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Report No: PAD2008

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED CREDIT

IN THE AMOUNT OF EUR 133.8 MILLION

(US$150 MILLION EQUIVALENT)

TO THE

REPUBLIC OF KENYA

FOR AN

OFF-GRID SOLAR ACCESS PROJECT FOR UNDERSERVED COUNTIES

July 5, 2017

Energy and Extractives Global Practice
Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective May 31, 2017)

Currency Unit =	Kenyan Shilling (KES)
KES 103.4 =	US$1
US$1 =	EUR 0.89182199

FISCAL YEAR

July 1 - June 30

ABBREVIATIONS AND ACRONYMS

AFD	*Agence Française de Développement* (French Development Agency)
AFREA	Africa Renewable Energy Access Program
ARAP	Abbreviated Resettlement Action Plan
ATL	Above the Line
BP	Bank Policy
BTL	Below the Line
CAPEX	Capital Expenditure
CBK	Central Bank of Kenya
CPS	Country Partnership Strategy
CRA	Commission of Revenue Allocation
DA	Designated Account
DC	Direct Current
DFID	U.K. Department for International Development
EBP	Evaluated Bid Price
EIRR	Economic Internal Rate of Return
ERB	Electricity Regulatory Board
ERC	Energy Regulatory Commission
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EU	European Union
FIM	Facilities Implementation Manual
FM	Financial Management
GBV	Gender-Based Violence
GDC	Geothermal Development Corporation
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	*Deutsche Gesellschaft für Internationale Zusammenarbeit* (German Agency for International Cooperation)
GoK	Government of Kenya

GPOBA	Global Partnership on Output-Based Aid
IA	Implementing Agency
IDA	International Development Association
IEC	International Electrotechnical Commission
IFC	International Finance Corporation
IFMIS	International Financial Management Information System
IFR	Interim Financial Report
IP	Indigenous People
IPP	Independent Power Producer
KEEP	Kenya Electricity Expansion Project
KEMP	Kenya Electricity Modernization Project
KenGen	Kenya Generation Company Limited
KEPH	Kenya Essential Package for Health
KES	Kenyan Shilling
KetraCo	Kenya Electricity Transmission Company Ltd
KOSAP	Kenya Off-grid Solar Access Project
KPI	Key Performance Indicator
KPLC	Kenya Power and Lighting Company
Kw	Kilowatt
LED	Light-Emitting Diode
Li-ion	Lithium-Ion
LMCP	Last Mile Connectivity Program
M&E	Monitoring and Evaluation
MoEP	Ministry of Energy and Petroleum
MoIC	Ministry of Interior and Coordination
MTF	Multi-tier Framework
MW	Megawatts
NEDI	North and Northeastern Development Initiative
NES	National Electrification Strategy
NGO	Nongovernmental Organization
Ni-Cad	Nickel-Cadmium
NiMH	Nickel Metal Hydride
NPV	Net Present Value
NT	National Treasury
O&M	Operation and Maintenance
OAG	Office of the Auditor-General
OP	Operational Policy
OPEX	Operational Expenditure
PA	Project Account
PAP	Project-Affected Person
PAYG	Pay as You Go
Pb-A	Lead-Acid
Pb-gel	Lead-Gel

PCU	Project Coordination Unit
PDO	Project Development Objective
PFM	Public Financial Management
PIM	Project Implementation Manual
PIU	Project Implementation Unit
POM	Project Operations Manual
PPA	Power Purchase Agreement
PPDA	Public Procurement and Asset Disposal Act
PPP	Public-Private Partnership
PPRA	Public Procurement Regulatory Authority
PPSD	Project Procurement Strategy for Development
PRAMS	Procurement Risk Assessment and Management System
PSP	Private Service Provider
PV	Photovoltaic
RAP	Resettlement Action Plan
RBF	Results-Based Financing
REA	Rural Electrification Authority
RPF	Resettlement Policy Framework
SA	Social Assessment
SDG	Sustainable Development Goal
SHS	Solar Home System(s)
SOE	Statement of Expenditure
SPPM	Strategic Planning and Program Management
SSP	Solar Service Provider
STEP	Systematic Tracking of Exchanges in Procurement
TA	Technical Assistance
TWG	Technical Working Group
VMG	Vulnerable and Marginalized Group
VMGF	Vulnerable and Marginalized Group Framework
VMGP	Vulnerable and Marginalized Group Plans
WRMA	Water Resource Management Authority

Regional Vice President:	Makhtar Diop
Country Director:	Diarietou Gaye
Senior Global Practice Director:	Riccardo Puliti
Practice Manager:	Sudeshna Ghosh Banerjee
Task Team Leader(s):	Patrick Thaddayos Balla

BASIC INFORMATION

Is this a regionally tagged project?	Country(ies)	Financing Instrument
No		Investment Project Financing

[ ] Situations of Urgent Need of Assistance or Capacity Constraints

[✓] Financial Intermediaries

[ ] Series of Projects

Approval Date	Closing Date	Environmental Assessment Category
26-Jul-2017	30-Jun-2023	B - Partial Assessment

Bank/IFC Collaboration
No

Proposed Development Objective(s)

The Project Development Objective is to increase access to modern energy services in underserved counties of Kenya

Components

Component Name	Cost (US$, millions)
Component 1: Mini-grids for Community Facilities, Enterprises, and Households	40.00
Component 2: Stand-alone Solar Systems and Clean Cooking Solutions for Households	48.00
Component 3: Stand-alone Solar Systems and Solar Water Pumps for Community Facilities	40.00
Component 4: Implementation Support and Capacity Building	22.00

Organizations

Borrower : The National Treasury

Implementing Agency :	Kenya Power and Lighting Company (KPLC) Rural Electrification Authority Ministry of Energy and Petroleum

PROJECT FINANCING DATA (US$, Millions)

[ ] Counterpart Funding	[ ] IBRD	[✓] IDA Credit [ ] Crisis Response Window [ ] Regional Projects Window	[ ] IDA Grant [ ] Crisis Response Window [ ] Regional Projects Window	[ ] Trust Funds	[ ] Parallel Financing

Total Project Cost:	Total Financing:	Financing Gap:
150.00	150.00	0.00
	Of Which Bank Financing (IBRD/IDA): 150.00	

Financing (in US$, millions)

Financing Source	Amount
International Development Association (IDA)	150.00
Total	**150.00**

Expected Disbursements (in US$, millions)

Fiscal Year	2017	2018	2019	2020	2021	2022	2023
Annual	0.00	15.00	40.00	45.00	25.00	15.00	10.00
Cumulative	0.00	15.00	55.00	100.00	125.00	140.00	150.00

INSTITUTIONAL DATA

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Finance & Markets
Water

Climate Change and Disaster Screening

This operation has been screened for short and long-term climate change and disaster risks

Gender Tag

Does the project plan to undertake any of the following?

a. Analysis to identify Project-relevant gaps between males and females, especially in light of country gaps identified through SCD and CPF

Yes

b. Specific action(s) to address the gender gaps identified in (a) and/or to improve women or men's empowerment

Yes

c. Include Indicators in results framework to monitor outcomes from actions identified in (b)

Yes

SYSTEMATIC OPERATIONS RISK-RATING TOOL (SORT)

Risk Category	Rating
1. Political and Governance	Substantial
2. Macroeconomic	Moderate
3. Sector Strategies and Policies	Moderate
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Substantial

9. Other	Moderate
10. Overall	Substantial

COMPLIANCE

Policy

Does the project depart from the CPF in content or in other significant respects?

[ ] Yes [✓] No

Does the project require any waivers of Bank policies?

[ ] Yes [✓] No

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	✓	
Natural Habitats OP/BP 4.04	✓	
Forests OP/BP 4.36		✓
Pest Management OP 4.09		✓
Physical Cultural Resources OP/BP 4.11		✓
Indigenous Peoples OP/BP 4.10	✓	
Involuntary Resettlement OP/BP 4.12	✓	
Safety of Dams OP/BP 4.37		✓
Projects on International Waterways OP/BP 7.50		✓
Projects in Disputed Areas OP/BP 7.60		✓

Legal Covenants

Sections and Description

To ensure proper and efficient oversight of the Project, the Recipient shall by not later than 6 months from the Effective Date, establish and thereafter, maintain, throughout the Project implementation period, a Project steering committee, chaired by the Cabinet Secretary of the MOEP, with composition satisfactory to the Association, to be responsible for overall oversight and policy guidance to the Project.

Sections and Description

To ensure proper and efficient implementation of the Project at County level, the Recipient shall by not later than 6 months from the Effective Date, establish and thereafter maintain, throughout the Project implementation period, a County working group, for each respective County, with composition satisfactory to the Association, to be responsible for day to day oversight and of Project activities at County level.

Sections and Description

To ensure proper and efficient implementation of the Project Implementing Entity's Respective Part of the Project, each Project Implementing Entity shall establish, by not later than three (3) months after the Effective Date, and thereafter maintain throughout the Project implementation period, a Project implementation unit, with adequate financial resources and staff in adequate numbers, including fiduciary and technical staff, all with terms of reference, qualifications and experience satisfactory to the Association.

Conditions

Type	Description
Disbursement	No withdrawal shall be made under Category (3) unless and until: (i) the fund managers for the Debt Facility and the RBF Facility have been appointed; and (ii) the fund managers have prepared, and the Recipient has adopted the Facilities Implementation Manual, all in accordance with Section I.E.1 of Schedule 2 of the Financing Agreement.
Effectiveness	The Project Implementation Manual has been prepared and adopted by the Recipient in accordance with Section I.D of Schedule 2 of the Financing Agreement.
Effectiveness	The Subsidiary Agreements have been executed on behalf of the Recipient and the respective Project Implementing Entity.

