



**Global Conference on Women's studies**  
**18-20 December 2020**  
**Oxford-UK**

# **Feasibility of Off-Grid Solar Energy Enabling Sustainable Development of Women in Rural Kenya**

**Laura Hellqvist**

SOAS

## **Abstract.**

This paper examines the attempts of the government of Kenya and international development agenda to achieve the objective of providing energy access for all and facilitate empowerment and poverty reduction to the rural areas within the framework of sustainable development goals. Energy has been recognised as the key enabler of economic and social development, however, the efforts to bring energy access to women within the rural communities are falling short. The policy tools and economic instruments prescribed to address energy deficiency are not designed according to the local socio-economic conditions, which will be examined through empirical evidence produced from an energy access project in Kenya. Thereby, allowing the critical exploration of linkages between gender, energy and poverty reduction within the development framework. The remote locations are cumbersome and the solutions prescribed by the international stakeholders are proving insufficient in the spreading of energy access to women, setting the ambitions of achieving long-term sustainable development at risk. Achieving energy access has positively impacted rural areas, but more should be done in providing a sufficient quantity of energy to enable women in rural communities to empower their own economic and social development trajectories, as providing small-scale energy access levels in isolation might not adequately serve these objectives.

**Keywords:** Energy access, gender, socio-economic development

## **Introduction**

In efforts to achieving poverty eradication, sustainable development and protection of the planet the United Nations (UN) developed the 17 Sustainable Development Goals (SDG), that came into effect on January 2016 through to 2030 when the targets are expected to be attained. Realising the SDGs is a monumental effort, and one SDG is recognised as having special importance in the obtainment of development and the eradication of poverty globally. This is the goal number 7; *Affordable and Clean Energy*, 'ensure access to affordable, reliable, sustainable and modern energy for all' (UNDP). United Nations Conference on Trade and Development acclaims that the role of modern energy access is pivotal in the overall success of all the SDGs (UNCTAD 2017). The SDG 7 does not contain direct targets for women in ensuring universal modern clean energy access but does acknowledge that women and girls are facing adverse effects from the combustible fuels currently utilised in



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

lighting and cooking (UN SDGs). However, the SDG 5, which is dedicated to the obtainment of gender equality and 'achieving gender equality and empowerment of all women and girls' (UN SDGs) is the first direct objective and goal in the international sustainable development agenda within the UN framework with inclusion of gender, as previously the efforts to create equity in this framework were left unaddressed (Bradshaw & Linneker 2014). For any meaningful furthering of climate policy and sustainable development, it is imperative to include gender focus to ensure that policies are all-inclusive, and address the current environmental macro-level gender inequalities to create transformative changes thereby creating a higher possibility of the attainment of the SDGs on nationwide levels.

As energy is a key enabler of human development, the Government of Kenya (GoK) has set an ambitious energy agenda that is to extend energy services nationwide. Initially, the agenda was set for 2020, but it has been extended to 2022 due to the difficulties of expanding energy access to the rural off-grid areas (WB 2018). Kenya has been one of the most successful countries in the abatement of energy deficiency in the Global South, increasing its energy access by 3 percentage points per annum since 2010 (IBRD 2019) and hosts one of the most widely adopted off-grid solar (OGS) photovoltaic programmes globally, accrediting the spread of energy access to the rural areas.

This paper has recognised the major obstacles facing the electrification objective for women to be the overall policy design around the energy agenda, high up-front costs, the public funding constraints as well as the uncoordinated planning by public and private sector actors, and the lack of detailed socioeconomic data of the rural women and their specific needs. Without data, the policy designs cannot be adjusted accordingly throughout the energy access programmes creating impediments especially in the creation of gendered access, and Kenya is already facing significant challenges in the obtainment of its electrification objective as it currently hosts around 18 million people living without energy (AEP 2019). Furthermore, the rural areas of Kenya have an added burden of introducing energy access to the off-grid areas due to the high number of poor people living with less than USD 2 per day. Around 80 per cent of people in rural communities are living under such conditions (Steps Centre 2014), and the number of women constitutes 95 per cent that faces multi-dimensional poverty in the rural areas (PEP 2017).

