda for Sustainable Development Goals (SDGs)[12] Goal 7 which is based on this. The paper thus mainly focuses on addressing these challenges and offer solutions to promote the uptake, access

[8] Ibid.
[9] See Samoita D and others, 'Barriers and Solutions for Increasing the Integration of Solar Photovoltaic in Kenya's Electricity Mix' (2020) 13 Energies 5502.
[10] Christine W Njiru and Sammy C Letema, 'Energy Poverty and Its Implication on Standard of Living in Kirinyaga, Kenya' (2018) 2018 Journal of Energy, 2.
[11] Dilip Ahuja and Marika Tatsutani, 'Sustainable energy for developing countries' [2009] S.A.P.I.EN.S. Surveys and Perspectives Integrating Environment and Society <http://journals.openedition.org/sapiens/823> accessed 24 April 2021.
[12] UN General Assembly, *Transforming our world: the 2030 Agenda for Sustainable Development*, 21 October 2015, A/RES/70/1.

and use of sustainable and affordable renewable energy for the Kenyan people in line with SDG Goal 7.

2. Place of Clean and Affordable Energy in Sustainable Development Agenda

Right to energy is so important that some authors have argued that 'food and energy are the two essential resources to support the modern and civilized society of the mankind'.[13]

The United Nations 2030 Agenda for Sustainable Development Goals (SDGs) Goal 7 seeks to 'ensure access to affordable, reliable, sustainable and modern energy for all'. The associated targets that are meant to create action to ensure universal access to sustainable energy include: By 2030, ensure universal access to affordable, reliable and modern energy services; by 2030, increase substantially the share of renewable energy in the global energy mix; by 2030, double the global rate of improvement in energy efficiency; By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology; and by 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support.[14] This goal was informed by the fact that 'the world has experienced a rapid demand of energy sources, both fossil fuels and renewables'.[15] In addition, 'as the population continues to grow, so will the demand for cheap energy, and an economy reliant on fossil fuels is creating drastic changes to

[13] Tomabechi K, 'Energy Resources in the Future' *Energies* 2010, 3, 686-695, 686.
[14] 'Goal 7: Affordable and Clean Energy' (*The Global Goals*) <https://www.globalgoals.org/7-affordable-and-clean-energy> accessed 18 April 2021.
[15] Franco IB, Power C and Whereat J, 'SDG 7 Affordable and Clean Energy: EWisely: Exceptional Women in Sustainability Have Energy to Boost–Contribution of the Energy Sector to the Achievement of the SDGs'.

our climate'.[16] Urbanization and ambitions of economic development will also demand more energy.[17]

The United Nations rightly points out that while 'energy is central to social and economic well-being, 1.1 billion people have no access to electricity, while 2.9 billion have to cook with polluting, inefficient fuels such as firewood'.[18] Some commentators have observed that 'SDG 7 Affordable and Clean Energy ensures access to affordable, reliable, and sustainable energy and is crucial in achieving many of the SDGs – from poverty eradication via advancements in health, education, water supply, and industrialization to mitigating climate change'.[19]

Access to cleaner and affordable energy sources is thus an important part of the journey towards achieving the sustainable development goals.

3. Accessing Clean and Affordable Energy Needs for All: The Kenyan Experience

Most developing countries are struggling with growing population and it is expected that today's world population will increase 1.26 times to reach 9.7 billion in 2050 with most of the world's population which include 90% of the population growth belonging to the developing countries.[20]

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[16] 'Goal 7: Affordable and Clean Energy' (*UNDP*) <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-7-affordable-and-clean-energy.html> accessed 18 April 2021.

[17] Hafner M, Tagliapietra S and de Strasser L, 'The Challenge of Energy Access in Africa' in Manfred Hafner, Simone Tagliapietra and Lucia de Strasser (eds), *Energy in Africa: Challenges and Opportunities* (Springer International Publishing 2018) <https://doi.org/10.1007/978-3-319-92219-5_1> accessed 19 April 2021

[18] Valencia M, 'Sustainable Energy for All Shifts Gear to Speed Delivery of Affordable, Clean Energy' (*United Nations Sustainable Development*) <https://www.un.org/sustainabledevelopment/blog/2016/06/sustainable-energy-for-all-shifts-gear-to-speed-delivery-of-affordable-clean-energy/> accessed 18 April 2021.

[19] Franco IB, Power C and Whereat J, 'SDG 7 Affordable and Clean Energy: EWisely: Exceptional Women in Sustainability Have Energy to Boost–Contribution of the Energy Sector to the Achievement of the SDGs', 106.

[20] Salvarli MS and Salvarli H, *For Sustainable Development: Future Trends in Renewable Energy and Enabling Technologies* (IntechOpen 2020) <https://www.intechopen.com/books/renewable-energy-resources-challenges-and-applications/for-sustainable-development-future-trends-in-renewable-energy-and-enabling-technologies> accessed 19 April 2021.

Kenya, just like many other developing countries in Africa, is dealing with the burden of a growing population, environmental pollution, poverty, corruption and legal and policy framework inadequacies, among others, which all affect the achievement of clean and sustainable energy for all.[21] In addition, cultural perceptions (including myths about the flavour of food cooked on traditional stoves and the relative safety and cost of clean alternatives) have also been identified as a significant barrier to wider uptake of clean cooking fuels.[22]

These challenges informed the drafting of the sustainable development goals and the related targets. As a result, the environment which is being increasingly polluted because of rapid industrialization and human work is critical in the sustainable development agenda where sustainable development mainly covers the use of renewable energy, energy security, energy pricing, energy policy, renewable energy applications and smart grid technologies.[23] The World Health Organization in a 2018 Household Energy Assessment Rapid Tool (HEART) developed in Kenya highlights human health issues from non-renewable energy sources where it points out that 'household air pollution (HAP) from inefficient fuel combustion is one of the most important global environmental health risks today' especially in low- and middle income countries such as Kenya, where majority of the population still rely on solid fuels (wood, animal dung, charcoal, crop wastes and coal) burnt in inefficient, highly polluting stoves for cooking and heating.[24] Indeed, this trend is expected to go on for longer if the latest

[21] Painuly JP, 'Barriers to Renewable Energy Penetration; a Framework for Analysis' (2001) 24 Renewable energy 73.

[22] Ngeno G and others, 'Opportunities for Transition to Clean Household Energy in Kenya: Application of the Household Energy Assessment Rapid Tool (HEART)', *Opportunities for transition to clean household energy in Kenya: application of the household energy assessment rapid tool (HEART)* (2018), 1.

[23] Salvarli MS and Salvarli H, *For Sustainable Development: Future Trends in Renewable Energy and Enabling Technologies* (IntechOpen 2020) <https://www.intechopen.com/books/renewable-energy-resources-challenges-and-applications/for-sustainable-development-future-trends-in-renewable-energy-and-enabling-technologies> accessed 19 April 2021.