PROJECT TEAM

Bank Staff

Name	Role	Specialization	Unit
Patrick Thaddayos Balla	Team Leader(ADM Responsible)	Energy Specialist	GEE01
Tesfaye Ayele	Procurement Specialist(ADM Responsible)	Senior Procurement Specialist	GGO01
Arun Kumar Kolsur	Procurement Specialist	Senior Procurement Specialist	GGO06

Mulugeta Dinka	Procurement Specialist	Senior Procurement Specialist	GGO01
Nagaraju Duthaluri	Procurement Specialist	Lead Procurement Specialist	GGO01
Henry Amena Amuguni	Financial Management Specialist	Senior Financial Management Specialist	GGO31
Arsh Sharma	Team Member	Financial Analyst	GEE08
Ben Okindo Ayako Miranga	Environmental Specialist	Social Safeguards Specialist	GEN01
Caroline Marie C. Cerruti Hailey	Team Member	Senior Financial Sector Specialist	GFM01
Dana Rysankova	Team Member	Senior Energy Specialist	GEEES
Edward Felix Dwumfour	Environmental Specialist	Senior Environmental Specialist	GEN01
Ezgi Canpolat	Team Member	Gender Consultant	GEESO
Gladys Akurut Alupo	Team Member	Program Assistant	AFCE2
Jean O Owino	Team Member	Finance Analyst	WFALA
Juliana Chinyeaka Victor	Team Member	Senior M & E Specialist	GEE08
Kenta Usui	Team Member	Energy Specialist	GEE01
Kirtan Chandra Sahoo	Team Member	Senior Carbon Finance Specialist	GCCFM
Kristoffer Welsien	Team Member	Water Specialist	GWA01
Laurencia Karimi Njagi	Team Member	Senior Energy Specialist	GEE01
Lien Thi Bich Nguyen	Team Member	Program Assistant	GHNGF
Mariano Salto	Team Member	Energy Economist	GEE01
Nana Nuamoah Asamoah-Manu	Team Member	Operations Officer	CASEE
Pedro Antmann	Team Member	Lead Energy Specialist	GEE08
Prajakta Ajit Chitre	Team Member	Infrastructure Finance Specialist	GEEFS
Rhonda Lenai Jordan Antoine	Team Member	Energy Specialist	GEE01
Richard H. Hosier	Team Member	Senior Energy Specialist	GEE08
Sudeshna Ghosh Banerjee	Team Member	Lead Energy Specialist	GEE01
Teuta Kacaniku	Team Member	Senior Infrastructure Finance Specialist	GEEFS
Yevgen Yesyrkenov	Team Member	Senior Carbon Finance Specialist	GCCFM

Zubair K.M. Sadeque	Team Member	Senior Energy Specialist	GEE08

Extended Team

Name	Title	Organization	Location
Aisha Abdulaziz Mahmoud	Rural Energy Specialist	Independent consultant	Kenya
Arne Jacobson	Renewable Energy Expert	Independent Consultant	India
Christopher Purcell	Renewable Energy Specialist	Independent consultant	South Africa
Daniel Murphy	Renewable Energy Specialist	Independent consultant	United States
Gordon Acholla	Consumer Awareness Consultant	Independent consultant	Kenya
Henry Gichungi	Mini-grids and Rural Energy Specialist	Independent consultant	Kenya
Kevin Kennedy	Renewable Energy Specialist	Independent consultant	Spain
Kiremu Magambo	Rural Water and Energy Specialist	Independent consultant	Kenya
Margeret Ombai	Social Development Specialist		Nairobi,India
Simon Karunditu	Off-grid Financing Specialist		Nairobi,

KENYA
KENYA: OFF-GRID SOLAR ACCESS PROJECT FOR UNDERSERVED COUNTIES

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I. STRATEGIC CONTEXT

A. Country Context

1. With a population of 45 million people and a gross domestic product (GDP) of US$61 billion, Kenya is one of the largest economies in Sub-Saharan Africa, achieving, in 2015, middle-income country status. In the past several years, the GDP growth rate, hovering above 5 percent, has outperformed the average for sub-Saharan Africa and is projected to rise to 5.9 percent in 2016 and 6 percent for 2017, underpinned by a strong growth of trade and services. Kenya's coastal location has propelled its emergence as a hub for trade in East African Community countries. Information and communication technology is playing a large role in the services sector, contributing 4.1 percent of the value added in the country. Mobile phone coverage is 82 percent of the population, with the number of Internet users and mobile money subscriptions on an upward trajectory. Mobile payments have reduced the cost of money transfers, extended access to finance for rural households, and been a source of employment. Kenya also improved its business environment as the country jumped from 129 in 2014/2015 to 92 in 2016/2017 in the World Bank's Doing Business Index.[1] Kenya combines vibrant economic activity in some of the largest cities with a continued dependence on agriculture in rural areas and widely heterogeneous access to education, social services, productive jobs, and infrastructure services.[2]

2. The effects of sustained macroeconomic growth are translating into improved quality of life. The national poverty rate fell from 47 percent in 2005 to 39 percent in 2012. Even so, gross national income per capita at US$1,340 in 2015 is still converging toward the regional average of US$1,638. Inequality remains high, with a Gini coefficient of 47.4. Opportunities are substantially different for those living in the arid and semiarid regions of Kenya, which are underserved, as well as between women and men. The 2010 Constitution of Kenya, enshrining devolution, marked a momentous point in the country's history. Kenya's decentralization is among the most rapid and ambitious processes globally, with new governance challenges and opportunities as the country builds a new set of county governments. The devolution process seeks to narrow long-term, deeply entrenched regional disparities and increase the responsiveness and accountability of the Government, especially county governments to citizens.

3. The Government of Kenya (GoK) Vision 2030 aims to "transform Kenya into a newly industrializing, middle-income country providing a high quality of life to all its citizens." Promoting equal opportunities across the entire Kenyan territory is key to realizing this vision. Energy is identified as one of the key sectors that form the foundation for sociopolitical and economic growth. Access to competitively priced, reliable, quality, safe, and sustainable energy is essential for achievement of the vision.

4. In June 2016, the World Bank committed to supporting a multisectoral initiative, called North and Northeastern Development Initiative (NEDI), focusing on counties where geographic inequalities in poverty and service delivery are particularly exacerbated. NEDI brings together a suite of transformative coordinated infrastructure investments in energy, transport, livestock, and water that are needed to

1 World Bank. 2016. *Doing Business 2017: Equal Opportunity for Fall.*
2 World Bank. 2016. *Kenya Economic Update* (Edition no. 13).

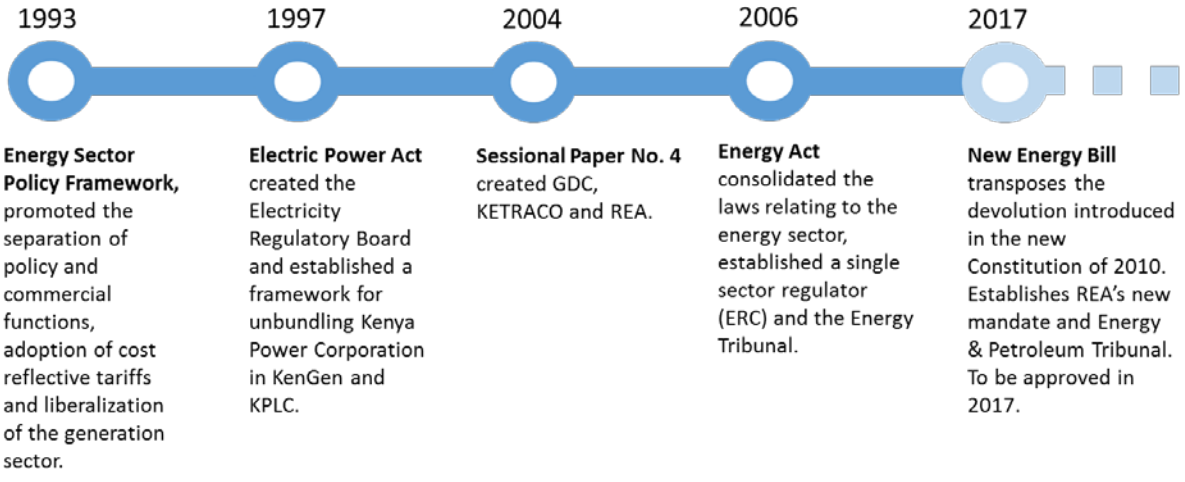
connect these counties to national and global markets. The proposed project is the energy sector investment of NEDI.

B. Sectoral and Institutional Context

5. Kenya has experienced a dynamic energy sector policy environment since the mid-1990s when the Electric Power Act was enacted to establish an enabling framework for power sector development. The act included the creation of a sector regulator, the Electricity Regulatory Board (ERB), and the functional unbundling of Kenya Power and Lighting Company (KPLC) (partially state-owned vertical integrated utility), mandating Kenya Electricity Generating Company Limited (KenGen) to be in charge of generation and KPLC to be in charge of transmission, distribution, and retail functions. A second generation of reforms was introduced with the enactment of the Energy Act 2006: the ERB was transformed into a single energy regulatory body—the Energy Regulatory Commission (ERC); the Kenya Electricity Transmission Company Limited (KETRACO), a state-owned company, was set up to facilitate creation of new transmission assets; the Geothermal Development Company (GDC) was incorporated to de-risk geothermal development by undertaking up-front steam field development works; and the Rural Electrification Authority (REA) was created with the mandate of accelerating rural electrification.

6. These two generations of reforms in the 1990s and 2000s have achieved considerable progress in market development. The sector operates on commercial principles supported by transparent financial relationships between the sector utilities. Electricity retail tariffs are cost reflective and the key public sector power utilities, KenGen and KPLC, are both listed on the Nairobi Securities Exchange. The generation sector is complemented by several independent power producers (IPPs) that sell electricity through long-term Power Purchase Agreements (PPAs) signed with KPLC.

Figure 1. Power Sector Reform Time Line



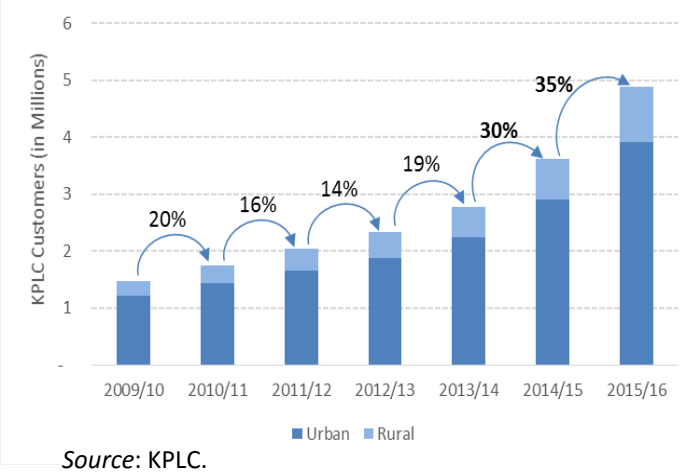
Source*: World Bank analysis.*

7. Kenya has recently embarked on a third generation of reforms through the new Energy Policy and Energy Bill to align the policy and regulatory framework of the sector with the 2010 Constitution and its

devolution framework, as well as global trends in sustainable energy (Figure 1). Some of the key provisions are (a) the establishment of an obligation on the part of the National Government and county governments to provide affordable energy services to all areas; (b) sharing of roles of electricity planning, development, services, and regulation between the National Government and county governments; and (c) enhancing competition in the power sector. The bill also envisages creation of new institutions or expanded mandates for existing entities, particularly an Energy Regulatory Authority, a Rural Electrification and Renewable Energy Corporation (REA's new mandate), and Energy and Petroleum Tribunal. The Energy Bill is expected to be approved by the senate by December 2017.