Firstly, the analysis will focus on the history of rural electrification in Kenya and the importance it denotes in the provision of socio-economic development for women and girls. The modes of OGS systems are also significant in their energy-producing capabilities in transforming economic productivity in the rural areas, which will be shown, as well as the important role of the international stakeholders in providing financing to the OGS schemes in Kenya. Thereafter, the examination will focus on the different structures of the subsidy and financing schemes towards rural poor acquiring OGS systems and the different institutionalised obstacles women face in the process. Empirical evidence showcasing the realities of energy programme employment in rural Kenya is studied through the Last Mile Connectivity Project. Lastly, the analysis will focus on the overall sustainable development goals framework and the indicators embedded in the agenda and how the formulation is skewing the implementation of gender targets in practice, thereby possibly hindering the obtainment of energy access and women's socio-economic development in Kenya.



### **The development of OGS in Kenya**

Rural communities mainly rely on different fossil fuel sources for their energy needs in the absence of a grid connection, such as coal, diesel and kerosene. For households lacking the financial capacity to afford such modes of energy, the women and girls usually spend hours in a day collecting wood and dung for heating, lighting and cooking. Therefore, creating an urgent need in the dissemination of modern energy in rural areas providing labour-saving technology releasing women from work at home to entrepreneurial work (Dinkelman 2011). Furthermore, the reliance on such traditional energy sources inhibits the transition from subsistence economies to more diversified economic systems, leaving women trapped in a perpetual cycle of underdevelopment (Yadoo & Cruickshank 2012).

Highlighting the importance of macro-level energy and economic policies to guide policy development in the energy sector instead of continued reliance on private sector actors in providing much-needed energy access in rural areas. Especially in Kenya, the private sector and the international financial institution such as the World Bank and the African Development Bank dominate the development processes of the energy sector by providing technical and financial assistance, which in the past has lacked the emphasis of ensuring the equal addressing of universal access to sustainable modern energy for all. The policy instruments have mainly targeted the investment gap in the OGS projects by implementing neo-liberal market instruments in efforts to address this gap and in the creation of free-market system around the technological spreading thereby leaving the socio-economic characteristics of the rural consumers unaddressed. (UNEP 2011)

The traditional methods of energy access provision is through a grid connection, however, due to the significant upfront capital costs and investments coupled with prolonged timelines this is an unattainable option for many developing nations (Steps Centre 2014), in addition, the hard to reach areas and the solvency levels of the rural people have created an imperative towards the implementation of innovative OGS systems in the rural areas. OGS is a critical source of the first level of energy access and initially, most off-grid services were centred around solar home systems and solar lighting, constituting the focal point of energy modes in this paper due to the lesser dissemination of mini-grids in the rural communities (IBRD 2019). OGS systems have reached a stage of maturity where these are regarded as the most economical source of electricity (APP 2015), and due to the nature of this technology, it is estimated that approximately 70 per cent of all sustainable energy needs will be met by offgrid technologies in the developing countries (Steps Centre 2014). The most recent data obtained from 2017 shows that 47 per cent of the rural areas in Kenya are still lacking energy access, and 35 per cent have access to some form of off-grid energy (IBRD 2019). However, currently, no detailed data is available on the level of women's energy access in Kenya.

The types of OGS systems vary per levels of electricity output starting from Tier 1 that symbolises the lowest level and produces an approximate amount of 22 Watts of energy, allowing the lighting of one light bulb and charging of a mobile phone (Inclusive Infrastructure 2020), this is most often the first level of access of rural households due to its affordability. The larger OGS systems beyond the lowest Tier up to level 6 are typically



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

above 50 Watts and these have the potential of connecting a wide range of appliances such as fans and refrigerators (Sanya, Prins, Visco & Pinchot 2016), creating the potential for economic output diversification by the use of modern technological applications (UNITE; APP 2015). However, in Kenya the energy access levels even in the achieved provisions of energy have stagnated on the lowest Tier levels, indicating that most households are unable to use their connections towards the diversification of their access (Appendix).