[24] Ngeno G and others, 'Opportunities for Transition to Clean Household Energy in Kenya: Application of the Household Energy Assessment Rapid Tool (HEART)', *Opportunities for transition to clean household energy in Kenya: application of the household energy assessment rapid tool (HEART)* (2018), vi.

reports are anything to go by. It is reported that Kenyans are expected to pay higher for liquefied petroleum gas from 1st July 2021 following the reinstatement of value-added tax (VAT) on liquefied petroleum gas (LPG) through the Finance Act 2020, but the implementation of the charges was deferred to the second half of 2021 due to the Covid-19 crisis.[25] This is a retrogressive move by the Government from the earlier development where 'Kenyan households had since June 2016 been enjoying low cooking gas prices after the Treasury scrapped the tax on LPG to cut costs and boost uptake among the poor who rely on dirty kerosene and charcoal for cooking', a move that was in line with the country's commitment to achievement of SDG Goal 7.[26] With affordability being a key access barrier to clean cooking fuels, such as liquefied petroleum gas (LPG), this move is likely to erode the gains made in transitioning the country to cleaner technologies.[27]

It has been suggested that while many developing countries have been apparently trying to restructure their energy sectors it is difficult to realize innovations in the energy sector as they struggle with cost, market share and policy as the main barriers for the development of renewable energy.[28] This is especially important since the reserves of fossil fuels are naturally expected to come to an end.[29]

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[25] April 23 2021 F, 'Cooking Gas Prices to Rise Sh350 on New Tax' (*Business Daily*) <https://www.businessdailyafrica.com/bd/economy/cooking-gas-prices-rise-sh350-on-new-tax-3373296> accessed 23 April 2021; Kerubo MJ and B, 'Higher Gas Costs: What You'll Pay to Refill Your Cylinders Beginning July' (*The Standard*) <https://www.standardmedia.co.ke/nairobi/article/2001410538/kenyans-to-pay-more-for-cooking-gas-beginning-july> accessed 23 April 2021.

[26] June 11 2020 T, 'Kenyans to Pay Sh300 More for Cooking Gas' (*Business Daily*) <https://www.businessdailyafrica.com/bd/economy/kenyans-to-pay-sh300-more-for-cooking-gas-2292630> accessed 23 April 2021.

[27] Shupler M and others, 'Pay-as-You-Go Liquefied Petroleum Gas Supports Sustainable Clean Cooking in Kenyan Informal Urban Settlement during COVID-19 Lockdown' [2021] Applied Energy 116769.

[28] Salvarli MS and Salvarli H, *For Sustainable Development: Future Trends in Renewable Energy and Enabling Technologies* (IntechOpen 2020) <https://www.intechopen.com/books/renewable-energy-resources-challenges-and-applications/for-sustainable-development-future-trends-in-renewable-energy-and-enabling-technologies> accessed 19 April 2021.

[29] Ibid.

Kenya's major sources of energy for the main economic production are oil, geothermal and hydro resources for electricity production where oil-based electricity generation is environmentally harmful, expensive and a burden to the national trade balance; the rivers for hydropower and their tributaries are found in arid and semi-arid areas with erratic rainfall leading to problems of supply security, and geothermal exploitation has cost and risk issues, amongst others.[30] The cost of electricity generation and supply is also affected by the overdependence on Hydroelectric Power (HEP) as the main source of renewable energy, which is weather dependent and the unpredictable weather, due to climate change has made power rationing a common phenomenon in a number of Sub-Saharan Africa countries during the dry seasons.[31] It has been observed that while 'Renewable Energy Technologies (RETs) provide attractive environmentally sound technology options for Africa's electricity industry, the success of RETs in the region has been limited by a combination of factors which include: poor institutional framework and infrastructure; inadequate RET planning policies; lack of co-ordination and linkage in the RET programme; pricing distortions which have placed renewable energy at a disadvantage; high initial capital costs; weak dissemination strategies; lack of skilled manpower; poor baseline information; and, weak maintenance service and infrastructure'.[32]

The challenges of energy cost and reliability in Kenya are made worse by the energy transmission and distribution virtual monopoly currently existing in Kenya.[33] Kenya Electricity Generating Company (KenGen), generates about 70% of Kenya's electricity.[34] On the same breadth, Kenya Power owns

[30] Samoita D and others, 'Barriers and Solutions for Increasing the Integration of Solar Photovoltaic in Kenya's Electricity Mix' (2020) 13 Energies 5502, 1.

[31] ISSAfrica.org, 'Monopoly on Electricity Supply Contributes to Deforestation' (*ISS Africa*, 9 March 2010) <https://issafrica.org/amp/iss-today/monopoly-on-electricity-supply-contributes-to-deforestation> accessed 22 April 2021.

[32] Karekezi, S., Kithyoma, W., & Energy Initiative, "Renewable energy development." In *workshop on African Energy Experts on Operationalizing the NEPAD Energy Initiative, June*, pp. 2-4. 2003, 1.

[33] Owiro, D., Poquillon, G., Njonjo, K. S., & Oduor, C., 'Situational Analysis of Energy Industry, Policy and Strategy for Kenya' [2015] Institute of Economic Affairs.

[34] 'Who We Are' <https://www.kengen.co.ke/index.php/our-company/who-we-are.html> accessed 22 April 2021.

and operates most of the electricity transmission and distribution system in the country and sells electricity to over 8 million as at end of June 2020.[35] The Government of Kenya has a controlling stake at 50.1% of shareholding with private investors at 49.9%.[36] Lack of competition in the electricity generation and supply sector has been blamed for inefficiency and high costs of energy.[37]

The *Energy Act, 2019*[38] was enacted to consolidate the laws relating to energy, to provide for National and County Government functions in relation to energy, to provide for the establishment, powers and functions of the energy sector entities; promotion of renewable energy; exploration, recovery and commercial utilization of geothermal energy; regulation of midstream and downstream petroleum and coal activities; regulation, production, supply and use of electricity and other energy forms; and for connected purposes.[39] While the citizenry was hoping that the enactment of this law would liberalize the energy market in Kenya and eliminate Kenya Power's monopoly in transmission and distribution of electricity in the country through licensing of other companies, the Government seemed to only affirm the same.[40]

KenGen is among the companies that have been seeking to enter the retail market and sell electricity directly to consumers.[41] However, to the

[35] 'Who We Are | Kplc.Co.Ke' <https://www.kplc.co.ke/content/item/14/about-kenya-power> accessed 22 April 2021.
[36] Ibid.
[37] ISSAfrica.org, 'Monopoly on Electricity Supply Contributes to Deforestation' (*ISS Africa*, 9 March 2010) <https://issafrica.org/amp/iss-today/monopoly-on-electricity-supply-contributes-to-deforestation> accessed 22 April 2021.
[38] Energy Act, No. 1 of 2019, Laws of Kenya.
[39] Ibid, Preamble.
[40] 'Now Government Reaffirms Kenya Power's Monopoly' (*The East African*) <https://www.theeastafrican.co.ke/tea/business/now-government-reaffirms-kenya-power-s-monopoly-1408382> accessed 22 April 2021.
[41] 'KenGen Moves to End Kenya Power's Monopoly by Selling Electricity Directly to Consumers' (*Sun-Connect East Africa News*, 26 November 2020) <https://sun-connect-ea.org/kengen-moves-to-end-kenya-powers-monopoly-by-selling-electricity-directly-to-consumers/> accessed 22 April 2021; Siele M, 'Kengen to Begin Direct Power Sales Ending KPLC Monopoly - Business Today Kenya' <https://businesstoday.co.ke/kengen-to-begin-direct-power-sales-ending-kplc-monopoly/> accessed 22 April 2021;

disappointment of many Kenyans, the Government declined to license other companies, as yet.[42]