8. Kenya's generation capacity currently stands at a comfortable 2,300 megawatts (MW) while peak demand reached 1,636 MW.[3] Installed capacity grew by about 800 MW between 2010 and 2015, and the recent commissioning of 280 MW of new geothermal power in Olkaria fields (supported by the World Bank, under Kenya Electricity Expansion Project -P103037) expanded the contribution of renewable energy to 49 percent of total electricity generation, displacing conventional thermal generation and propelling Kenya as a global leader in renewable-based generation. Several transmission projects were recently completed or are ongoing to ensure proper evacuation of new generation projects as well as to extend power service to unconnected areas of the country. However, transmission capacity needs to be scaled up substantially to ensure quality of service delivery to the rapidly growing consumer base and to support income generation and productive growth.

Figure 2. KPLC Customer Connections (millions)



Source: KPLC.

9. The GoK has embraced electrification as a flagship endeavor with a focus on the distribution sector reaching all Kenyans with energy services by 2020. Kenya has emerged as a star in achieving progress on electrification, from 23 percent in 2009 to about 50 percent in 2016, underpinned by huge investments across the sector value chain. Today, there are about 5 million KPLC consumers - more than 1 million consumers have been added annually in the past two years (Figure 2). The GoK has adopted the Last Mile Connectivity Program (LMCP) as the primary grid densification vehicle—to connect all consumers within 600 m of a transformer—and assembled close to US$700 million in donor resources (including the World Bank-financed Kenya Electricity Modernization Project [KEMP-P120014]) to speed

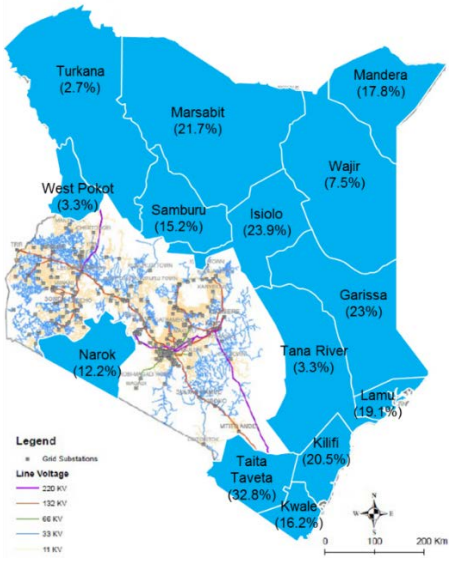
3 This wide margin is justified by the hydrological seasonality uncertainties that make the overall power system more vulnerable, hence the need for a comfortable level of generation capacity well beyond peak demand.

up access in grid-connected areas. Since Kenya's grid is almost exclusively concentrated in the central corridor where there is the highest population density (Annex 6), this approach is the least-cost way of harnessing economies of scale in network design with a potential of reaching about 70–80 percent of consumers.

10. Kenya is also leading the way on balancing a rapidly growing electrification program with consumer affordability in a financially sustainable manner. The LMCP design encompasses a substantial decrease in the connection fee charged to household customers—from KES 35,000 (US$343) to KES 15,000 (US$147) (to be paid in installments). However, such consumer connection charges are insufficient to cover the connection costs (of US$1,000 per connection) borne by KPLC. New households are overwhelmingly low-volume consumers paying a lifeline tariff and are cross-subsidized by other consumers. Initially, KPLC shouldered this gap with commercial loans, but this imposed an increasing burden on the utility's finances. To ensure sustainability, a two-pronged approach was implemented: first, in 2015, a World Bank guarantee (IDAG2330)[4] supported KPLC to restructure US$500 million of short-term, expensive, commercial debt into a long-term maturity loan and, second, a concessional debt by the donors to the GoK is being on-granted to KPLC for electrification purposes, thereby keeping the debt off KPLC's books.

11. While 5.5 million consumers are connected to the grid, about 4 million households currently lack access to electricity. It is expected that 3 million new users will be reached through the traditional grid extension approach (LMCP and grid expansion) while the remainder would achieve access through off-grid solutions, such as stand-alone solar systems and mini-grids. While not the focus of this project, grid expansion will take time and is not guaranteed in the near term; therefore, there are areas extending 15 km beyond existing KPLC infrastructure that may also be the target of temporary interventions such as stand-alone systems or mini-grids. The areas highlighted in blue in the Figure 3 represent the areas beyond the planned grid extension and are also the counties selected in the proposed project.

Figure 3. Grid Map of Kenya, Highlighting Underserved Counties



[4] On June 16, 2017, approval was granted transferring IDA G2330 from P120014 to P145104

Note: Numbers in parenthesis indicate electrification rates.

12. With World Bank support, Kenya has recently launched the Multi-tier Framework (MTF) Survey to accurately estimate the quality of energy access. The MTF, developed by the Global Tracking Framework of Sustainable Energy for All,[5] moves beyond the traditional binary way of defining electrification to adopt a tiered definition (Tier 1 to Tier 5) based on the attributes of energy service such as affordability, reliability, legality, and so on. The survey will provide key insights into supply alternatives that households are using and will provide additional demand data on energy-related expenditure, as well as into user preferences and satisfaction with service. While the survey will be nationally representative, it will be oversampled on the project counties to develop a nuanced understanding of the socioeconomic profile of communities in these areas. The emerging results from this survey are presented in Annex 1.

Kenya Has a Long History of Off-grid Electrification in Both Mini-grids and Stand-alone Systems

13. **Stand-alone solar home systems.** Kenya is unique in the world in terms of the depth and dynamism of its solar off-grid market. The market for stand-alone solar photovoltaic (PV) systems started to be developed in Kenya in the mid-1980s but was catalyzed in 2008 when Kenya was selected as one of the two pilot countries for the Lighting Africa program.[6] The off-grid solar PV market in Kenya has been growing exponentially: 2.7 million quality-certified lanterns and small solar kits have been sold since 2009, out of which 700,000 were sold in FY15 (Figure 4). The share of quality products improved rapidly—more than 40 percent of the off-grid lighting market now consists of products that have met Lighting Global standards,[7] up from just 3 percent in 2009. Kenyan private sector players have developed innovative business models to reach more customers over the past years, including developing efficient supply channels for cash sales of portable lanterns and solar home systems (SHS)[8]; pioneering the rollout of technological approaches such as pay-as-you-go (PAYG) systems that enable customers to pay for their solar products in affordable, monthly installments, often through mobile money; and attracting private equity and debt capital to fund their fast-growing businesses.

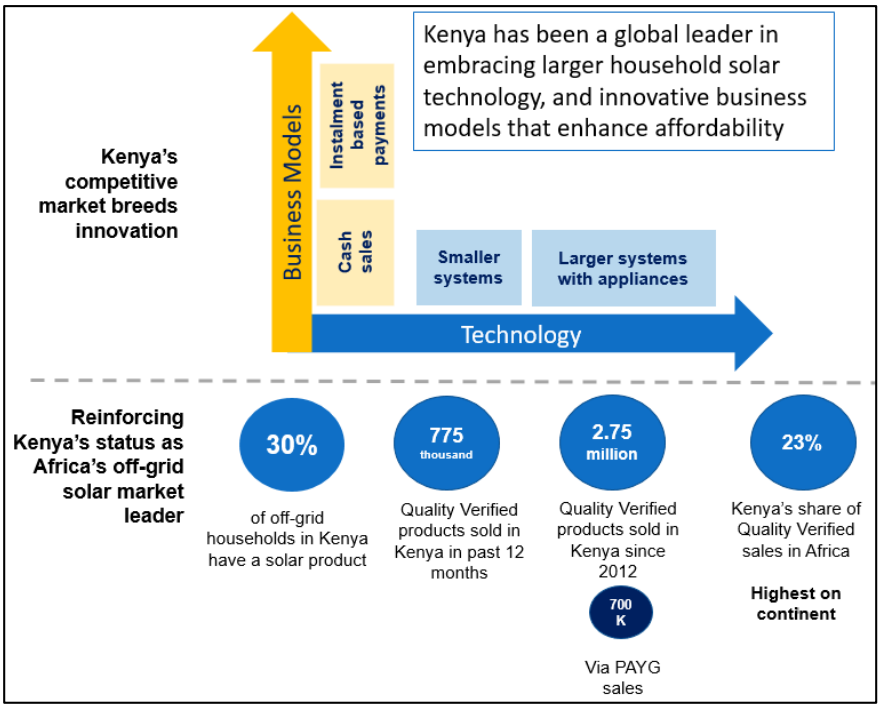
5 See http://trackingenergy4all.worldbank.org/. Under the MTF, Tier 1 (minimum 12 Wh per day) and Tier 2 (minimum 200 Wh per day) are defined as providing access up to four hours per day and at least one hour at night and can be used for basic applications such as task lighting, radio, and phone charging. Tier 3 has a minimum of one kWh per day and up to eight hours per day and at least three hours at night. Tier 4 has a minimum of 3.4 kWh per day and up to 16 hours per day and at least four hours at night. Tier 5 consists of safe, reliable, unlimited 24-hour service from a grid system.

6 Lighting Africa, a joint International Finance Corporation (IFC) and World Bank program launched in 2007, was the first private sector-oriented effort to leverage new light-emitting diode (LED) lighting technologies to build sustainable markets that provide safe, affordable, and modern off-grid lighting to communities in Africa that lack access to electricity. The program developed standards and a testing methodology to support quality products (and began to test solar lanterns available in the Kenya market); provided the private sector information about the market and consumers and business development services; and carried out a comprehensive consumer awareness program focused on promoting high-quality products.

7 Lighting Global supports the growing global market for modern off-grid lighting with a widely applicable, rigorous quality assurance framework. The key quality assurance activities include measuring, benchmarking, and communicating information about product quality and performance.

8 SHS feature a PV panel or panels, a charge controller, a large rechargeable battery, multiple light fixtures, and an interface for connecting devices such as mobile phones and direct current (DC)-powered appliances such as radios, televisions, fans, and other small appliances.

Figure 4. Status of Stand-alone Solar PV Systems in Kenya



Source: World Bank analysis, Lighting Africa.

14. Kenya's thriving off-grid solar industry translates into robust competition, with companies seeking to differentiate themselves to customers through their product offerings. Products range from small portable task lights that retail for US$5 up to larger SHS that are capable of powering appliances such as TVs, fans, satellite decoders, and refrigerators. Several companies offer entry-level multi-light systems, typically with two–four fixed light points, a portable lantern, a radio, and mobile phone charging capabilities. Many of these companies then offer larger systems capable of powering appliances to their same customers, often using modular systems to scale up their power generation and storage capacity.