### **Acquisition of the OGS systems**

The argument for ensuring the spreading of energy access to the rural areas is supported by the claims of OGS enabling economic development within these communities and in the empowerment of the poorest to diversify their economic output (IRENA 2017). However, the mode of the OGS system is imperative, as the energy applications vary significantly in their power-producing capacities and the more energy an off-grid system produces raises it the associated costs to the consumer. Most of the OGS systems are sold through financing and loan packages to consumers where they agree to pay a certain upfront sum and finance the rest through a loan cycle with an added interest for a certain number of years depending on the service provider (AfBD 2014). There are no separate subsidy or financing schemes that would specifically target women, as all programmes and projects target the rural poor as a uniform class of consumers. Moreover, the ability of consumers to upgrade their systems is largely dependent on their solvency levels and often the upfront costs are simply too high for rural people to finance. Especially, if they cannot access external financing, which is often the case of women, as they lack the collateral to apply for loans. In Kenya this is a rampant issue facing women specifically, as most often the land, property, vehicles and livestock are under a man's name, creating an impenetrable obstacle for women to further their economic development. Even in the case of women-headed households that constitute around 32 per cent they still only hold 1 per cent of land titles individually. (Farouky & Wanzala 2018)

In addressing the solvency levels of rural women to ensure them acquiring OGS systems it is usually necessary for these technologies to be subsidised to lower the initial upfront costs and the consequent loan. Denoting, that either the international development stakeholders have to endorse such a subsidy structure or the that the government has to provide essential support for such energy access schemes. During the past decades the private sector actors have mainly controlled the OGS development, but this has not provided sufficient levels of access to the rural people, therefore, the GoK has entered as a stakeholder in some of the rural electrification projects to provide additional support towards it 2022 universal energy access objective.

### **Last Mile Connectivity Project**

The most notable rural energy programme run by the GoK in cooperation with several notable international stakeholder partners such as the World Bank, African Development Bank, The European Union, the French Development Agency and the European Investment Bank is the Last Mile Connectivity Programme (LMCP) with a financial appraisal of USD 630 million and the project spanning over several years since 2014. (Inclusive Infrastructure 2020) The target stakeholders are specifically the rural communities and impoverished households, that have been excluded from the previous connectivity efforts and



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

simultaneously tackling issues around the social and economic conditions of the rural poor. The LMCP project focuses on different kinds of energy modes including the OGS systems. (Inclusive Infrastructure 2020)

The LMCP is specifically developed to address the obstacles of financing off-grid electricity by providing increased subsidies and loan packages, however, these subsidies are only partial and the rural households still face a significant upfront cost resulting in many households unable to pay for the associated fees. Furthermore, due to the financial constraints of rural households, energy is often not viewed as a priority over food and clothing, as even the subsidised connection fee is USD 171 and the annual average income of a rural household is USD 205, making energy an unaffordable luxury to many (Bauer 2019). This is the direct result of the GoK not including diversified policies addressing the underlying conditions of the rural poor (Phillips et al. 2020) and creating a conflict between the acquisition of basic goods by households.

The LMCP has also embedded policy tools to create inclusion of women in the project design, such as increased economic participation, which is the supply contract of treated wooden poles that women can sell. This is to directly designed to create conditions for poverty reduction by creating employment opportunities for women in addition to the benefits they get to enjoy through the access to energy (AfDB 2020). The project elements include the inclusivity of women through policy, regulation and standards to target the energy poverty of low-income communities, which was addressed through stakeholder engagement by a special team of consultants to map the specific socio-economic characteristics of the rural consumers.

