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Energy Research & Social Science 68 (2020) 101677

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

COVID-19 and energy access: An opportunity or a challenge for the African continent?

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ARTICLE INFO

Keywords:
Energy access
COVID-19
Challenges
Opportunities

ABSTRACT

As the COVID-19 pandemic gains ground in the African continent, it will create havoc and unprecedented health and economic crisis. The crisis has exposed the robustness and resilience of the economies and services such as health systems around the world and it is disaster in the making while the pandemic is spreading fast to the African continent. This is alarming mainly because the continent has weak health system compounded by low access to modern and reliable electricity. It is also anticipated that the crisis will be brought ample opportunities and the African governments and the people should make coordinated and concerted effort in developing conducive business environment and exploit the opportunities presented to facilitate energy access focusing on clean and renewable energy technologies. This is a big test for the continent and thus it will either brought prosperity through facilitating universal energy access by effectively utilizing the opportunities brought by the crisis or the lack of energy access will continue affecting communities the ability to improve their livelihoods.

1. Introduction

African leaders have agreed on the provision of universal access to modern energy and energy services [1,2] and on complete decarbonization of the energy sector limiting the climate change to well below 2 °C [3,4]. Many has doubted achievement of these goals citing the financial challenges facing Africa though the state of renewable energy technologies has improved, and their costs have fallen. However, even with the lowering cost of the technologies, deployment of renewable energy in the continent is challenging because of its relatively large initial investment and the lack of sufficient financial resources [5]. This is affecting facilitation of energy access in the continent. In sub-Saharan Africa, energy access stands at 43% [6], which is half of the global electrification rate of 89% in 2017 [6].

Experiences in several developed and developing nations showed that there are several barriers for the renewable energy industry, which is slowing down the diffusion of technologies to the end users. Some of these barriers include but not limited to: poor linkages and dis-integrated efforts according to a study conducted in Ethiopia and Bangladesh [7], high initial investment cost of the technologies, lack of local manufacturing of the technologies, lack of skilled workforce, lack of clear policies and incentives, regulatory barriers, lack of full awareness of the advantages of the technologies by end users etc. A study in Greece on the barriers for transition to solar based power supply showed that the sector's key barriers include limited public acceptance of renewable energy-related initiatives, instabilities in the regulatory framework, high technological costs, and unfavorable policy orientation [8], which directly affects the businesses engaged in solar energy. Lack of consumer awareness and education, legislative and regulatory roadblocks, and financing are considered as a key market barrier according to a study by [9]. A study in Ghana by Kuada et al. [10] showed a grim reality that is affecting local firms' participation and growth because of positive perception of local consumers towards foreign solar energy providers compared to local firms. However, the study highlighted that collaboration between the two firms enhanced credibility of the local firms. High initial cost and lack of promotion/acceptance by consumers are also the challenges for the business [11]. In some countries such as Nigeria, political instability, inadequate solar initiative's research, lack of technological know-how, short-term policies are considered as a key challenge in addition to the other challenges mentioned in the previously aforementioned studies [12]. A study in Kenya shows that lack of suitable environment, lack of affordable funds, lack of awareness and lack of capacity building are considered as the four summarized barriers to the solar technology penetration [13].

However, even with the availability of these huge barriers there have been progresses though at a slower rate. For example, off-grid energy companies have made significant progress in facilitating energy access to 470 million people in the last decade [14]. These progresses are now being affected and could be reversed because of the arrival of

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https://doi.org/10.1016/j.erss.2020.101677
Received 28 May 2020; Received in revised form 20 June 2020; Accepted 24 June 2020
Available online 22 July 2020

COVID-19 as the pandemic is causing unprecedented disruptions to the businesses and the day-to-day life of human being in the world. It has exposed the robustness and resilience of the businesses and services such as health systems around the world and it is disaster in the making while the pandemic is spreading fast to the developing world-particularly to the African continent [15]. This is alarming mainly because the continent has weak health system compounded by low access to modern and reliable electricity. In sub-Saharan Africa, only 28% of health facilities have access to reliable electricity [16]. A number of hospitals that have access to electricity equally suffer from frequent blackouts, which is a daily occurrence in the continent. The spread of COVID-19 would be the greatest test of these under-served health systems.