Figure 5. Examples of SHS offerings in Kenya

Tier 1 offering (M-KOPA IV)
- 2 fixed lights
- 1 portable light
- Radio
- Phone charging capabilities

Tier 2 offering (Mobisol Buffalo)
- 19" flatscreen TV
- 4 fixed lights
- 1 portable light
- Radio
- Phone charging capabilities

15. **Mini-grids.** The mini-grid program to electrify remote centers has also been running since the 1980s. Currently, there are 20 Government-developed (public) mini-grid stations owned by REA and managed by KPLC. The total operational capacity installed for these mini-grids is roughly 20 MW, overwhelmingly dominated by diesel fueled plants, serving larger towns in the remote areas. There are also mini-grid IPPs (for example, entities that combine self-generation with providing power to neighboring communities and sometimes injecting power into the national grid), as well as privately owned and operated mini-grids developed by nongovernmental organizations (NGOs), communities, and private companies located throughout the country. It is currently estimated[9] that the capacity of all privately developed mini-grids is roughly 66 MW. Again, however, the expansion of mini-grids in the underserved counties has been limited. REA and KPLC have focused on electrification of urban centers, while private sector mini-grids have in general been deployed in the more populated 'core' market. Smaller rural towns in underserved counties remain, in general, without power.

16. **The GoK would like to expand electricity services to underserved areas through mini-grids and stand-alone systems as grid penetration remains limited, poverty is rampant, and social exclusion is prevalent.** These underserved areas, which cover the geographical scope of the proposed project, are identified as 14 counties, deemed 'marginalized' by the Commission on Revenue Allocation (CRA). Due to the remoteness and sometimes dispersed nature of the target populations and considering the socioeconomic profile and lifestyles of those residing in these counties, the proposed project is designed to address high costs of provision of infrastructure services, low affordability of the potential users, and sustainability of service provision using an abundantly available renewable energy resource.

17. **The socioeconomic profile, geography, and remoteness of the populations in these counties make an ideal case for off-grid provision.** The availability of wind and solar resources is also relevant for utility-scale development for input to the grid and such developments are happening. However, the potential of grid expansion in these underserved counties remains limited at present. Such off-grid

[9] "Kenya: Preparation of a Program for the Promotion of Investments in Green Mini-Grids" executed by the French Development Agency (*Agence Francaise de Developpement*, AFD) with support from Economic Consulting Associates and EED Advisory a part of the Green Mini-Grids Kenya program of U.K. Department for International Development (DFID), April/July 2015, and "Kenya Market Assessment for Off-Grid Electrification," Final Report, October 2015, executed by IFC with support from Carbon Africa Limited, Trama TecnoAmbiental S.L., Research Solutions Africa Limited, and Energy Research Centre of the Netherlands.

solutions, as envisaged in the proposed project, are a pre-electrification solution. As and when demand grows, the geospatial analysis will provide guidance on whether capital investments need to be made for grid-based solutions.

18. **The proposed project is part of the implementation road map of the National Electrification Strategy[10] (NES), underpinned by a geospatial plan** that lays out the technical, financial, and institutional road map to universal electrification in Kenya by 2020. The draft NES, expected to be finalized in September 2017, proposes mechanisms to balance KPLC's consumer intensification with service provision beyond the grid. The people inhabiting the underserved areas are largely cash poor, nomadic, and pastoralist—in contrast with those living in grid-connected areas—also known as the core market. Roughly 80 percent of households currently with SHS are located within 5–10 km of the national grid, with the footprint in off-grid areas negligible (Annex 6). Therefore, the challenge is to create mechanisms to incentivize the private sector to deliver services in these areas in a sustainable manner; dovetail with anchor loads such as community facilities to reach remote households; and ensure affordability for consumers and adequacy of revenue for service providers. See Annex 8 for more on the NES.

19. **The proposed project is designed around three core principles: diversification, private sector participation, and flexibility**. The first principle is ensuring that the project reaches diverse beneficiaries with varied needs including households, community facilities such as health centers, secondary schools, county offices, and so on. Even then, the economies of scale are such that reaching all consumption points together allows a more attractive opportunity for the private sector as well as benefits for the consumers in the form of longer-term reliable and affordable energy services. The second principle centers on maximizing private sector participation in the delivery of off-grid energy services. Leveraging private sector investment will help reach a larger number of beneficiaries, maximize project impact, and support sustainability of service. Third, the project recognizes that achieving these outcomes requires flexibility with respect to market approaches. This spectrum ranges from fully market-delivered approaches to more regulated ones where the Government maintains a leading role in service provision. Most often, this necessitates a hybrid approach that leverages the comparative advantages of both public and private sectors. Such flexibility recognizes the complexities associated with delivering energy services in off-grid areas and seeks to maximize the likelihood of success through tailored approaches to sustainable market development.

20. By virtue of its design, the proposed project brings together strengths of the World Bank Group. It is a collaboration with International Finance Corporation (IFC) and World Bank's Lighting Africa program as well as with Finance and Markets and Water Global Practices of the World Bank. he proposed project is expected to be complemented by a carbon grant from Carbon Initiative for Development (Ci-Dev). The grant will support connection subsidies in Component 1 and results-based payments for sustainability of service for Components 2 and 3.

C. Higher Level Objectives to which the Project Contributes

21. The proposed project is aligned with the Country Partnership Strategy (CPS, FY14–18),[11] whose overarching goal is the sustainable reduction in poverty and an increase in shared prosperity. Aligned both

10 Supported by KEMP (P120014).
11 Report No. 87024-KE.

with Kenya's Vision 2030 and its Medium-Term Plan, the strategy highlights three domains of engagement: (1) Competitiveness and sustainability—growth to eradicate poverty; (2) Protection and potential—human resource development for shared prosperity; and (3) Consistency and equity—delivering a devolution dividend. The proposed project directly links to these domains as it will provide energy services to households and energy and water services to public institutions/community facilities. An expected outcome of CPS Domain 1 is "Improved Enabling Environment for Private Investment." The proposed project will utilize IDA resources to leverage private sector finance and harness private sector efficiencies in a hitherto risky endeavor. CPS Domain 2 calls for renewed efforts to include the marginalized and disadvantaged. As such, the proposed project will target communities in Kenya's 14 underserved counties—a largely indigenous population that is particularly affected by public health predicament also arising from a lack of energy services. Additionally, Domain 2 of the CPS also prioritizes improving access to basic water services. The project is in line with the Progress and Learning Review (PLR) which proposed to extend the CPS by two years to FY20, and the domains of engagement remain the same as in the CPS. The proposed project will focus on the installation and maintenance of solar water pumps for drinking water, contributing to this priority

22. The proposed project is a part of the World Bank's NEDI. The initiative, launched in June 2016, focuses on transformative and integrated infrastructure (energy, transport, and water) investments that are needed to connect the region to national and global markets. Success will require strong collaboration with the National Government and county governments, the private sector, community based organizations, and development partners. The proposed project has received the strong endorsement of the President of Kenya as well as the Governors of NEDI counties.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

23. The Project Development Objective is to increase access to modern[12] energy services in underserved counties of Kenya.

B. Project Beneficiaries

24. The proposed project is expected to provide electricity services to approximately 277,000 households (close to 1.3 million people), 1,097 community facilities, and 380 boreholes. Additionally, 150,000 efficient cookstoves will be sold and installed in the target counties. Beneficiaries will receive modern and climate-friendly infrastructure services such as electricity, improved water, and cooking solutions for the first time and replace consumption of alternative fuels and unimproved options. The beneficiaries are located in counties deemed marginalized by the CRA and consist primarily of the relatively cash-poor, remote, indigenous, and pastoralist population. Many of these areas have also experienced significant security disruptions in recent years. Therefore, provision of infrastructure facilities, energy and water, could have a profound impact on these communities.

[12] Electricity and modern cooking solutions.

C. PDO-Level Results Indicators

25. The PDO level indicators are the following (Section VII presents the full Results Framework):

Indicator Name	Core	Unit of Measure	Baseline	End Target
People provided with new or improved electricity service (Corporate Results Indicator)	X	Number	0.00	1,272,525
Community facilities provided with new or improved electricity service	X	Number	0.00	1,097
Renewable energy generation capacity (other than hydropower) constructed under the project (MW) (Corporate Results Indicator)	X	Megawatts	0.00	9.6

III. PROJECT DESCRIPTION

A. Project Components

26. The project will be implemented in 14 counties in the north and northeastern parts of Kenya (Garissa, Isiolo, Kilifi, Kwale, Lamu, Mandera, Marsabit, Narok, Samburu, Taita Taveta, Tana River, Turkana, Wajir, and West Pokot). These counties have been defined as 'marginalized areas' by the CRA. The CRA defines these as "communities that have been excluded from social and economic life of Kenya for different reasons" and "geographic locations (county or sub-county) where significant populations of underserved communities live" (CRA 2013[13]). Four of these counties (Kwale, Kilifi, Narok, and Taita Taveta) are not part of NEDI. The 14 underserved counties collectively represent 72 percent of the country's total land area and 20 percent of the population, including historically nomadic societies that even today rely on pastoralism. Their population is highly dispersed, at a density four times lower than the national average. They present profound infrastructure deficits, including lack of access to roads, electricity, water, and social services. There is also significant insecurity in certain areas, giving rise to substantial numbers of displaced persons and livelihood adaptations that further undermine economic prosperity.

27. The project proposes a comprehensive suite of investments to provide modern energy services to households, enterprises, and community facilities, with pragmatic business models to attract private sector investment, sustainable services, know-how, and efficiencies. A substantial TA component is proposed to support a widespread consumer education campaign to inform and engage with citizens, create a new strategic planning and program management (SPPM) unit to coalesce sector planning and NES implementation efforts, and launch an inclusive county capacity-building program across various dimensions identified through a needs assessment.

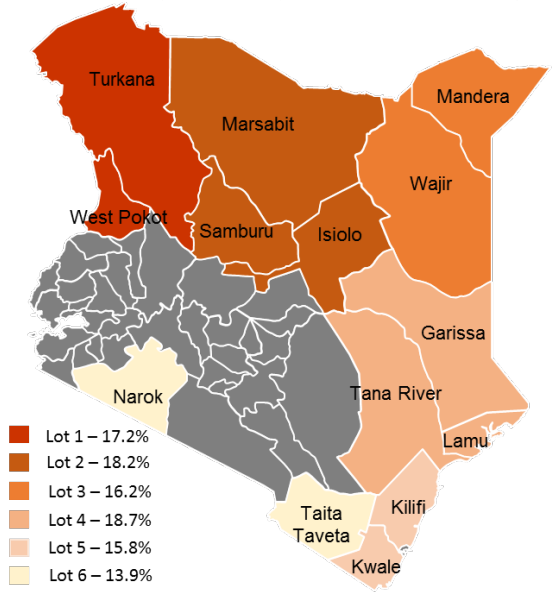
28. The project area is divided into six lots (referred to as 'service territories' hereon) based on county allocations derived from scale of challenge (unelectrified population and community facilities), poverty index, and population density to (a) achieve greatest impact with limited IDA resources; (b) deliver services where the need is the largest; (c) consider additional costs due to low population density, and (d)

13 Commission on Revenue Allocation, Policy on the Criteria or Identifying Marginalised Areas and Sharing of the Equalisation Fund, February 2013.

consider principles of equality such that all the counties should benefit in a similar manner (Figure 6). Such a division into lots allows economies of scale in the procurement and elicits private sector contractors to be present in these underserved counties over a long term. All the procurements in the proposed project will be carried out according to these lots. [14]

29. The implementing agencies (IAs) are the Ministry of Energy and Petroleum (MoEP), KPLC, and REA. Components 1 and 3 will be implemented by KPLC and REA. Component 2 will be implemented by the MoEP through a competitively selected consortium as a facilities manager. The MoEP will implement Component 4 as well.