In summary, therefore, Kenya's energy sector still suffers from consistent power outages especially during dry seasons, high electricity tariffs specially exacerbated by high poverty and employment rates, energy retail sector monopoly, and cultural issues and biases that affect uptake of cleaner energy technologies, among others.[43] Notably, as far as the use of clean energy is concerned, it is estimated that two-thirds of Kenya's energy currently comes from bioenergy.[44] In addition, as Kenya seeks to move from non-renewable energy sources to renewable energy sources as envisaged under the United Nations 2030 Agenda for Sustainable Development Goals, moving an economy which relies heavily on wood fuel and biomass as its largest energy source, to achieve sustainable energy use through the gradual increase in the use of renewable energy sources that are often expensive due to the technology deployed, in the face of oil and coal discoveries that could be more readily accessible in spite of its known effects on the environment is a great challenge.[45] This is mainly due to higher poverty levels in many households in developing countries, such as Kenya thus making it nearly impossible to afford the renewable and cleaner energy sources.[46] This is what is also mainly referred to as energy poverty, which the World Economic Forum in 2010 defined as 'the lack of access to sustainable modern energy services and products'.[47] Related to this definition is the observation that 'it

[42] 'Now Government Reaffirms Kenya Power's Monopoly' (*The East African*) <https://www.theeastafrican.co.ke/tea/business/now-government-reaffirms-kenya-power-s-monopoly-1408382> accessed 22 April 2021.

[43] Avila, N., Carvallo, J. P., Shaw, B., & Kammen, D. M., "The energy challenge in sub-Saharan Africa: A guide for advocates and policy makers." *Generating Energy for Sustainable and Equitable Development, Part* 1 (2017): 1-79.

[44] 'Kenya Energy Outlook – Analysis' (*IEA*) <https://www.iea.org/articles/kenya-energy-outlook> accessed 21 September 2020.

[45] Owiro, D., G. Poquillon, K. S. Njonjo, and C. Oduor. "Situational analysis of energy industry, policy and strategy for Kenya." *Institute of Economic Affairs* (2015), p. 7.

[46] Karekezi, S., Kithyoma, W., & Energy Initiative, "Renewable energy development." In *workshop on African Energy Experts on Operationalizing the NEPAD Energy Initiative, June*, pp. 2-4. 2003; Christine W Njiru and Sammy C Letema, 'Energy Poverty and Its Implication on Standard of Living in Kirinyaga, Kenya' (2018) 2018 Journal of Energy.

[47] 'Energy Poverty' (*Habitat For Humanity*)

is not only a matter of sustainability: energy poverty can be found in all conditions where there is a lack of adequate, *affordable*, reliable, quality, safe and environmentally sound energy services to support development.(emphasis added).[48] The connection between energy poverty and socio-economic development is that 'insufficient energy usually translates into the impossibility to develop agriculture and manufacturing, thus keeping the poorest countries trapped in a vicious circle: they cannot afford the energy that can drive them out of poverty'.[49]

It is, therefore, possible to conclude that as the situation currently stands, majority of Kenyan population are suffering from energy poverty that needs to be addressed.

4. Delivering Clean and Affordable Energy for All: The Global Trends and the Lessons

While it has been argued that there is no "one size fits all" approach to successful clean household energy initiatives, some commentators have observed that a suite of options targeted to different sociocultural environments is likely to have wider acceptance.[50]

4.1. Transition to Cleaner Energy Models

It has been observed that 'one of the biggest limitations to achieving the SDGs is linked to the geography: the population in need is mostly located in rural areas, where there is no grid-electricity, and its expansion is often financially and logistically infeasible'.[51] In light of this, it has been suggested that 'off-grid power has been instrumental in addressing this problem, notably stand-alone solutions, such as solar panels, hydro mini-grids, biogas mini-grids, among others, all of which comes from renewable sources, and

<https://www.habitat.org/emea/about/what-we-do/residential-energy-efficiency-households/energy-poverty> accessed 23 April 2021.

[48] Ibid.

[49] Ibid.

[50] Ngeno G and others, 'Opportunities for Transition to Clean Household Energy in Kenya: Application of the Household Energy Assessment Rapid Tool (HEART)', *Opportunities for transition to clean household energy in Kenya: application of the household energy assessment rapid tool (HEART)* (2018), 1.

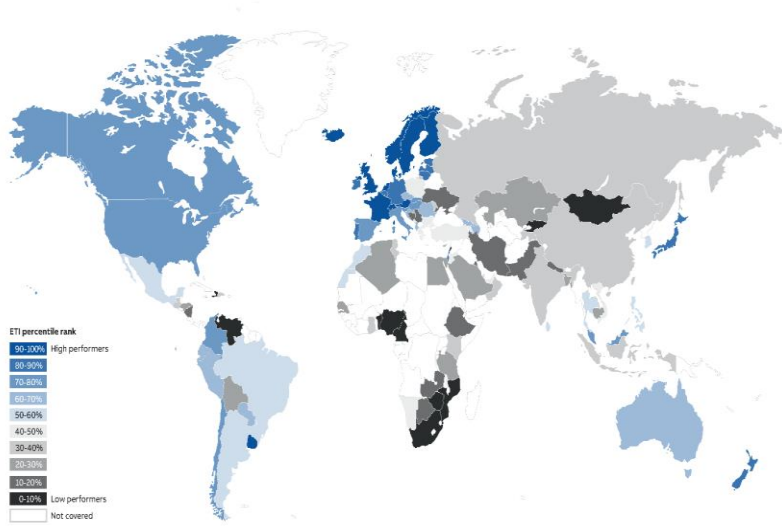
[51] 'Energy Poverty' (*Habitat For Humanity*) <https://www.habitat.org/emea/about/what-we-do/residential-energy-efficiency-households/energy-poverty> accessed 23 April 2021.

which makes it the perfect alternative to obtain a reliable and sustainable energy service, at a considerably low price'.[52] As such, 'off-grid renewables give developing countries the opportunity to erase the electricity gap without passing through a phase of fossil fuels that would be hard to sustain in terms of cost, natural resources, and global environment'.[53]

There has been calls for 'pro-poor access to electricity measures that will ensure that there is access that provides poor people with energy services enabling poverty reduction, which services include, for example: light, information and communications technologies, mechanical power for productive uses, and refrigeration or water pumping, as their poverty impacts may consist of income generation, female empowerment, or better education and health'.[54] This can be achieved in what is referred to as 'energy transition', defined as the global energy sector's shift from fossil-based systems of energy production and consumption — including oil, natural gas and coal — to renewable energy sources like wind and solar, as well as lithium-ion batteries.[55]

Notably, Sweden was listed in 2020 Energy Translation Index (ETI) ranking for the third consecutive year as the country most ready to transition to clean energy, followed by Switzerland and Finland.[56] The ETI analyzes each country's readiness to adopt clean energy using three criteria: energy access and security; environmental sustainability; and economic development and growth.[57] Conspicuously, the top ten countries in the ranking were from the developed world, showing their readiness to transition.[58] Most African countries were ranked lowly or not considered at all, as demonstrated in the map below.