The pandemic is having unpredictable consequences leading to several of these and other challenges and at the same time bringing opportunities for facilitating energy access through the utilization of renewable energy technologies. Therefore, this paper explores these key challenges and opportunities and recommends policy directions to overcome those challenges by exploiting the available opportunities.

2. COVID-19 and the challenges for energy access

With the lack of local development and manufacturing of renewable energy technologies in most of the African countries, many of them are dependent on importing solar and wind energy technologies in order to fulfill the local demands. For example, in the period 2009–2013 alone, African countries (mainly South Africa, Ethiopia and Egypt) collectively imported wind turbines to the amount of USD 342 million from other countries [17]. They have also imported PV cells and modules from China worth of USD 869 million in the same period [17,18].

It has been known through several researches that lack of consumer awareness [9,11], initial investment [11,19] are the key barriers for the solar industry growth. The arrival of COVID-19 brings another unprecedented negative impact on the growth of renewable energy-based businesses such as PV suppliers and distributors in the continent. The greatest negative impact of COVID-19 is the disruption of supply chain of renewable energy technologies mainly because the source of these technologies such as China, the USA and Germany shifted their attention to deal with the pandemic and worldwide transportation being halted. The off-grid energy businesses were employing nearly 370,000 worldwide including in the African continent particularly as suppliers, distributors and installation experts of solar technologies [14]. However, the pandemic is putting these jobs at risk as businesses are being forced to lay of their employees because of reducing liquidity adding up to the already high unemployment rate in the continent. The impact is more visible for off-grid energy companies that have the greatest impact in reaching to communities living beyond the gird systems [14]. Prior to the pandemic, solar-based off-grid businesses have been flourishing in the African continent driving and accelerating energy access particularly in the rural communities where there is lack of grid systems. They are now the most susceptible to the COVID-19 because of liquidity with customer liquidity coming to standstill, decreasing sales, and reduced access to capital making it difficult to maintain their businesses.

A survey was conducted by GOGLA focusing on its members who are involved in off-grid energy businesses. The main purpose of the survey was to understand the impact of COVID-19 on the activity of the businesses and the type of support they will need to sustain their businesses. According to the survey result, nearly 46% of the respondents are very much concerned for their businesses with the possibility of ceasing operations, reduced demand for new sales, decrease of the ability of customer's to pay for products and services, disruption in supply leading to stock-outs, and shortage of working capital [20]. Most of the respondents indicated getting support in terms of relief funds and bridging loans as their first priority in order to overcome impacts of the pandemic on their businesses [20].

3. COVID-19 and the opportunities for energy access

3.1. COVID-19 and reliable energy access

Research results on the assessment of the impact of Covid-19 shows that existing energy systems are being under pressure [21]. To the contrary, energy intensive businesses and industries are being closed reducing their electricity consumption. A recent study by the International Energy Agency showed that countries are experiencing an average of 25% and 18% decline with full and partial lockdown respectively with the demand reduced by 3.8% globally including the demand for oil dropping by 5% [22]. In Africa where the energy supply is not reliable and strained, a closure of these energy intensive business and industries is becoming an opportunity to provide sustained and reliable electricity supply to the people who are staying at homes. Health systems that have unreliable access to electricity are also benefiting from such closures. This is a huge short-term opportunity for the housing and health sectors as the reliability of electricity has dramatically improved during the pandemic. With the disruption of the global transport sector, the oil market has dropped affecting the profits of fuel-based industries and supply of electricity through fuel-based generators [23]. Notwithstanding the disruption of the technology supply chain, this is becoming a driving force for the renewable energy-based industries to expand their businesses as a matter of urgency to support the health facilities to deal with the on-going pandemic [23]. This is expected to have positive outlook for increasing the share of renewable energy in the energy mix.