Figure 6. Proposed Project Funding Allocation and Solutions per Lot/Service Territory



% indicates funding allocation per Service Territory under Components 2 & 3

Lot/ Service Territory	County	Mini-grid Sites	Solar Systems				Solar Pumping Systems	Cook stoves
			Homes	Secondary Schools	Level 2 & 3 Health Clinics	ACC Offices		
1 Northwest	West Pokot	26	42,953	42	165	22	65	34,018
	Turkana							
2 North	Marsabit	29	45,432	28	133	17	69	35,982
	Samburu							
	Isiolo							
3 Northeast	Mandera	32	40,537	23	112	23	62	20,066
	Wajir							
4 East	Garissa	23	46,695	15	127	22	71	23,114
	Tana River							
	Lamu							
5 Southeast	Kilifi	1	39,568	52	104	5	60	19,586
	Kwale							
6 South	Taita Taveta	10	34,815	47	143	17	52	17,233
	Narok							
	Total	121	250,000	207	784	106	380	150,000

Component 1: Mini-grids for Community Facilities, Enterprises, and Households (IDA US$40 million equivalent)

30. This component will support the electrification of areas where electricity supply through mini-grids represents the least-cost option from a country perspective, as underpinned by the geospatial plan.

14

Category/Dimensions	Weight (%)	Indicator	Calculation
Poverty gap	50	x = 5 – wealth index *Source:* DHS 2014	$100 \times \frac{x_i}{\sum_{i=1}^{14} x_i}$
Need for electricity services	35	y = Unelectrified structures (that will not be served by KOSAP mini-grids) *Source:* World Bank analysis (geospatial study)	$100 \times \frac{y_i}{\sum_{i=1}^{14} y_i}$
Cost premium for infrastructure development	15	z = 100 – population density *Source:* DHS 2014	$100 \times \frac{z_i}{\sum_{i=1}^{14} z_i}$
Total	100		

Note: DHS = Demographic and Health Survey.

Depending on the number of users to be supplied and the service level defined for each type of user (households, enterprises, community facilities, and so on), the generation system of each specific mini-grid will combine solar PV, battery storage, and thermal units running on diesel. Mini-grids will be developed under a public-private partnership (PPP) whereby private investment and public funds co-finance construction of generation facilities, and public funding is used to construct the distribution network. A single private service provider (PSP) will be responsible for construction (and partial financing) of the generation system and for construction of the distribution network of each mini-grid. The same PSP will sign two long-term contracts with KPLC: (a) a 7–10-year PPA for the operation and maintenance (O&M) of the generation system and recovery of the privately financed part of the investment and (b) a 7–10-year service contract for O&M of the distribution network, including revenue cycle services (as required). Ultimately, after the recovery of the private investments, all assets (both generation and distribution) will be in GoK ownership. All electricity consumers supplied through mini-grids will be KPLC customers and pay the same tariff for each category charged to users connected to the national grid, ensuring effective implementation of a national uniform tariff policy.

31. The component will be implemented in approximately 120 locations throughout the 14 target counties, typically in mini-grids supplying 100–700 prospective users, with an approximate total demand of 20–-300 kilowatt (kW). These potential sites, capturing approximately 27,000 consumers in total, have preliminarily been identified as part of the geospatial plan. Each service territory will comprise 20 or more mini-grids located in geographically contiguous areas, with 2,000 or more serviceable customers. There will be a mix of more densely populated sites and less densely populated sites in each lot, where possible, to enhance their overall commercial attractiveness. PSPs can bid separately for each lot, with multiple lots potentially awarded to the same PSP.

32. REA and KPLC will jointly implement the component, with the procurement of lots divided among them. This component will be complemented by TA, under Subcomponent 4.2, to (a) confirm the sites through further feasibility studies and techno-economic analysis; (b) promote productive and efficient use of energy by users; and (c) provide technical, legal, and procurement support to effectively design the bidding documents and supervise the construction of the mini-grid assets.

Component 2: Stand-alone Solar Systems and Clean Cooking Solutions for Households (IDA US$48 million equivalent)

33. **Subcomponent 2A: Stand-alone Solar Systems for Households (IDA $42 million equivalent).** This subcomponent will support off-grid electrification of households in the 14 target counties where a stand-alone solar system is the most appropriate technology to deliver energy services, leveraging Kenya's unique off-grid solar market dynamics and innovations. The subcomponent will provide incentives for solar off-grid companies currently operating in the more densely populated areas of Kenya to expand to underserved counties and provide services to the off-grid households in these counties. These services, provided through portable SHS, are well-suited to some of the population in the underserved counties, as the households do not always live in permanent structures. In addition, affordability is ensured by allowing the households to pay for systems over time. The willingness–to-pay analysis, confirmed by the

preliminary results from the MTF surveys, shows over half a million households that could theoretically afford a Tier 1 level SHS.[15]

34. The subcomponent will be accomplished through two financing instruments to which eligible solar service providers (SSPs) will have access:

i. **Results-based financing (RBF) facility, competitively awarded incentives**, to compensate SSPs for initial, ongoing incremental, and opportunity costs associated with an expansion of operations in underserved counties. A percentage cap will be set within each lot so that multiple service providers will have the opportunity to operate within the space. A competitive approach will be used, whereby service providers will bid based on a financing amount per household connection, with the lowest financing requirements winning. RBF will specify installment payments based on the achievement of pre-agreed connection milestones and satisfactory after-sales service support.

ii. **Debt facility, debt financing to SSPs**, to support up-front costs associated with getting hardware inventory into the market and medium-term consumer financing to enable households to pay off the systems over time. Two typologies of business models underpin the majority of SSPs that operate in the Kenyan market. First are service providers that sell solar products on an over-the-counter (cash sale) basis. These service providers require shorter-term debt in U.S. dollars or other major foreign currency to finance costs associated with hardware manufacture and transit to Kenya (typically from China) until a sale is made. This cycle typically lasts anywhere from six to nine months. A second prevailing business model is PAYG, whereby customers pay for the systems in monthly installments (typically between 12 and 36 months), and SSPs carry the default risk during the payback period. In addition to hard currency working capital debt, these businesses must also borrow local currency so as to be able to extend credit to their customers. Given that service providers' revenues are in local currency, solar service providers require loans in Kenyan shillings. Debt under the facility will only be denominated in local currency, given that project funds will be held in Kenyan shillings.

35. The implementation of this subcomponent will be under the direct oversight of the MoEP. The MoEP will competitively select the Facility Manager, which will be a consortium with demonstrated experience with managing similar instruments in Kenya and similar geographies. An OP 10.00 assessment of financial intermediary financing will be carried out for the Facility Manager as part of the procurement process, and expected to be completed within effectiveness period.

36. **Subcomponent 2B: Clean Cooking Solutions for Households (IDA US$6 million equivalent).** This subcomponent will support a transition from low-efficiency baseline stoves to cleaner, higher-efficiency improved stoves. To accomplish this objective, cleaner household cooking appliances and fuels will be promoted. Activities will begin by focusing on five underserved counties in the northwestern part of the country (West Pokot, Turkana, Isiolo, Samburu, and Marsabit). A Stove-Market Testing Program will be

15 Simulations using 2014 FinAccess household survey data show that in a scenario where 7 percent of household expenditures are made on stopgap lighting, over 500,000 of the 1.2 million off-grid households could afford a PAYG SHS offering (assuming a 3-light point system, offered at a monthly cost of KES 500 and paid off over 36 months).

undertaken in the urban areas and densely settled parts of Turkana County with the support of ESMAP. The stoves to be included will be determined following a call for Expressions of Interest from stove manufacturers wanting their products to be exposed to these new markets. To be eligible, a woodstove will have to prove that its efficiency tests as a Tier 2 stove (roughly 30 percent efficient) and a charcoal stove will have to prove that its efficiency tests as a Tier 3 stove (roughly 40 percent efficient) to be eligible for inclusion in the market tests. These tests involve exposing both consumers and suppliers (retailers, wholesalers, and distributors) in the urban areas of Turkana County to these improved stoves. The results will be shared with the communities and interested parties. Field testing for additional stove models may be considered during the project implementation.

37. This subcomponent will operate a small window of the results-based facility established for Subcomponent 2A to support sales of eligible stoves in targeted counties. The facility will provide the selected distributors with financial support via a package of results-based incentives to enable them to market their stoves locally within the target counties, to increase their inventories of the selected higher-quality stoves, to purchase and transport them to the target communities in number, and to sell them in the communities. After the initiation of these activities in the Lot 1 and 2 counties (as presented under Subcomponent 2A), technical assistance funds will be used to prepare a similar activity in the second block of counties comprising Lots 5 and 6, excluding Narok.

Component 3: Stand-alone Solar Systems and Solar Water Pumps for Community Facilities (IDA US$40 million equivalent)

38. **Subcomponent 3A: Stand-alone Solar Systems for Community Facilities (IDA US$25 million equivalent).** This subcomponent will support the provision of electricity services to community facilities[16] in remote areas in underserved counties. A private sector contractor will be competitively selected for each service territory to supply, install, and maintain stand-alone solar systems in community facilities. A total of about 1,100 facilities could be reached through this subcomponent.

39. KPLC, the IA, will sign two contracts with the contractor in each service territory—one for the supply and installation of the stand-alone solar systems and the other for the provision of maintenance services for 7–10-year duration. The contract will specify the minimum requirements with regard to quality standards in electricity supply for the community facilities, developed by the Ministry of Health, Ministry of Education, and Ministry of Interior. Contracts will stipulate the minimum package acceptable as 'basic service' but allow room for provision of additional services to community facilities. The proposed project will cover the supply and installation costs and KPLC will pay the contractor fees under the maintenance contract with allocation or revenues from beneficiary facilities. The costs of maintenance contracts are expected to be passed through into tariff revenues recognized by the ERC.

40. KPLC will take the retail risk of serving these new consumers, for which their payment record for such an arrangement is still unknown. Therefore, a payment risk mechanism will be available to KPLC, to

16 The community facilities considered in this component are the existing and upcoming: (a) health facilities (Levels 2 and 3); (b) educational facilities (secondary schools and technical training institutes); and (c) administrative offices (for example, Assistant County Commissioner offices).

which the proposed project will set aside funds equivalent to 6–12 months of maintenance fees that KPLC can draw upon in case of inadequate revenues to pay the contractor.