[52] Ibid.
[53] Ibid.
[54] Pueyo, A., *Pro-poor access to green electricity in Kenya*. No. IDS Evidence Report; 135. IDS, 2015, 3.
[55] 'Global Energy Transition Index, 2020 and Its Highlights – Civilsdaily' <https://www.civilsdaily.com/news/global-energy-transition-index-2020-and-its-highlights/> accessed 19 April 2021.
[56] 'These Countries Are Leading the Transition to Sustainable Energy' (*EcoWatch*, 14 May 2020) <https://www.ecowatch.com/sustainable-energy-countries-2645997492.html> accessed 19 April 2021.
[57] Ibid.
[58] Ibid.



Source: World Economic Forum, Fostering Effective Energy Transition 2020[59]

Currently, Sweden boasts of about 54% energy that comes from renewable energy sources, with the country having attained the government's 2020 target of 50 per cent in 2012, while the power sector targeting to get to 100 per cent renewable electricity production by 2040.[60] Notably, Sweden's high share of renewable energy is attributed to hydropower (water) and bioenergy which are the top renewable sources in Sweden – hydropower mostly for electricity production and bioenergy for heating.[61] Sweden's success has been attributed to, inter alia, its market-based approach to energy policy, which is focused on creating well-functioning and competitive energy markets.[62] The Swedish energy policy agreement of 10 June 2016 set the

[59] 'Energy Transition Index 2020' <https://new.abb.com/news/detail/67960/energy-transition-index-2020> accessed 19 April 2021.
[60] 'Energy Use in Sweden' (*sweden.se*, 23 December 2015) <https://sweden.se/nature/energy-use-in-sweden/> accessed 19 April 2021.
[61] Ibid.
[62] International Energy Agency, *Energy Policies of IEA Countries: Sweden 2019 Review*<https://www.connaissancedesenergies.org/sites/default/files/pdf-actualites/Energy_Policies_of_IEA_Countries_Sweden_2019_Review.pdf> accessed 19 April 2021.

path for the current success, based on reconciling: ecological sustainability; competitiveness; and security of supply.[63] In addition, the Policy was meant to create a basis for ensuring that 'Sweden achieves a robust electricity system with high reliability, low environmental impact and with access to electricity at competitive prices and also create long-term perspectives and clarity for market participants and bring new jobs and investments to Sweden.[64]

Kenya can learn a lot from the Swedish experience and it is high time that the stakeholders embark on the necessary steps to move the country towards consistent transition towards cleaner renewable energy sources for all.

4.2. Investing in Science, Technology and Innovation for Provision of Sustainable Energy for All

It has been agreed by many commentators that in order to meet the ever escalating energy needs of the growing population, energy solutions should be supported by utilizing renewable energy sources even though currently, the contribution of renewable energy to the world primary energy is not high to meet the primary energy and electricity supplies.[65] It has been observed that 'energy markets across the world are in the middle of a revolution, triggered by the pursuit of decarbonization and fueled by innovation'.[66]

Some commentators have pointed out that 'new enabling technologies related to renewable energies will help to reduce environmental costs, and

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[63] Swedish Nuclear Society and Analysgruppen, *The Swedish energy policy agreement of 10June 2016 – unofficial English translation*< *https://balticbrilliantproject.eu/onewebmedia/Swedish_political_energy_agreement_2016.pdf*> accessed 19 April 2021.

[64] Ibid.

[65] Salvarli MS and Salvarli H, *For Sustainable Development: Future Trends in Renewable Energy and Enabling Technologies* (IntechOpen 2020) <https://www.intechopen.com/books/renewable-energy-resources-challenges-and-applications/for-sustainable-development-future-trends-in-renewable-energy-and-enabling-technologies> accessed 19 April 2021.

[66] Woodhouse S and Bradbury S, 'Chapter 2 - Innovation, Disruption, and the Survival of the Fittest' in Fereidoon P Sioshansi (ed), *Innovation and Disruption at the Grid's Edge* (Academic Press 2017) <https://www.sciencedirect.com/science/article/pii/B9780128117583000024> accessed 22 April 2021.

thus the energy systems will be operated as both securely and economically without environmental problems, making new renewable energy markets a necessity in both the wholesale and retail markets.[67]

Kenya has been making some commendable steps towards its transition to cleaner energy technologies since June 2016 when the Ministry of Finance zero-rated LPG gas to boost uptake by the poorer households. Notably, this has also seen the introduction of Pay-As-You-Go (PAYG) LPG smart meter technology in Kenya, enabling more Kenyans to embrace and enjoy the use of LPG for cooking and lighting as a cleaner and cheaper energy option.[68] Notably, across the world digitisation has driven and enabled the transformation of energy systems with many new companies entering the market with innovative products based on digital solutions, and companies from the information and communication sector and other companies from outside the industry increasingly driving the change.[69]

There is also a need for continued investment in fuel efficient cook stoves improvements in developing countries as part of efforts to reduce indoor pollution and improve cooking efficiency.[70] This calls for a greater role of the Government and private sector to encourage use of energy efficient stoves and other related innovations.[71]

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[67] Salvarli MS and Salvarli H, *For Sustainable Development: Future Trends in Renewable Energy and Enabling Technologies* (IntechOpen 2020) <https://www.intechopen.com/books/renewable-energy-resources-challenges-and-applications/for-sustainable-development-future-trends-in-renewable-energy-and-enabling-technologies> accessed 19 April 2021.

[68] Shupler M and others, 'Pay-as-You-Go Liquefied Petroleum Gas Supports Sustainable Clean Cooking in Kenyan Informal Urban Settlement during COVID-19 Lockdown' [2021] Applied Energy 116769.

[69] Johannes Giehl and others, 'Survey and Classification of Business Models for the Energy Transformation' (2020) 13 Energies 2981, 12.

[70] Manibog, Fernando R. "Improved cooking stoves in developing countries: problems and opportunities." *Annual Review of Energy* 9, no. 1 (1984): 199-227.

[71] 'The Livelihoods Carbon Fund Doubles Its Investment in an Energy Efficiency Project to Reach 600,000 People in Kenya – Livelihoods Funds' <https://livelihoods.eu/the-livelihoods-carbon-fund-doubles-its-investment-in-an-energy-efficiency-project-to-reach-600000-people-in-kenya/> accessed 24 April 2021; Lucy Stevens and others, 'Market Mapping for Improved Cookstoves: Barriers and Opportunities in East Africa' (2020) 30 Development in Practice 37; 'Improved Cookstoves, Kenya | Natural Capital Partners'

Decarbonisation, decentralisation and digitalisation have been flaunted as part of the future of the global energy sector.[72] Decarbonisation is defined as the reduction of carbon dioxide emissions through the use of low carbon power sources, achieving a lower output of greenhouse gasses into the atmosphere.[73] Notably, decarbonisation involves increasing the prominence of low-carbon power generation, and a corresponding reduction in the use of fossil fuels which means increased use of renewable energy sources like wind power, solar power, and biomass.[74] Decarbonising the power sector is used to mean reducing its carbon intensity: that is, reducing the emissions per unit of electricity generated (often given in grams of carbon dioxide per kilowatt-hour).[75]

It is important to point out that the Paris Agreement was created to hold nations accountable in their efforts to decrease carbon emissions, with the central goal of ensuring that temperatures do not rise 2 degrees Celsius above pre-industrial level.[76] It has been observed that the growth of renewable sources of power, such as wind turbines, solar panels and coal-to-biomass upgrades as well as other innovations, such as using batteries and allowing homes to generate and share their own power, can also lead to higher rates of decarbonisation.[77]

<https://www.naturalcapitalpartners.com/projects/project/kenya-improved-cookstoves> accessed 24 April 2021.