3.2. COVID-19 and the environment

The pandemic has been an effective learning school for those who denied the cause of environmental impact to the world. During the pandemic, the demand for oil and other dirty fuels has collapsed with transportation systems and industries coming to a halt causing a dramatic change in the environment. Studies in the COVID-19 epicenters such as Wuhan, Spain, the USA indicated that pollution has reduced up to 30% [24] with Delhi, the megacity of India, registering about 40% to 50% improvement in air quality within four days of lockdown [25] and Rio de Janeiro showing a substantial reduction of CO levels averaging from 30.3% to 48.5% [26]. This is sending clear message to the world to change the way we have been doing business prior to the pandemic and should be utilized as the greatest opportunity and united the world particularly the African continent to rethink and clear the way for investing more in clean and reliable energy resources and make business process easy for those who are interested to enter to the renewable energy sector.

4. The way forward

The COVID-19 pandemic has brought an opportunity to reinforce the need for sustainable energy transitions in the African continent. The worldwide disruption of supply chain of renewable energy technologies has created a shortage of supply and is one of the key lessons for the African continent to focus on the localization of manufacturing of renewable energy technologies. Completed dependence on imported technology has hug risk and the continent shall look for different mechanisms to improve capacity of the manufacturing industries. The continent has been very slow in localization of the manufacturing of renewable energy technologies because of lack of investment capital, underdeveloped renewable energy supply chain, lack of skilled workforce, inaccurate perception of renewable energy capacity, lack of research and development etc. The lack of developing local capacity combined with the disruption of the energy technology supply chain, the pandemic has slowed down facilitation of energy access affecting the unsustainable businesses that have been involved in the off-grid energy sector. This is a wakeup call for the African continents to find

ways of developing effective policy to support and stimulate the local industrial capacity in order to develop and manufacture their own energy technologies and facilitate energy access to achieve the Sustainable Development Goals.

Localization of manufacturing of renewable energy technologies can be done by developing and implementing internationally proven effective policy tools such as financial incentives for research and development, renewable energy-based power generation, manufacturing industries etc. In addition, introducing Feed in Tariff, carbon pricing/trading and other related polices are an effective way to facilitate localization of renewable energy technology development and manufacturing. It is clear that incentives are wide in nature but those that have huge impact in localization of renewable energy technologies can include grants for R&D from diversified financial resources, Tax deductions for investments in research and development, performance based financial award that doesn't require repayment, financial subsidies to power generated with locally-made renewable energy technologies, reduction of income tax for utilities who sell power generated by locally manufactured renewable energy technologies etc. In addition, specific incentives for the manufacturing industries can be making available ready-to-start workforce, providing free worker recruitment services, providing land at nominal prices for potential manufacturers particularly for those who focus on import substitutions of energy technologies, tax deductions for labor cost involved in the local manufacturing industries, reduction of income tax for joint ventures involved in local manufacturing of energy technologies to encourage knowledge and technology transfer from foreign direct investment to the local firms etc.

In addition to the policies and incentives that can be enacted by governments, several development partners and funding organizations are mobilizing resources to protect the progress made so far towards achieving the sustainable development goals in Africa in order to effectively exploit the opportunities created by the crisis. A coordinated effort is being made by GOGLA to protect its members involved in off-grid energy business through COVID-19 Energy Access Relief Fund [27]. The relief response is being coordinated by a coalition of leading companies, investors, industry association, and sector support providers working under the umbrella of Energy Access Action Network and is developing early interventions to support the industry by bridging the liquidity crisis facing by the young industries. This is planned to be achieved through technical assistance, sector wise policy interventions, consumer protection and relief, and financial assistance for energy access companies [14]. There are also several other financial pledges, examples include: $160 million by the African Development bank, $91.5 million by the export import bank of the United States [28]. However, as per the "Africa Energy Outlook 2019 report", nearly $120 billion is required to provide universal access to 530 million people of the continent. This reinforces the need for the African governments to make substantial effort in developing conducive business environment including developing strong project implementation, monitoring and evaluation making the case to get more funding from developing partners. Such financial supports shall be utilized wisely and invested in sectors that can have huge impact such as in building capacity of the manufacturing industries and in safe guarding the off-grid energy business that have been creating substantial progress in facilitating energy access to the communities beyond the grid system.