41. **Subcomponent 3B: Solar Water Pumps for Community Facilities (IDA US$15 million equivalent).** This subcomponent will support financing solar-powered pumping systems to increase sustainable access to water supply by equipping new boreholes and retrofitting existing diesel-powered boreholes associated with community facilities within the target counties. A private sector contractor will be competitively selected for each service territory to supply, install, and maintain stand-alone solar systems in community facilities.

42. REA, the IA, will sign two contracts with the contractor in each service territory—one for the supply and installation of the stand-alone solar systems and the other for the provision of maintenance services for a 7–10-year duration—similar to the design in Subcomponent 3A. The payment for maintenance services will be recovered on a monthly basis (or at a frequency determined by relevant stakeholders—counties, REA, and community facilities) from community facilities hosting these boreholes.

43. A payment risk mechanism will be available to REA, to which the proposed project will set aside funds equivalent to 6–12 months of maintenance fees that REA can draw upon in case of inadequate allocation from the beneficiary facilities to pay the contractor.

Component 4: Implementation Support and Capacity Building (IDA US$22 million equivalent)

44. **Subcomponent 4A: Consumer Education and Citizen Engagement (IDA US$2 million equivalent).** This subcomponent will support the consumer education and citizen engagement activities for the program's key delivery areas. Consumers in these areas are unlikely to be aware of the new technologies being presented and have a right to expect clear, thorough information about the advantages of the services and how to access them. The activities supported under this subcomponent will provide recurring opportunities for consumers to interact with service providers to share their feedback and concerns. For those who have some knowledge of the products, these outreach activities will provide them with the necessary guidance on how to get the best out of the products in the way they use and maintain them. Finally, in these target areas, acceptance and sustained demand is generated when the buy-in of key opinion leaders is obtained. The consumer education and citizen engagement program will employ both 'above the line' (ATL) (mass media tools) and 'below the line' (BTL) (one-on-one) channels to reach out to different target audiences while ensuring opportunities for two-way dialogue.

45. **Subcomponent 4B: Implementation Support and Capacity Building (IDA US$20 million equivalent).** This subcomponent will support a program of activities designed to strengthen the capacity of the Recipient for Project management, implementation and coordination, monitoring and evaluation, including: (i) financing the fees for managing and operating the RBF Facility and Debt Facility; (ii) provision of technical assistance and undertaking sector studies; (iii) establishing a strategic planning and program management unit with within MoEP and supporting project implementation in MoEP, KPLC, and REA; (iv) provision of technical assistance for sector County capacity building; (v) establishment of a quality of service monitoring unit in the Energy Regulatory Commission; and (vi) capacity building of underserved Counties.

B. Project Cost and Financing

46. The breakdown of project costs and financing by component is as follows.

Table 1: Breakdown of Project Cost and Financing by Component (US$)

Project Components	Project Cost	IDA Financing
1. Mini-grids for Community Facilities, Enterprises, and Households	40,000,000	40,000,000
2. Stand-alone Solar Systems and Clean Cooking Solutions for Households *Subcomponent 2A: Stand-alone Solar Systems for Households* *Subcomponent 2B: Clean Cooking Solutions for Households*	48,000,000 *42,000,000* *6,000,000*	48,000,000 *42,000,000* *6,000,000*
3. Stand-alone Solar Systems and Solar Water Pumps for Community Facilities *Subcomponent 3A: Stand-alone Solar Systems for Community Facilities* *Subcomponent 3B: Solar Water Pumps for Community Facilities*	40,000,000 *25,000,000* *15,000,000*	40,000,000 *25,000,000* *15,000,000*
4. Implementation Support and Capacity Building *Subcomponent 4A: Consumer Education and Citizen Engagement* *Subcomponent 4B: Implementation Support and Capacity Building*	22,000,000 *2,000,000* *20,000,000*	22,000,000 *2,000,000* *20,000,000*
Total Costs	150,000,000	150,000,000

C. Lessons Learned and Reflected in the Project Design

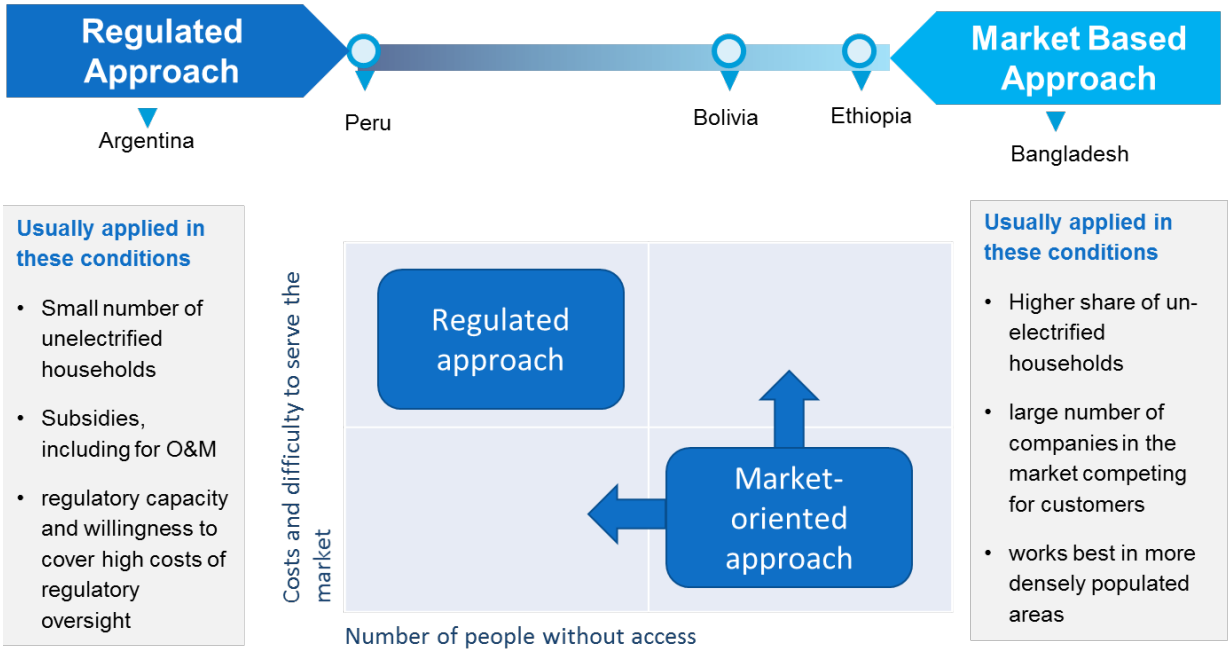
47. Over the past decades, the World Bank and other development partners have supported off-grid SHS projects providing access to modern energy services to more remote households, businesses, and institutions that could not be reached by conventional grid expansion. Among the most cited successful examples are projects in Sri Lanka,[17] Bangladesh,[18] Mongolia,[19] Bolivia,[20] Peru,[21] Argentina,[22] and Ethiopia (Figure 7). The project benefits from a long history of World Bank, other donor, and private sector involvement in mini-grids (Mali, Tanzania, India, Cambodia, and so on). Traditionally, the mini-grids were hydro or diesel powered. Recently, the advances of solar PV technology have resulted in a surge of solar PV battery or solar PV diesel hybrid mini-grids around the world; this technology is rapidly becoming lower cost than diesel, in particular in remote locations where diesel supply is a challenge. Given the excellent solar energy potential in most low-access countries, solar PV technology represents an opportunity to deploy mini-grids at a much larger scale than previously possible.

Lessons from SHS Projects

17 Govindarajalu, C., Raihan Elahi, and Jayantha Nagendra. 2008. *Electricity Beyond the Grid: Innovative Programs in Bangladesh and Sri Lanka.* ESMAP, World Bank.
18 Sadeque Z., Raihan Elahi, and Dana Rysankova. *Scaling up Access to Electricity: The Case of Bangladesh*. World Bank Livewire.
19 Jayawardena M., Salvador Rivera, and Chrisantha Ratnayake. 2012. *Capturing the Sun in the Land of the Blue Sky: Providing Portable Solar Power to Nomadic Herders in Mongolia*. World Bank.
20 Reiche K., Dana Rysankova, and Susan Goldmark. 2007. *Output-Based Aid in Bolivia: Balanced Tender Design for Sustainable Energy Access in Difficult Markets*. OBA Approaches, GPOBA.
21 http://www.worldbank.org/en/results/2014/09/24/peru-brings-electricity-to-rural-communities
22 Argentina, Renewable Energy in the Rural Market Project, Implementation Completion Report, 2013.

48. **A wider range of solutions and flexible business models in one country** (in parallel or sequentially) are needed to respond to the diverse needs of varied population of different characteristics, the geographic population density and housing patterns, and income segments. The new technologies, falling costs, and innovative business models provide an opportunity to reach a much wider spectrum of the population, including the poor, by catering to a much broader range of technology options, business approaches, and intervention mechanisms, which can be provided in parallel. This also allows leveraging transaction costs over larger disbursement volumes and scaling up the off-grid project ambition.

Figure 7. Spectrum of Off-grid Options



Source: World Bank analysis.

49. **Malleability to adapt to the changing environment is important.** The proposed project has been designed to be flexible to adapt to changes in market conditions and consumer needs. Most of the off-grid electrification programs have evolved over time with important design features changed or new features introduced midcourse. In Bangladesh, both microfinance and fee-for-service models were introduced, but the microfinance model was much more effective to reach households and the fee-for-service model was abandoned. In addition, the market uptake was accelerated significantly, when consumer buyback schemes for purchasing SHS were introduced a few years into the program, reducing the risk perception of the users. Over time, smaller systems were also introduced to serve poorer market segments, as technology advancements reduced the cost and increased the efficiency of SHS. In Ethiopia, in contrast, the original focus was to support distributors of solar lanterns, but over time the project is now moving toward supporting larger systems. In the Philippines, the dealer-based model of selling SHS fell short of achieving the access targets set by the Government, and a fee-for-service mode was adopted during the course of the project. The same was the case in Cambodia. The initial pace of SHS installation was very sluggish, primarily because rural households could not afford the up-front payments to the suppliers. The model was then changed to a 'hire-and-purchase model'. In Mongolia the project planned

for a network of private dealers that would self-finance the purchases of SHS and then sell them to herders. However, there was a midcourse correction as the ability of the private sector to buy in bulk was overestimated, as was their ability to reach widely dispersed herders. Instead, the project adopted the Government's parallel program of buying the SHS and then distributing them to herders through far-reaching Government channels. In Bolivia, one of the two companies, which were awarded midterm service contracts, declared a bankruptcy and the contracts had to be re-awarded midcourse.