[72] 'Decarbonisation, Decentralisation and Digitalisation: The Big Drivers at PowerGen 2017' <https://www.power-technology.com/features/featuredecarbonisation-decentralisation-and-digitalisation-the-big-drivers-at-powergen-2017-5856615/> accessed 23 April 2021.

[73] 'What Is Decarbonisation?' <https://www.twi-global.com/technical-knowledge/faqs/what-is-decarbonisation.aspx> accessed 24 April 2021.

[74] Ibid.

[75] 'What Is "Decarbonisation" of the Power Sector? Why Do We Need to Decarbonise the Power Sector in the UK?' (*Grantham Research Institute on climate change and the environment*) <https://www.lse.ac.uk/granthaminstitute/explainers/what-is-decarbonisation-of-the-power-sector-why-do-we-need-to-decarbonise-the-power-sector-in-the-uk/> accessed 24 April 2021.

[76] 'What Is Decarbonisation?' (*Drax*, 21 August 2020) <https://www.drax.com/sustainability/what-is-decarbonisation/> accessed 24 April 2021.

[77] Ibid.

Arguably, new digital tools can promote sustainability, including satellites to verify greenhouse gas emissions and technologies to track air pollution at the neighbourhood level.[78] The digitalization of the power sector is associated with greater transparency into operations, which greatly increases efficiency and reliability while decreasing costs and consequently; consumers will not only see the benefits of digitalization through lower monthly utility bills but also reduced outages and faster response times.[79]

It has been observed that 'the digitalisation of the power sector has already begun, with block chain and smart meters becoming commonplace as well as there being a possibility of virtual power plants replacing traditional ones, interlinking small scale solar and wind with base load to create a reliable power system.[80]

The International Energy Agency recommends some policy actions that governments can take to prepare for digitalisation which include: Build digital expertise within their staff; ensure appropriate access to timely, robust, and verifiable data; build flexibility into policies to accommodate new technologies and developments; experiment, including through 'learning by doing' pilot projects; participate in broader inter-agency discussions on digitalisation; focus on the broader, overall system benefits; monitor the energy impacts of digitalisation on overall energy demand; incorporate digital resilience by design into research, development and product manufacturing; provide a level playing field to allow a variety of

[78] ESI Africa, 'How Digitalisation Is Reshaping the Energy Sector' (*ESI-Africa.com*, 30 July 2020) <https://www.esi-africa.com/smart-grids/how-digitalisation-is-reshaping-the-energy-sector/> accessed 23 April 2021.

[79] 'What Could Digitalization Achieve in the Power Sector?]' (*Alliance to Save Energy*, 10 December 2020) <https://www.ase.org/blog/what-could-digitalization-achieve-power-sector> accessed 23 April 2021.

[80] 'Decarbonisation, Decentralisation and Digitalisation: The Big Drivers at PowerGen 2017' <https://www.power-technology.com/features/featuredecarbonisation-decentralisation-and-digitalisation-the-big-drivers-at-powergen-2017-5856615/> accessed 23 April 2021.

companies to compete and serve consumers better; and learn from others, including both positive case studies along with more cautionary tales.[81]

4.3. Newer Business Models in Energy Sector: Opening Up the Energy Sector

It has been argued that 'the ongoing energy system transformation across the world, and especially in developed world, and the growth of renewable energies are changing the structure and value creation of the energy industry with adopted business model classes showing that traditional business models are affected by the decarbonisation, decentralisation and digitisation of the energy system in all segments and economic sectors.[82]

There is a need for the stakeholders in the energy sector to adopt business models that ensure that consumers get value, one that encourages consumers to pay for value, and one that converts those payments to profits.[83] Liberalization and energy system transformation can arguably significantly increase the pace of change and have impact on the business model landscape substantially.[84]

In many countries around the world, especially in the developed world, there has been a trend of liberalization, unbundling and deregulation of the energy sector in order to improve access to energy.[85] The liberalization of the energy market is defined to mean the opening of the electricity and gas market to free competition where existing monopolies are broken and the market is opened to more participants.[86]

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[81] ESI Africa, 'How Digitalisation Is Reshaping the Energy Sector' (*ESI-Africa.com*, 30 July 2020) <https://www.esi-africa.com/smart-grids/how-digitalisation-is-reshaping-the-energy-sector/> accessed 23 April 2021.
[82] Johannes Giehl and others, 'Survey and Classification of Business Models for the Energy Transformation' (2020) 13 Energies 2981, 12.
[83] Fuentes-Bracamontes R, 'Is Unbundling Electricity Services the Way Forward for the Power Sector?' (2016) 9 The Electricity Journal 16.
[84] Giehl J and others, 'Survey and Classification of Business Models for the Energy Transformation' (2020) 13 Energies 2981.
[85] Fuentes-Bracamontes R, 'Is Unbundling Electricity Services the Way Forward for the Power Sector?' (2016) 29 The Electricity Journal 16.
[86] 'Liberalization & Unbundling of Energy Markets | Definition' (25 March 2020) <https://www.next-kraftwerke.com/knowledge/liberalization-energy-markets> accessed 22 April 2021.

Liberalization in regard to the energy markets and specifically electricity and gas mainly refers to "the opening up of an industry to more competition, often involving the relaxing of government restrictions to break up existing monopolies and open the market to more participants."[87] Liberalization has been characterized as involving the introduction of competition (via structural changes such as the removal of subsidies, vertical unbundling of integrated utilities to facilitate non-discriminatory access to monopoly networks and horizontal unbundling of incumbents to create viable competitors) and the establishment of independent energy sector regulators. [88] Expressed differently, in electricity and downstream gas supply, liberalization has often involved privatization (and/or the introduction of new private entrants) and structural reform of national industries to create competitive wholesale and retail markets with regulated non-discriminatory third party access to monopoly transmission and distribution networks.[89]

Where liberalization has been achieved such as the European Union energy markets, it was done to benefit consumers through; raising employment levels, increasing business efficiency and increasing a country's potential economic development and GDP growth.[90] Thus, "opening up these markets to competition allows consumers to benefit from lower prices and new services...more efficient and consumer-friendly than before" and consumers benefit because a breaking up of a monopoly and introducing competition will help give consumers savings in price but also choice of what service they demand.[91] It has also been argued that 'potential economic development and GDP growth is likely to occur as shown by the benefits to consumers, employment and efficiency because of increased employment which will cause more people to spend disposable income; an increase in companies

[87] 'GRIN - Liberalisation of Energy Markets. Effects on Gas and Electricity Generation, Distribution and Supply' <https://www.grin.com/document/323337> accessed 23 April 2021.
[88] Michael G Pollitt, 'The Role of Policy in Energy Transitions: Lessons from the Energy Liberalisation Era' (2012) 50 Energy policy 128.
[89] Michael G Pollitt, 'The Role of Policy in Energy Transitions: Lessons from the Energy Liberalisation Era' (2012) 50 Energy policy 128, 3.
[90] 'GRIN - Liberalisation of Energy Markets. Effects on Gas and Electricity Generation, Distribution and Supply' <https://www.grin.com/document/323337> accessed 23 April 2021.
[91] Ibid.