Therefore, with committed and dedicated leadership and substantial support from development partners of the continent, there is a real opportunity for the continent to succeed. This crisis has all the means to be effective in facilitating energy access focusing on clean and renewable energy if the political leadership in the continent is ready to grasp this opportunity and change the way business have been going on before the pandemic. Therefore, it is time for the African continent to either brought prosperity through facilitating universal energy access by effectively utilizing the opportunities brought by the crisis or communities will continue using conventional energy resources affecting their livelihoods.

5. Conclusion

Energy access has always been a critical issue in the African continent with only 43% of the Sub-Saharan Africa having access to clean and modern electricity. The key challenges have been mainly lack of finance, lack of quality infrastructure, lack of skilled workforce, lack of conducive business environment etc. The arrival of COVID-19 pandemic has exposed vulnerability of the continent in this sector and has exposed the robustness and resilience of the businesses and services such as health systems around the world and it is disaster in the making while the pandemic is spreading fast to the African continent because of its weak health system compounded by low access to modern and reliable electricity. The pandemic has also brought an opportunity to reinforce the need for sustainable energy transitions in the African continent. Several development partners and funding organizations are mobilizing resources to protect the progress made so far towards achieving the sustainable development goals in Africa in order to effectively exploit the opportunities created by the crisis. It is also anticipated that the crisis will be brought ample opportunities and the African governments and the people should make coordinated and concerted effort in developing conducive business environment and exploit the opportunities presented to facilitate energy access focusing on clean and renewable energy technologies. Development and implementation of the recommended policy directions in this paper could help the continent to facilitate energy access and achieve the sustainable development goals.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] M. Bazilian, B.F. Hobbs, W. Blyth, I. MacGill, M. Howells, Interactions between energy security and climate change: a focus on developing countries, Energy Policy 39 (6) (2011) 3750–3756.
[2] P. Nussbaumer, M. Bazilian, A. Patt, A statistical analysis of the link between energy and the millennium development goals, Clim. Dev. 5 (2) (2013) 101–112.
[3] O. Edenhofer, Climate Change 2014: Mitigation of Climate Change vol. 3, Cambridge University Press, 2015.
[4] J. Rogelj, W. Hare, J. Lowe, D.P. Van Vuuren, K. Riahi, B. Matthews, Tatsuya Hanaoka, Kejun Jiang, and Malte Meinshausen. Emission pathways consistent with a 2 c global temperature limit, Nature Clim. Change 1 (8) (2011) 413.
[5] H. Kunreuther, S. Gupta, R. Valentina Bosetti, V.D. Cooke, M. Ha-Duong, J. Hermann Held, A.P. Llanes-Regueiro, E. Shittu, et al., Integrated risk and uncertainty assessment of climate change response policies, Climate Change 2014: Mitigation of Climate Change: Working Group III Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2014, pp. 151–206.
[6] Moussa P Blimpo and Malcolm Cosgrove-Davies. Electricity access in SubSaharan Africa: Uptake, reliability, and complementary factors for economic impact. World Bank Publications, 2019.
[7] Kassahun Y. Kebede, Toshio Mitsufuji, and Mohammad T. Islam. Building innovation system for the diffusion of renewable energytechnology: Practices in ethiopia and bangladesh. Procedia Environmental Sciences, 28:11–20, 2015.
[8] Alexandros Nikas, Vassilis Stavrakas, Apostolos Arsenopoulos, Haris Doukas, Marek Antosiewicz, Jan Witajewski-Baltvilks, and Alexandros Flamos. Barriers to and consequences of a solar-based energy transition in greece. Environmental Innovation and Societal Transitions, 2018.
[9] KR Ambepitiya. Strategies to promote solar power energy: A review of literature, 2015.
[10] John Kuada, Esther Mensah, Andreea I Bujac, and Jeanne S Bentzen. Marketing solar energy in ghana: A relational perspective. In Exploring the Dynamics of Consumerism in Developing Nations, pages 301–320. IGI global, 2019.
[11] KR Ranjan, SC Kaushik, NL Panwar, and V Siva Reddy. Solar energy entrepreneurship: Todays challenges, tomorrows opportunities. 2010.
[12] D Abdullahi, S Suresh, S Renukappa, and D Oloke. Key barriers to the implementation of solar energy in nigeria: A critical analysis. In IOP Conference Series: Earth and Environmental Science, volume 83, page 012015. IOP Publishing, 2017.