50. **Quality control matters.** It is crucial to establish quality assurance of product performance at the beginning of a project to establish credibility and consumer confidence. The need for quality assurance for SHS was determined early in the Bangladesh project. Procurement of the SHS was the responsibility of the microfinance institutions and NGOs, which were to follow established commercial practices. Stringent quality standards were set, including a five-year warranty for batteries, and these quality standards were strongly enforced. In Mongolia, as a result of adoption of international standards for SHS as well as robust after-sales service and warranties, the credibility of these products in the eyes of the consumers was enhanced. The impressive efforts of Lighting Africa in establishing and certifying products has been instrumental in kick-starting the East African market. At the same time, in the fast-evolving technology environment, it is important that the quality standards adapt to reflect the latest available technologies so that they do not become a barrier to introducing more efficient technologies.

51. **Sustainability of the program must be thought through up front.** While designing off-grid electrification business models, it is advisable to think carefully about sustainability up front and to set up strategy beyond the project life. In designing SHS programs for rural areas in Cambodia, the choice of appropriate system sizes based on robust up-front analysis, suitable delivery approaches, and post installation O&M arrangements had a significant bearing on the efficiency, cost-effectiveness, and sustainability of those programs. In Laos the focus was on the IA carrying the principal responsibility to ensure the sustainability of the SHS program, particularly when installation, operation, and maintenance of the SHS were outsourced to the private sector. Therefore, an appropriate M&E system that ensures clearly defined terms of reference as well as establishes appropriate compensation schemes is required.

52. **Cost sharing with consumers is the key to an enduring service delivery model.** The successful experiences in Bangladesh and Mongolia demonstrate that poor households are willing to pay for energy services. The Bangladesh project (through a minimal subsidy per SHS and the leveraging of microfinance institution services) showed that even low-income rural households are willing and able to pay for SHS to have access to improved lighting services. The Mongolia project illustrated that while the affordability of the herder population was limited, there was still a strong willingness to pay for good-quality and reliable products and services if the consumers were well informed and after-sale services were accessible to a dispersed population. The Mongolian experience also showed that payment for SHS created a sense of ownership compared to the distributing of grants. The market-based approach supported by Lighting Africa in 11 countries has also shown strong uptake by households of reliable, affordable, modern, solar-based energy services. The success of Bangladesh and PAYG companies in Kenya has shown that people are able to pay for larger systems as well, as long as the up-front payment can be spread over time.

Lessons from Mini-grid Projects

53. **Mini-grid selection and technical design.** Mini-grids should be deployed where they are the least-cost electrification method. Mini-grids are mostly suited for rural towns/larger villages that (a) are

relatively remote and therefore unlikely to be served by the national grid; (b) are relatively densely populated; and (c) have expected loads that justify the mini-grid investments as opposed to deploying individual household systems. This usually requires a certain size (for example, 100 households plus) and sufficient existing or potential business and institutional loads. Mini-grid potential should ideally be mapped through a least-cost electrification plan and its viability confirmed through detailed feasibility studies. Although mini-grids are typically applied in remote locations, sometimes they can be used as a temporary solution (pre-electrification) in areas where the grid may eventually arrive. In that case, the mini-grids should apply technical standards that would allow future interconnection with the main grid.

54. **Private sector participation.** Recent trends demonstrate a growing participation of the private sector, including several larger international utilities and technology providers, in mini-grids. Innovative private sector business models have emerged, for example, those using smart prepaid meters, allowing remote monitoring, and balancing of supply and demand, resulting in increased reliability at reduced operating costs. This creates an opportunity to attract more private sector financing and efficiency in operation into the mini-grid space. However, to attract private sector, mini-grids need to be financially viable and regulatory risks need to be minimized. For example, the private sector needs to have clarity about the tariffs it is allowed to charge (and if applicable, subsidies it is entitled to), licensing regime and the time frame during which it is entitled to operate the mini-grid and/or the rules of what happens when the main grid arrives. Private sector opportunities can be leveraged best through creating conditions for a large-scale mini-grid deployment to leverage economies of scale in both construction and operation.

55. **Sustainability.** One of the key challenges in past mini-grid operations has been their sustainability, especially in community-based mini-grids, which often resulted in tariffs that were insufficient to cover the costs of O&M and eventual mini-grid expansion. The private sector-driven mini-grids on the other hand tended to result in high user tariffs, which limited the household electricity usage and impact and often led to community and political discontent, due to the high difference between the main grid and mini-grid tariffs. Most governments and donors are therefore exploring PPPs that rely on public resources to reduce the mini-grid costs, thereby reducing user tariff. RBF approaches (for example, a specified dollar amount paid against connection or against service delivered), in particular, appear to be suitable for mini-grid financing. Mini-grid financial sustainability can further be increased by promoting day use of energy. In particular, support for productive uses should be an inherent part of mini-grid development. Considering the concentration of low-income households in remote areas served by mini-grids, good practices also include support to the households to acquire energy efficient appliances. Finally, evidence exists that gender-sensitive designs, for example, those that provide increased opportunities for women to engage in productive uses, can also enhance sustainability of mini-grids.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

56. The MoEP will provide overall coordination of the project and implement Components 2 and 4. KPLC and REA will be responsible for the implementation of Components 1 and 3. The MoEP will competitively procure a consortium as a facilities manager for Component 2. The detailed implementation arrangements are presented in Annex 2.

57. The KOSAP PCU, hosted in the MoEP, will be responsible for not only implementing Components 2 and 4 of the proposed project but also the overall coordination of project implementation and oversight, including the following: (a) defining, jointly with the respective county governments, the project areas based on technical and policy development priorities; (b) resolving, in consultation with the county governments, challenges requiring high-level intervention facing the project; (c) monitoring the implementation of the project; and (d) consolidating information from IAs on progress of implementation and results reporting. KPLC and REA will establish respective PIUs to manage their specific components.

58. The proposed project has been designed under the overall guidance of a technical working group (TWG) constituted for this project. The TWG, co-led by the Director of Renewable Energy of the MoEP and a county government nominee, comprises representatives of the IAs, Ministries of Health, Education, and Interior, the ERC, and chief executives responsible for energy in all the 14 beneficiary counties. During implementation, there is expected to be a three-tier structure to sort out unique county-level issues regarding high-level guidance. At the highest level is the steering committee led by the Cabinet Secretary of the MoEP. At the mid-level is the TWG that will address common challenges arising during project implementation. County working groups will resolve any issues arising at the county level.

B. Results Monitoring and Evaluation

59. Overall project M&E will be carried out at the PCU in the MoEP. The proposed project coordinator in the MoEP will consolidate the quarterly progress reports of KPLC, REA, and the facilities manager and coordinate the implementing entities' TA and capacity-building program. The Project Implementation Manual (PIM) of each IA must establish thorough component-level indicators on which to report. Within the PCU, a dedicated M&E officer will be responsible for M&E and preparing monthly progress reports for discussion by the TWG and steering committee.

60. The ESMAP-funded MTF Energy Access Survey, fielded in December 2016, has collected and provided baseline data for the 14 project counties. This survey will be repeated at least once during the implementation period to evaluate the benefits of the electrification to consumers, sustainability of efforts, and emerging impacts, including gender.

61. KPLC has a well-established department for customer service that annually fields beneficiary feedback surveys. The World Bank is supporting such surveys for the slum electrification component of the ongoing Kenya Electricity Expansion Project (KEEP -P103037) (including the KEEP Additional Financing). Similar feedback surveys will be rolled out to these 14 project counties, as part of M&E efforts in the proposed project, specifically for Components 1 and 3. Subcomponent 3B will benefit from the GSM-based remote sensors that will be attached to every water pump. For Component 2, the facilities manager will have responsibility to track the number of SHS installed in these 14 counties, since the financing will be predicated on the results achieved on the ground. The SSPs benefitting from the proposed project will be required to maintain a customer database that provides customer contacts and basic profiles, along with repayment history (in the case of PAYG businesses). An independent verification agent will validate a sample of installations made under the project. This component will also gather feedback from consumers on a frequent basis, such as through cell phone surveys.

C. Sustainability

62. Sustainability is a core principle of the proposed project fostered through the following approaches. First, off-grid supply solutions are identified based on a comprehensive geospatial plan with a robust approximation of consumption points and total demand. This plan will be updated over time allowing a regular assessments of economic viability. Second, the quality of service standards for the mini-grids, which will be established by the ERC (informed by the recently completed mini-grid regulations study and the NES) and Lighting Global, for the stand-alone community and home systems will be adhered to, and funding allocations to companies will be tied to delivering services according to the standards. Third, O&M services for mini-grids (Component 1) and stand-alone community and solar water pumps (Component 3) will be contracted out to ensure attention to replacement and repairs of these assets.

D. Role of Partners

63. Kenya boasts an active donor community with multilateral and bilateral financiers who have contributed consistently to the evolving thinking across the sector value chain and, more specifically, on electrification. Kenya is the birthplace of a flourishing private solar industry, including the innovative PAYG model. Many companies started their solar business in Kenya and since then have expanded into other markets. Both the donors and the private sector are partners to the GoK in the aspirations to connect everyone across Kenya. The GoK's flagship LMCP and the slum electrification programs have attracted donor resources, to the tune of US$740 million and the mini-grids have so far received funding amounting to about US$130 million (Table 2). Based on recent information collected by Power Africa, the predominant source of funding for the private solar industry has been in the form of equity from impact investors, estimated to be about US$300 million. The NES has approximated about US$2.5 billion incremental investment needs to reach universal electrification by 2020. The proposed project will contribute to largely fulfilling the investment needs in off-grid.

64. The GoK is promoting the proposed project as the flagship off-grid program underpinned by the NES, and other donors are expressing their willingness to join in this endeavor. Key donors are active in financing the off-grid space including AfD, GIZ, KfW, DFID, Spain and Norway. US Power Africa has recently recommended an off-grid accelerator program to leverage funding from social impact bonds and other innovative risk-reducing facilities for the deployment of solar home systems with debt and equity investments from impact investors. The proposed KOSAP has also elicited interest from EU to contribute to its debt and result based financing facility.

Table 2. Ongoing Donor Funding for Grid and Mini-grid Electrification (US$, millions)

Donor	Grid Electrification	Mini-grid Electrification
World Bank	275	11
African Development Bank	150	—
EIB	65	—
EU	38	—
AFD	212	36
GIZ	—	8

KfW	—	16
DFID	—	40
Embassy of Spain	—	16
Nordic Funds	—	4
Total	**740**	**131**

Source: World Bank Analysis.

Note: EIB = European Investment Bank; GIZ = *Deutsche Gesellschaft für Internationale Zusammenarbeit*; KfW = *Kreditanstalt für Wiederaufbau*.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

65. The overall risk rating of the project is considered Substantial. Key risks and mitigation measures are discussed in the following paragraphs.