The public consultations were conducted by the Rural Electricity Authority of Kenya but instead of the actual stakeholder engagement as set out in the project appraisal, the teams did not consult any women and the project priorities were based on technical rather than on social criteria (Inclusive Infrastructure 2020). Thereby missing the opportunity of creating meaningful inclusion and providing a socio-economic change in the lives of these rural women. Furthermore, the continuous challenge in the project implementation and the consequent policy design lack detailed socio-economic data in gender, income levels and age. (Ibid) Without such disaggregated data the project planning and amendments in policy design are difficult and delay the development of specific solutions for women in energy access provision and ensuring equitable development outcomes of energy interventions require the integration of such factors (Dutta, Kooijman & Cecelski 2017). Arguably being one of the reasons for the postponement of the government's energy objective for all by 2 years.

### **Equity in development and energy access**

In the LMCP one of the key indicators is gender inclusion as a substantial part of the project appraisal and planning, nevertheless, the programme has failed to create significant change in the energy access of women or in the economic empowerment beside the opportunity to sell wooden poles. The policy measure is questionable from the offset as the creation of employment should ensure long-term opportunities for women through training and education to a vocation, which exist plenty in the renewable energy arena, therefore making it questionable how such a short-term opportunity would create and empower long-term economic development. Demonstrating the piecemeal basis of integration of gender into the



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

project frameworks and the lack of monitoring of the results and impact of specific policy and economic instruments utilised. Socio-economic growth and development of women won't take place in isolation, as it is directly depended on the policies and actions of the government and the international development agenda (Esquivel 2016). The LMCP project has failed to address the macroeconomic and structural drivers that prevent women's obtainment of development through such energy access programmes that are intended to lift women out of poverty and better the living standards of households suffering from multifaceted underdevelopment.

Additionally, the project does not address the limited use of the energy connection and offers no subsidies towards the acquiring of technical appliances (Inclusive Infrastructure 2020), that could be used towards increasing the economic productivity away from the current household drudgery facing many women. The subsidies granted for the project also failed to lower the general cost of energy access to a level where it is plausible for households to acquire and sustain such connections in the long-term, demanding further monetary investments from the stakeholders and the GoK in the supporting of the subsidy schemes.

The SDGs were developed in support of the obtainment of sustainable development and the eradication of poverty whilst transitioning towards a clean energy future, functioning as a direction for individual countries like Kenya in helping with the formulation of solutions towards these goals and tackling underdevelopment. However, the SDG monitoring framework does not provide adequate gender-specific indicators nor methods on the achievement of the individual goals, as the current gender 'neutral' approaches overlook the differences of the impacts and benefits of development efforts (Dutta, Kooijman & Cecelski 2017), such as the LMCP project in Kenya. The different SDGs such as the SDG 7 and SDG 5 should support the formulation of common linkages in aiding the transition towards the obtainment of these objectives. As standalone indicators and goals they are not supportive in the tracking of progress, influencing of policy design nor the building of a coherent gender framework inclusive of data for the measuring of progress on economic, social and environmental targets (Azcona and Bhatt, 2020).

### Conclusion

The SDGs lack the comprehensive integration of gender in the indicators, creating difficulty in the consequent project planning and implementation. Additionally, the institutional structures are often unfavourable in the Global South towards women's socio-economic development efforts in society, especially in the rural areas. Creating significant obstacles for developing countries such as Kenya to tackle such complex development goals simultaneously, and the gender, energy, poverty nexus cannot be addressed adequately without the proper implementation of gender into the project frameworks, as showcased with the LMCP project. Furthermore, the ability of energy access transforming the socio-economic circumstances in the rural areas is doubtful due to the low voltage levels of the existing offgrid systems that have been deployed in Kenya during the past decade. The ability of rural households to empower their socio-economic development trajectories through energy is questionable if the connection levels allow the electrification of only one lightbulb. Providing, that the sustainable energy projects should address not only the low levels of



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

energy provided but also the policy instruments and economic tools imbedded in the programmes to create gender inclusiveness, instead of offering 'neutral' policy approaches. Otherwise, the economic empowerment of women will fall short and concomitantly pushing the objective of universal energy for all beyond 2022.