also increases employment but also the reduction in market prices will result in consumers having more disposable income to be spent on other goods and services, and this will lead to economic development in other industries and businesses and is likely to increase GDP.[92] It has also been observed that 'the introduction of competition in downstream energy sectors, such as electricity and gas supply, facilitates competition in upstream gas and coal production sectors; while the general increase in energy trading facilitates the introduction of emissions markets'.[93]

Notably, while Kenya may have attained some milestone as far as unbundling (encouraging private generators of power, and separating generation from distribution) is concerned, the same cannot be said about liberalization (which is visibly missing from the Vision 2030). Notably, the electricity sector is unbundled and generation by independent power producers is permitted by law and is regulated, where as at 2018, it was estimated that the private sector produces 28% of Kenya's centralised electricity supply. [94] This was enabled through Feed-in tariffs (FITs) Regulations which were introduced in 2008 and revised in 2010 and 2012 to enable independent power producers to sell electricity to KPLC at a fixed price for a fixed term of 20 years.[95] Despite the commendable considerable success of this development, there has been challenges in uptake of this generated power. For instance, it is estimated that Kenya's Lake Turkana wind farm and its 365 turbines make for a generating capacity of more than 300MW, creating one of the most productive projects anywhere in the world.[96] Wind power has become a key contributor to the national grid to the extent that where there is interruption in its production, consumers have

[92] Ibid.
[93] Michael G Pollitt, 'The Role of Policy in Energy Transitions: Lessons from the Energy Liberalisation Era' (2012) 50 Energy policy 128, pp. 2-3.
[94] Kees Mokveld & Steven von Eije, *Final Energy report Kenya*, Commissioned by the Netherlands Enterprise Agency 2018, 13 <https://www.rvo.nl/sites/default/files/2019/01/Final-Energy-report-Kenya.pdf> accessed 19 April 2021.
[95] Ibid, 13.
[96] 'What's Driving Wind Power in Kenya and What Challenges Lie in Wait?' <https://www.nsenergybusiness.com/features/wind-power-kenya-challenges/> accessed 24 September 2020.

ended paying more for electricity in the country.[97] Notably, the Lake Turkana Wind Power (LTWP) has been allocated a maximum production quota of 210MW, against an installed capacity of 310MW.[98] While independent power producers have made considerable efforts to produce enough power to run the country, there have been problems with uptake of the same by the Kenya Power and Lighting Company Plc (KPLC). For instance, in the recent times and partly due to the Corona Virus (Covid-19) pandemic, there have been reports that measures to contain the pandemic have led to reduced demand for power especially among the commercial consumers who account for over 65% of the power use in the country.[99] Reports also indicate that KPLC has prioritized the uptake of geothermal at 39.5 per cent, hydro at 33.9 per cent, wind at 14 per cent, diesel at 9.7 per cent with other sources like solar, imports from Uganda and co-generation accounting for about three per cent.[100] This has thus left some of the producers with excess power.[101] This shows that Kenya's main consumers of electricity are commercial businesses and when these run into difficulties, the independent power producers are left stranded.[102] This happens while there are still reports that there are homes in Kenya still not connected to the grid despite the Government's best efforts to do so.[103] Thus, even as the

[97] 'Consumers Pay the Price as Covid Electricity Cuts Hit Turkana Project - The East African' <https://www.theeastafrican.co.ke/tea/business/consumers-pay-the-price-as-covid-electricity-cuts-hit-turkana-project-1939124> accessed 19 April 2021.

[98] 'Consumers Pay the Price as Covid Electricity Cuts Hit Turkana Project - The East African' <https://www.theeastafrican.co.ke/tea/business/consumers-pay-the-price-as-covid-electricity-cuts-hit-turkana-project-1939124> accessed 1 October 2020.

[99] 'Consumers Pay the Price as Covid Electricity Cuts Hit Turkana Project - The East African' Monday September 14 2020 <https://www.theeastafrican.co.ke/tea/business/consumers-pay-the-price-as-covid-electricity-cuts-hit-turkana-project-1939124> accessed 1 October 2020.

[100] 'Consumers Pay the Price as Covid Electricity Cuts Hit Turkana Project - The East African' Monday September 14 2020 <https://www.theeastafrican.co.ke/tea/business/consumers-pay-the-price-as-covid-electricity-cuts-hit-turkana-project-1939124> accessed 1 October 2020.

[101] Ibid.

[102] "The Seven Major Threats to Kenya's Power Sector." *Energy For Growth*, https://www.energyforgrowth.org/memo/the-seven-major-threats-to-kenyas-power-sector/. Accessed 24 Apr. 2021; Avila, Nkiruka, Juan Pablo Carvallo, Brittany Shaw, and Daniel M. Kammen. "The energy challenge in sub-Saharan Africa: A guide for advocates and policy makers." *Generating Energy for Sustainable and Equitable Development, Part* 1 (2017): 1-79.

[103] *Kenya Energy Situation - Energypedia.Info*.

Government looks for ways to produce cleaner power, there is also a need to address the disconnect between production and distribution of the power possibly through liberalization of the energy sector.[104]

While this has been attributed to the Covid-19 pandemic that afflicted almost the whole world in 2020, it raises a concern as to whether the power producers' major customers are only the commercial users.[105] This is because, it has already been pointed out that there are households in Kenya that still mainly rely on kerosene and biomass (firewood and charcoal) as their main source of energy for their inability to afford electricity.[106] Thus, even as we vouch for increased transition to renewable energy by way of increased production, this scenario points out the fact that there is more than availability of the renewable energy: the same must not only be made available but must also be made affordable to the local 'mwananchi' (citizen).Affordability of energy is key.

While the Energy Ministry had expressed optimism of introducing net metering for customer-sites generation (dependent on the enactment of the energy bill), establish regulations for mini-grids, and had started exploring the idea of local-currency-denominated tariffs in a bid to encourage local commercial banks to participate in energy projects,[107] this was however not achieved after the enactment of the Energy Act, 2019[108]. Liberalization of the sector would make all of these easier to actualize, for the benefit of consumers.

Arguably, the current unbundling structure has not achieved a lot for the Kenyan people as the high cost and unreliability of electricity supply in the country are still major issues, as these are greatly affected by state monopoly

https://energypedia.info/wiki/Kenya_Energy_Situation. Accessed 24 Apr. 2021.

[104] 'Liberalization & Unbundling of Energy Markets | Definition' (25 March 2020) <https://www.next-kraftwerke.com/knowledge/liberalization-energy-markets> accessed 22 April 2021.

[105] The Seven Major Threats to Kenya's Power Sector." *Energy For Growth*, https://www.energyforgrowth.org/memo/the-seven-major-threats-to-kenyas-power-sector/. Accessed 24 Apr. 2021.

[106] *Kenya Energy Situation - Energypedia.Info*. https://energypedia.info/wiki/Kenya_Energy_Situation. Accessed 24 Apr. 2021.

[107] Kees Mokveld & Steven von Eije, *Final Energy report Kenya*, Commissioned by the Netherlands Enterprise Agency 2018, 13.