[13] Izael P. Da Silva, The four barriers for the diffusion of solar energy technologies in Africa: Trends in kenya. Africa, Policy Review (2015).
[14] Energy Access Action Network. Covid-19 energy access relief response. https:// www.energyaccessrelief.org, 2020 (Accessed: 2020- 06-19).
[15] Felix Tih. Covid-19 spreading rapidly in africa. https://www.aa.com.tr/en/africa/ covid-19-spreading-rapidly-in-africawho-/1798673, 2020 (Accessed: 2020-06-19).
[16] Powering Health care. Powering health care for women, children, and families: The challenge. https://poweringhc.org/about-us/, 2020 (Accessed: 2020-05-28).
[17] UNEP. South-south trade in renewable energy: trade flow analysis of selected environmental goods. 2014.
[18] Rasmus Lema, Roberta Rabellotti, Padmashree Gehl Sampath, Innovation trajectories in developing countries: Co-evolution of global value chains and innovation systems, Eur. J. Dev. Res. 30 (3) (2018) 345–363.
[19] Saskia Harkema, Mirjam Leloux, Florentin Popescu, Bas van Santen, Challenges in the diffusion and adoption of sustainable energy solutions among smes, Small 50 (10) (2015) 10.
[20] GOGLA. Covid-19: Coordinating an industry response for the off-grid solar sector. https://africa-energy-portal.org/node/2011, 2020 (Accessed: 2020-05-25).
[21] The World Bank. Energy access takes center stage in fighting covid-19 (coronavirus) and powering recovery in africa. https: //www.worldbank.org/en/news/opinion/ 2020/04/22/ energy-access-critical-to-overcoming-covid-19-in-africa, 2020 (Accessed: 2020-05-28).
[22] IEA. The impacts of the covid-19 crisis on global energy demand and co2 emissions. https://www.iea.org/reports/ global-energy-review-2020, 2020 (Accessed: 2020-05-26).
[23] Ivan Penn. Oil companies are collapsing, but wind and solar energy keep growing. https://www.nytimes.com/2020/04/07/business/energyenvironment/coronavirus-oil-wind-solar-energy.html, 2020 (Accessed: 2020- 06-19).
[24] Sulaman Muhammad, Xingle Long, and Muhammad Salman. Covid-19 pandemic and environmental pollution: A blessing in disguise? Science of The Total Environment, page 138820, 2020.
[25] Susanta Mahato, Swades Pal, and Krishna Gopal Ghosh. Effect of lockdown amid covid-19 pandemic on air quality of the megacity delhi, india. Science of the Total Environment, page 139086, 2020.
[26] Guilherme Dantas, Bruno Siciliano, Bruno Boscaro, Franca, Cleyton M. da Silva, Graciela Arbilla, The impact of covid-19 partial lockdown on the air quality of the city of rio de janeiro, Brazil, Sci. Total Environ. 729 (2020) 139085.
[27] GOGLA. Covid-19 energy access relief fund. https://www.gogla. org/covid-19-energy-access-relief-fund, 2020 (Accessed: 2020-05-26).
[28] Ujunwa Ojemeni. Can covid-19 accelerate funding for access to electricity. https:// www.devex.com/news/ opinion-can-covid-19-accelerate-funding-for-access-to-electricity-97067, 2020 (Accessed: 2020-05-27).