### References

- African Development Bank (AfDB). 2014. Kenya Country Strategy Paper 2014-2018. Available from: [https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018 - Kenya Country Strategy Paper.pdf](https://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/2014-2018_-_Kenya_Country_Strategy_Paper.pdf)
- African Development Bank (AfDB). 2020. Last Mile Connectivity Project Kenya: Project Appraisal Report October 2014. <https://www.afdb.org/en/documents/kenya-last-mileconnectivity-project-project-appraisal-report>
- Africa Energy Portal (AEP). 2019. Kenya outshines neighbours in access to mains electricity. Available from: <https://africa-energy-portal.org/news/kenya-outshines-neighbours-accessmains-electricity>
- Africa Progress Panel (APP). 2015. Light Power Action. Available from: [https://www.africa50.com/fileadmin/uploads/africa50/Documents/Knowledge\\_Center/APP\\_Lights\\_Power\\_Action\\_2016\\_PDF.pdf](https://www.africa50.com/fileadmin/uploads/africa50/Documents/Knowledge_Center/APP_Lights_Power_Action_2016_PDF.pdf)
- Azcona, G., Bhatt, A. 2020. Inequality, gender, and sustainable development: measuring feminist progress. *Gender & Development* 28, 337–355. Available from: <https://doi.org/10.1080/13552074.2020.1753390>
- Bauer, L. 2019. Power Isn't Water: Learning from Kenya's Rural Electrification Efforts. Blum Centre for Developing Economics. Available from: <https://blumcenter.berkeley.edu/news-posts/power-isnt-water-learnings-from-kenyas-ruralelectrification-efforts/>
- Bradshaw, Sarah., Linneker, Brian. 2014. Gender and Environmental Change in the Developing World. IIED Working Paper. London, UK. Available from: <http://pubs.iied.org/10716IIED>
- Dinkelman, Taryn. 2011. The Effects of Rural Electrification on Employment: New Evidence from South Africa. *The American Economic Review*, Vol. 101, No. 7, 3078-3108. Available from: <https://www.jstor.org/stable/41408731>
- Dutta, S., Kooijman, A., Cecelski, E. Energia, International Network on Gender and Sustainable Development. 2017. Energy Access and Gender Getting the Balance Right. International Bank for Reconstruction and Development. Available from: <http://documents1.worldbank.org/curated/en/463071494925985630/pdf/115066-BRIP148200-PUBLIC-FINALSEARSFGenderweb.pdf>



## Global Conference on Women's studies 18-20 December 2020 Oxford-UK

Esquivel, V. 2016. Power and the Sustainable Development Goals: a feminist analysis. *Gender & Development* 24, 9–23. Available from: <https://doi.org/10.1080/13552074.2016.1147872>

Inclusive Infrastructure. 2020. Last Mile Connectivity Programme Kenya. Available from: <https://inclusiveinfra.github.org/case-studies/last-mile-connectivity-programkenya/#:~:text=Summary,to%20the%20national%20electricity%20grid.&text=They%20includethe%20Last%20Mile,slums%20where%20connectivity%20is%20poor.>

International Bank for Reconstruction and Development (IBRD). 2019. Tracking SDG7 The Energy Progress Report. Available from: <https://trackingsdg7.esmap.org/data/files/downloaddocuments/2019-Tracking%20SDG7-Full%20Report.pdf>

IRENA. 2017. Accelerating Off-Grid Renewable Energy: Key Findings and Recommendations from IOREC 2016. Available from: <https://www.irena.org/publications/2017/Jan/Accelerating-Off-grid-Renewable-Energy--KeyFindings-and-Recommendations-from-IOREC-2016>

Partnership for Economic Policy (PEP). 2017. Women at high risk of poverty in rural Africa. Available from: <https://www.pep-net.org/women-high-risk-poverty-rural-africa>