[108] Act No. 1 of 2019, Laws of Kenya.

mainly through Kenya Power, a vertically integrated company.[109] Liberalization would ensure that for all forms of energy - gas, electricity, coal and oil - industrial and domestic consumers would be free to choose their supplier.[110] Kenya needs to borrow a leaf from some of the most successful countries in this sector such as Sweden and Singapore, among others.

In order to improve energy security and affordability, Singapore began to deregulate its electricity market since 2003, with the creation of the National Electricity Market of Singapore (NEMS) allowing for bid-ask offers to be made for the dispatch of electricity supply on the wholesale side and subsequently, the retail market liberalized in tranches, with 80% of electricity consumers currently already given an option to select their electricity retailers since late 2014.[111] As result, as at 2018, it was reported that 'supply competition and the retail liberalization efforts had possibly led to a combinatorial decrease in wholesale electricity prices by up to 9.11%, accounting for the influence of oil prices and volatility components'.[112] The country has also attracted investors in the sector making it more competitive for the retail consumer as far as choice of energy supplier is concerned.[113] Notably, 14 electricity providers participated in the pilot phase, including units of infrastructure companies.[114]

Kenya should follow in the footsteps of Singapore and other countries that have liberalized their energy markets in order to address the gap between

[109] Tarver, Evan. "Horizontal vs. Vertical Integration: What's the Difference?" *Investopedia*, https://www.investopedia.com/ask/answers/051315/what-difference-between-horizontal-integration-and-vertical-integration.asp. Accessed 24 Apr. 2021.

[110] World Trade Organization, "The Social Effects of Energy Liberalisation: The UK Experience," *Launching a Common European Energy Market*, Lisbon 5/6 June 2000, 2 < https://www.wto.org/english/tratop_e/serv_e/symp_mar02_uk_social_effects_energy_lib_e.pdf> accessed 19 April 2021.

[111] Loi TSA and Jindal G, 'Electricity Market Deregulation in Singapore – Initial Assessment of Wholesale Prices' (2019) 127 Energy Policy 1.

[112] Ibid.

[113] 'Singapore Electricity Market Deregulation Attracts DBS, StarHub' (*Nikkei Asia*)<https://asia.nikkei.com/Business/Markets/Nikkei-Markets/Singapore-electricity-market-deregulation-attracts-DBS-StarHub> accessed 19 April 2021.

[114] Ibid.

generation, transmission and distribution of energy and particularly electricity and consequently ensure that all people in the country have access to cleaner, affordable energy.

4.4. Enhancing the Role of Private Sector in Renewable Energy Sector

Notably, *Energy Act, 2019* provides for the establishment of the Rural Electrification and Renewable Energy Corporation which is charged with, *inter alia,* harnessing opportunities offered under clean development mechanism and other mechanisms including, but not limited to, carbon credit trading to promote the development and exploitation of renewable energy sources.[115] The Nuclear Power and Energy Agency is also mandated to, *inter alia,* put in place mechanisms to attract private sector funding in research and human resource development for matters relating to energy.[116]

With introduction of market liberalization in Kenya's energy sector, a robust carbon credit trading system in Kenya could achieve the twin goals of raising funds and climate change mitigation in the energy sector.[117] According to the International Finance Corporation (IFC), the estimated total investment potential for the climate-smart needs of Côte d'Ivoire, Kenya, Nigeria, and South Africa is $783 billion by 2030.[118] Sixteen percent of this potential is for renewable energy generation ($123 billion), while well over half ($499 billion) is for the transportation sector.[119] Regarding clean energy access in

[115] Sec. 44(1) (q), Energy Act, No. 1 of 2019, Laws of Kenya.
[116] Sec. 55(2) (k), Energy Act, No. 1 of 2019
[117] 'Kenyans Earn First Ever Carbon Credits From Sustainable Farming' (*World Bank*) <https://www.worldbank.org/en/news/press-release/2014/01/21/kenyans-earn-first-ever-carbon-credits-from-sustainable-farming> accessed 23 April 2021; Yiting Wang and Catherine Corson, 'The Making of a "charismatic" Carbon Credit: Clean Cookstoves and "Uncooperative" Women in Western Kenya' (2014) 0 Environment and Planning A 0; Kioko Nzuki Mwania, 'Carbon Trading In Kenya: A Critical Review'; Kanyinke Sena, 'Carbon Credit Schemes and Indigenous Peoples in Kenya: A Commentary' (2015) 32 Ariz. J. Int'l & Comp. L. 257.
[118] International Finance Corporation, *Climate Investment Opportunities in Emerging Markets: An IFC Analysis*, 2016, 60.< https://www.ifc.org/wps/wcm/connect/59260145-ec2e-40de-97e6-3aa78b82b3c9/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES&CVID=lBLd6Xq> accessed 19 April 2021.
[119] International Finance Corporation, *Climate Investment Opportunities in Emerging Markets: An IFC Analysis*, 2016, 60.< https://www.ifc.org/wps/wcm/connect/59260145-ec2e-40de-97e6-

Sub-Saharan Africa, it is estimated that 600 million people in the region have no access to basic electricity services, and this number will increase with a projected 2.3 percent annual population growth, with only seven Sub-Saharan countries presently having electricity-access rates exceeding 50 percent; the rest have an average grid access rate of just 20 percent.[120] In addition, the annual investment in the Sub-Saharan African power system is currently estimated at around $8 billion per year, or 0.5 percent of GDP while electricity demand in Africa is projected to triple by 2030, representing huge potential for investment in renewable energy.[121] It is also estimated that Africa's power sector requires investments of $70 billion per year, on average, between now and 2030, which can be split into about $45 billion per year for generation capacity and $25 billion for transmission and distribution, creating a huge opportunity for investments.[122] Kenya would greatly benefit from this opportunity considering that it requires huge investments in the energy sector, especially in the area of renewables considering that Kenya's development blueprint, Vision 2030 which seeks to create "a globally competitive and prosperous country with a high quality of life by 2030" and it aims to transform Kenya into "a newly-industrialising, middle income country providing a high quality of life to all its citizens in a clean and secure environment".[123] Notably, one of the foundations for Kenya Vision 2030 upon which the economic, social and political pillars of Kenya Vision 2030 will be anchored on include energy where the 'the Government of Kenya committed to continued institutional reforms in the energy sector, including a strong regulatory framework, encouraging private generators of power, and separating generation from distribution, with new sources of energy will be found through exploitation of geothermal power, coal, renewable energy sources, and connecting Kenya to energy-surplus countries in the region.[124]

3aa78b82b3c9/3503-IFC-Climate_Investment_Opportunity-Report-Dec-FINAL.pdf?MOD=AJPERES&CVID=lBLd6Xq> accessed 19 April 2021.

[120] Ibid, 61.

[121] Ibid, 61.

[122] Ibid, 61.

[123] Government of the Republic of Kenya, *Kenya Vision 2030: A Globally Competitive and Prosperous Kenya* (Government Printer Nairobi 2007).

[124] Ibid.