Phillips, J., Davies, G., Plutshack, V. 2020. Future Development, An off-grid energy future requires learning from the past. Brookings. Available from: <https://www.brookings.edu/blog/future-development/2020/05/04/an-off-grid-energy-future-requires-learning-from-the-past/>

Sanya, S., Prins, J., Visco, F. & Pinchot, A. 2016. Stimulating Pay-as-you-go energy access in Kenya and Tanzania: the role of development finance. World Resources Institute. Available from: <https://www.wri.org/publication/stimulating-pay-you-go-energy-accesskenya-and-tanzania-role-development-finance>

STEPS CENTRE. 2014. Financing sustainable energy for all: pay-as-you-go vs. traditional solar finance approaches in Kenya. Available from: <https://steps-centre.org/wpcontent/uploads/Financing-Energy-online.pdf>

UN SDGS. Goal 5: Achieve gender equality and empower all women and girls. Available from: <https://www.un.org/sustainabledevelopment/gender-equality/>

UNCTAD. 2017. The Least Developed Countries Report 2017, Transformational Energy Access. Available from: <https://unctad.org/en/pages/PublicationWebflyer.aspx?publicationid=1902>

UNDP. Sustainable Development Goals. Available from: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>



**Global Conference on Women's studies  
18-20 December 2020  
Oxford-UK**

UNEP. 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication – A Synthesis for Policy Makers. Available from: [www.unep.org/greeneconomy](http://www.unep.org/greeneconomy)

UNITE, United Nations. Universal Access to Electricity. Available from: <https://unite.un.org/sites/unite.un.org/files/app-desa-electrification/index.html>

Whiteman, Adrian. 2018. IRENA Statistics. (Personal communication)

The World Bank. 2018. Kenya Charts Path to Achieving Universal Access to Electricity. Available from: <https://www.worldbank.org/en/news/feature/2018/12/06/kenya-charts-path-to-achieving-universal-access-to-electricity>

Yadoo, Annabel., Cruickshank, Heather. 2012. The role of low carbon electrification technologies in poverty reduction and climate change strategies: A focus on renewable energy mini-grids with case studies in Nepal, Peru and Kenya. Energy Policy, 42.



**Global Conference on Women's studies  
18-20 December 2020  
Oxford-UK**

**Appendix**

Country Label	Type	Year	No. of units	Unit size (W)
Kenya	Solar lights (<11W)	2011	38,685	3
Kenya	Solar lights (<11W)	2011	84,624	3
Kenya	Solar lights (<11W)	2012	111,220	3
Kenya	Solar lights (<11W)	2012	234,530	3
Kenya	Solar lights (<11W)	2013	522,253	3
Kenya	Solar lights (<11W)	2013	534,342	3
Kenya	Solar lights (<11W)	2014	570,610	3
Kenya	Solar lights (<11W)	2014	717,344	3
Kenya	Solar lights (<11W)	2015	780,830	2
Kenya	Solar lights (<11W)	2015	552,829	2
Kenya	Solar lights (<11W)	2016	577,394	2
Kenya	Solar lights (<11W)	2016	638,302	3
Kenya	Solar lights (<11W)	2017	1,148,944	3
Kenya	SHS (11-50W)	2011	1,080	15
Kenya	SHS (11-50W)	2011	2,362	15
Kenya	SHS (11-50W)	2012	3,104	15
Kenya	SHS (11-50W)	2012	6,545	15
Kenya	SHS (11-50W)	2013	14,574	15
Kenya	SHS (11-50W)	2013	14,911	15
Kenya	SHS (11-50W)	2014	15,923	15
Kenya	SHS (11-50W)	2014	22,395	15
Kenya	SHS (11-50W)	2015	39,635	15
Kenya	SHS (11-50W)	2016	14,622	15
Kenya	SHS (11-50W)	2016	33,625	20
Kenya	SHS (11-50W)	2017	60,526	20
Kenya	SHS (>50W)	2015	701	132

Source: Whiteman, IRENA, 2018