There is a need for the Government of Kenya to recognise and reach out to the private sector through creating a conducive legal and policy environment for investments in the country's energy sector in order to enable it achieve its objectives in the energy sector for achievement of clean and affordable energy for its people.[125] This is because, as it has been suggested that 'that effective policies and institutions are the best way to enable developing countries, and the private sector operating in those countries, to attract private finance to drive sustained growth'.[126] Arguably, 'the private sector is critical to economic growth and poverty reduction, where sustainable and inclusive private sector-led growth can contribute to reducing poverty'.[127] In addition, 'partnerships between donors, partner governments and the private sector are being used to achieve private sector development objectives which enables governments to access private sector ideas, innovations and business models in search of solutions to intractable development problems'.[128]

4.5. Promoting Energy Efficiency in Kenya

While availability and affordability of energy is an important step towards attaining energy security for all, there is also a need to put equal emphasis on enhancing energy efficiency in the country.[129] Arguably, energy-efficiency or 'demand-side management' programs can provide a number of benefits in developing countries, including lower costs to customers, an fewer electrical supply problems, greater system reliability and a more moderate growth in demand.[130] Energy efficiency can be achieved through use of more energy efficient gadgets and appliances as well as employing everyday power saving practices especially in households.[131]

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[125] Tewes-Gradl, Christina, Anna Peters, Karin Vohla, and L. Lütjens-Schilling. "Inclusive Business Policies: How Governments can Engage Companies in Meeting Development Goals." *Endeva UG, Berlin* (2013).

[126] Tess ewton Cain, 'The Role of the Private Sector in Promoting Economic Growth and Reducing Poverty in the Indo-Pacific Region', 1.

[127] Ibid, 1.

[128] Ibid, 2.

[129] Patterson, Murray G. "What is energy efficiency?: Concepts, indicators and methodological issues." *Energy policy* 24, no. 5 (1996): 377-390.

[130] Dilip Ahuja and Marika Tatsutani, 'Sustainable energy for developing countries' [2009] S.A.P.I.EN.S. Surveys and Perspectives Integrating Environment and Society <http://journals.openedition.org/sapiens/823> accessed 24 April 2021.

[131] Attendant, An Automated, et al. *How You Can Help Reduce Greenhouse Gas Emissions at Home - Point Reyes National Seashore (U.S. National Park Service)*.

4.6. Addressing Barriers in Renewable Energy Uptake in Kenya

Renewable energy technologies (RETs) have been defined as energy-providing technologies that utilize energy sources in ways that do not deplete the Earth's natural resources and are as environmentally benign as possible.[132]

Some of the earliest barriers to embracing renewable energy technologies have been identified as cost-effectiveness, technical barriers, and market barriers such as inconsistent pricing structures, institutional, political and regulatory barriers, and social and environmental barriers where some may be specific to a technology, while others may be specific to a country or a region.[133]

Some of the barriers that are relevant to Kenya and ought to be taken up include: highly controlled energy sector where governmental monopoly of energy sector restricts private sector entry; monopoly of energy supplier and/ or distributor, electricity generation, transmission and distribution; controlled and lack of private sector investment.[134] There is also the problem of lack of involvement of stakeholders in decision-making processes leading to clash of interests where stakeholders' consultation culture is missing, stakeholders are dispersed, there is difficulty in communication, and there is fear of opposition.[135] Related to this and relevant to Kenya is the observation that there is also renewable energy technologies competing with conventional energy, leading to them being treated as a threat to utility dominance, threat to utility profit, powerful lobbies against renewable energy technologies, threat of transfer of control over energy, powerful lobbies for conventional energy and decoupling of investor–consumer interests.[136] It has been documented that while the government of Kenya has

https://www.nps.gov/pore/learn/nature/climatechange_action_home.htm. Accessed 24 Apr. 2021.

[132] Jim Watson, Oliver Johnson and Dong Wu, 'Renewable Energy Technologies for Rural Development' [2010] UNCTAD Current Studies on Science, Technology and Innovation.

[133] Painuly JP, 'Barriers to Renewable Energy Penetration; a Framework for Analysis' (2001) 24 Renewable energy 73, 75.

[134] Ibid, 83.

[135] Ibid, 83.

[136] Ibid, 83.

a history of welcoming private investment in the energy sector, the nature of the political system presents challenges –not least over corruption and access to land thus making investments carry higher risks for large, on-grid projects than they are for off-grid and micro-grid investments.[137]

While Kenya has made some impressive steps towards investing in renewable energy technologies such as wind power and geothermal, and which has seen electricity tariffs reduce during certain periods,[138] the reduction in prices has not been consistent.[139] There is a need for the country to continually invest in renewable sources of energy to boost reliability and hopefully reduce the cost of electricity due to reduction in production costs.[140] The legal, policy, institutional and technical barriers should be addressed to tap into the benefits of using renewable energy sources.[141]

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[137] Gordon E, 'The Politics of Renewable Energy in East Africa' (2018), 15< https://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/08/The-politics-of-renewable-energy-in-East-Africa-EL-29.pdf> accessed 19 April 2021.

[138] 'KENYA: 8% Reduction in Electricity Rates Thanks to Renewable Energies' (*Afrik 21*, 30 July 2018) <https://www.afrik21.africa/en/kenya-8-reduction-in-electricity-rates-thanks-to-renewable-energies/> accessed 22 April 2021; October 23 2020 F, 'Uhuru Tariff Cut Dims Kenya Power Revenue by Sh4.8bn' (*Business Daily*)<https://www.businessdailyafrica.com/bd/economy/uhuru-tariff-dims-kenya-power-revenue-by-sh4-8bn-2719632> accessed 22 April 2021; https://www.the-star.co.ke/authors/gilbertkoech. "Kenya Keen to Prioritise Clean, Renewable Energy." *The Star*, https://www.the-star.co.ke/sasa/technology/2020-04-24-kenya-keen-to-prioritise-clean-renewable-energy/. Accessed 24 Apr. 2021; Mactilda Mbenywe, "Uhuru addresses world forum, commits to mitigate climate change",Saturday Standard, 24 April 2021. < https://www.standardmedia.co.ke/kenya/article/2001410702/uhuru-commits-to-renewable-energy> 24 April 2021.

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There is also a need for digitalization, liberalization, civic education and deregulation of energy sector, among others in order to address the above mentioned challenges.[142]

5. Conclusion

The United Nations Development Programme (UNDP) has rightly pointed out that 'investing in solar, wind and thermal power, improving energy productivity, and ensuring energy for all is vital if we are to achieve SDG 7 by 2030'. In addition, 'expanding infrastructure and upgrading technology to provide clean and more efficient energy in all countries will encourage growth and help the environment'.[143]

It has also been observed that 'policy and market design are vital to steering digitally enhanced energy systems onto an efficient, secure, accessible and sustainable path'.[144] It is time for the stakeholders and especially the Government to consider liberalization of the country's energy sector, especially in electricity generation, transmission and distribution. Liberalization of Kenya's energy sector also calls for 'a strong framework for regulation which is essential together with the benefits of a more efficient, innovative, and customer-focused industry'.[145] There is a need for rethinking the current approaches in energy generation, transmission and distribution if the goal and dream of cleaner and affordable energy sources for all Kenyans are to be achieved as part of realisation of the 2030 Agenda on SDGs as well as Kenya's Vision 2030. Without implementing radical changes in the sector, SDG Goal 7 will remain a mirage. Delivering Clean and Affordable Energy for all is a noble dream that is achievable.

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