66. **Political and governance (substantial).** Kenya will hold the next general elections in August 2017 and the political campaign has already begun. There is a risk that the electrification efforts under the project would be used as an election tool and key policy decisions and strategic directions relating to project implementation could change post elections. The current challenges of devolution and tensions between the National Government and county governments relating to devolved sectors, which include energy, could also be exacerbated in the wake of political transition. To mitigate this risk, the project design ensures that county governments are represented in the TWG; in addition, county working groups will be constituted so that unique issues emerging in each county can be sorted out. The project also aims to develop comprehensive communications to provide accurate information to the public on the design, including its objectives, targeted beneficiaries, and roles and responsibilities of national, county, and community institutions.

67. **Institutional capacity (substantial).** All three agencies—the MoEP, KPLC, and REA—have implemented past and ongoing World Bank projects. However, this project's remit goes into areas the agencies do not have previous experience in. For Component 2, the MoEP will competitively procure an experienced Facility manager, but it needs adequate technical expertise in renewable energy and financial markets to effectively monitor the Facility manager. For Component 1 and Subcomponent 3A, this project marks a departure to off-grid projects with solar technology for KPLC, the national grid operator. For Subcomponent 3B, REA will implement solar water pumping projects with very nascent experience so far. Therefore, there are substantial resources in Component 4 to ensure an adequate skill set is hired from the market for all three agencies.

68. **Fiduciary (substantial).** The fiduciary risk primarily stems from Component 3. An experienced Facility Manager will be competitively procured by the MoEP; however, this is a new experience for the sector as a whole. There has been little debt for companies venturing into underserved counties. The market sounding with prospective Facility Manager has shown tremendous interest to manage these funds on behalf of the MoEP, but their performance can be assessed only during implementation.

Technical Design (substantial)

69. **Big grid versus small grid.** There remains a risk in off-grid electrification, particularly with mini-grids as to what happens when the grid reaches the same areas. This aspect is particularly relevant for the design of the operation, as the areas targeted by the proposed project cover more than 70 percent of Kenya's land area. To mitigate this risk, the GoK has is preparing the NES, aimed at providing a consistent road map for the development of grid extension and off-grid solutions over time and ensuring timely achievement of electrification targets at least cost for the country underpinned by the geospatial plan. Further, since most of the mini-grids are operated by KPLC after construction, which is also the approach proposed in KOSAP, this risk is largely mitigated.

70. **Private sector interest in underserved counties.** The private solar companies are largely confined to the core market and have a negligible footprint in the underserved counties. These areas are not a top priority in their business plans given the uncertainty on the geographic and socioeconomic profile of consumers as well as high cost (about four times higher than core market) to reach such areas. The companies could go either to such underserved market in Kenya or to other neighboring countries creating an attractive enabling environment for SHS provision. Therefore, the proposed KOSAP has selected a suite of instruments, after consultations with these companies, to create a level playing field between the core market and underserved counties. However, the risk remains that these companies will move only to geographically contiguous counties and to their core market and cherry-pick consumers. This risk is exacerbated by the fact that the project will be unable to make loans to solar service providers in hard currencies, a type of financing that is required to enable them to purchase inventory from international suppliers. Should this prove to be a major impediment, Component 2 may need to be restructured, thereby necessitating GoK agreeing to carry the foreign exchange risk associated with these loans. During project implementation, an option of including households in Component 3 will be considered if the private sector is unable or not interested to venture into selected areas.

Stakeholders (substantial)

71. **REA's broader mandate under the Energy Bill.** REA's role is envisaged to broaden under the Energy Bill to Rural Electrification and Renewable Energy Corporation that will include (among others) developing and updating a renewable energy master plan, establishing a framework of collaboration with county governments in discharge of their mandate, and undertaking feasibility studies and maintaining data with a view to availing the same to developers of renewable energy resources. The Energy Bill aims to consolidate the laws related to energy, to provide for national and county government functions in relation to energy; to establish the powers and functions of the energy sector entities; and promote renewable energy, among other areas. There would be possible clashes in terms of roles and responsibilities of these entities in managing the energy sector. Therefore, supporting REA through this transition is necessary and the World Bank is assisting with designing a new business plan that clearly outlines what REA's mandate should be in both grid and off-grid electrification and the profile of resources and skills required to fulfill this mandate.

72. **Role of county governments.** The delineation of the mandates of the National Government and county governments with regard to energy planning, development, operations, and regulation under Kenya's constitution is not clear. The National Government has the mandate for "energy policy including electricity and gas reticulation and energy regulation." The county governments' mandate is provided as "county planning and development, including—electricity and gas reticulation and energy regulation." There is a lack of clarity, for example, on the voltage of electricity infrastructure that will fall within

"reticulation" and, in addition, if the National Government's mandate extends to development of power generation, transmission, and distribution infrastructure and electricity supply and regulation functions or is it only limited to policy formulation of these aspects. This situation presents some challenges and risks: (a) the overlapping mandates of the two levels of governments in the implementation of electrification projects, both grid and off-grid, could be a potential cause of disagreements between the two governments on the scope of their mandates with regard to the project as well as the challenge of the mandate for consumer engagement within the counties; (b) management of the relationship between the counties and the National Government during project implementation; and (c) relatively limited capacity, so far, of the county governments to plan and implement the electrification projects (both grid and off-grid) and sustain related infrastructure.

73. The design of the proposed project is informed by wide consultations with various government agencies, development partners, the private sector, and beneficiaries. Their views will be considered to enhance project ownership. However, the risk remains that counties not included in the program may feel left out and those included may have higher expectations for project outcomes than can be supported. To mitigate this risk, a transparent selection criterion (based on countries designated as marginalized by the CRA) has been adopted and accepted and a comprehensive PIM will be developed for each implementing entity to narrate the requirements, procedures, and processes for accessing project funds, as well as various stakeholders' roles and responsibilities.

74. The project design includes the following measures to mitigate the risks emerging from devolution: (a) Involving the counties in the TWG in the design, implementation, and coordination; (b) Directly consulting with County Governors to ensure their buy-in and support; (c) Creating a county working group to support implementation of project components at the county level so that unique issues are sorted out and there is coordination among the components; (d) Leveraging the ongoing preparation of the NES to have a discussion and create consensus between the National Government and the county governments on their respective roles, especially on off-grid systems; (e) Carrying out a needs assessment for the 14 counties and devising an appropriate capacity-building program for the counties to be financed under the proposed project; and (f) Applying lessons learned from World Bank operations in devolved sectors (health, Devolution Program-for-Results, agriculture transport) into the project.

75. **Climate and Disaster Risks** The screening considered the various locations of the project interventions including the types of infrastructures of the project that may be vulnerable to various climatic hazards. The screening has confirmed exposure to these hazards. Kenya is vulnerable to extremes in temperature, flooding and drought, and high winds. The country periodically suffered from earthquakes. Risks will be addressed through proper design, operation, and maintenance of the infrastructure assets.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

Project Economic Analysis

76. **An economic analysis has been carried out to assess the economic viability of the project.** The economic internal rate of return (EIRR) and net present value (NPV) of the project are calculated using a

standard cost-benefit methodology. The economic evaluation is confined to the project activities that generate quantifiable benefits for which an economic value can be clearly identified and measured, notably benefits associated with investments under Components 1, 2, and 3. Component 4 is excluded because of the difficulty in valuing the outcomes of TA. The detailed economic and financial analyses are presented in Annex 4.

77. **The economic analysis shows that the project is economically viable even without any consideration of environmental externalities.** The baseline NPV of the proposed project is US$40.1 million (at 6 percent discount rate) with an economic return of 13 percent.

Table 3. Results of Economic Analysis

EIRR	
EIRR (excluding CO_2) (%)	13.0
EIRR (including CO_2) (%)	22.2
Composition of NPV	
NPV (excluding CO_2) (US$, millions)	40.1
NPV (including CO_2) (US$, millions)	103.6

78. **A sensitivity analysis in the form of switching values has been performed** to test the robustness of the economic results to changes in the key components of the project (capital expenditure [CAPEX], operational expenditure [OPEX], and SHS penetration). The results show that the project remains economically viable as long as the CAPEX increase remains below 41.7 percent or the OPEX increase falls below 38.2 percent or the penetration of the SHS does not fall below 31 percent (more than 171,850 systems distributed), revealing the economic robustness of the project.

79. **Greenhouse gas (GHG) accounting has been undertaken for this project**, which will result in significant GHG emission avoidance by replacing household usage of candles, kerosene, and charcoal fuels as well as diesel and firewood consumption in public facilities and farms. Most project activities will not directly emit GHG due to the use of solar technologies, except for mini-grids that will be partially fueled by diesel, as well as cookstoves that will continue to use renewable biomass fuels. For systems such as mini-grids, household SHS, community SHS, and solar pumps, GHG emissions over 20 years have been analyzed. For household cookstoves, GHG emissions have been analyzed over 5 years due to their shorter economic life. Total baseline emissions are estimated to be 5,096,218 tCO_2, whereas the project emissions total 1,198,829 tCO_2. Therefore, the project will result in 3,897,389 tons of avoided CO_2 emissions[23].

80. **Rationale for Public Sector Provision/Financing.** Achieving universal electrification by 2020 requires substantial scale-up of resources in the off-grid space in the underserved counties. Public financing of this project is necessary not only to reach these hitherto far-flung areas, but also to leverage private sector financing and support considerably de-risked opportunities for the private sector in a traditionally commercially unattractive sector. These underserved counties are characterized by low

[23] Kenya Solar Lighting Program (P163538) is an associated project to implement carbon finance payments for emissions reductions achieved within KOSAP. This project will monitor a subset of emissions reduced under KOSAP, estimated to total 329,142 tCO2.

density of population, high levels of poverty, and nomadic lifestyles. Grid connectivity in these areas is not economically feasible and the private sector footprint in these areas is extremely limited—there are only a handful of mini-girds or solar companies operating there. Therefore, public resources will be used to harness private sector efficiencies by creating appropriate incentives to mitigate the risks of doing business in these counties that are deemed commercially unattractive by the private sector. Further, public support and financing for solar technologies are also necessary to reduce the financial costs of solar power and to enable it to be competitive with thermal generation—so that the full externalities of solar power through avoided environmental and health damage costs can be captured. Finally, public support is necessary to demonstrate the applicability of innovative business models that blend the public and private sector strengths. Kenya has already been a beacon of innovation in the off-grid space, and the proposed project, by pushing the boundaries of innovation to benefit consumers largely out of the mainstream for decades, will have important lessons and customization opportunities for millions of the unelectrified in sub-Saharan Africa.

81. **Value Added of the World Bank's Support**. The World Bank, with its ability to design a customized electrification program drawing on decades of global experience and to harness recent technological advancements to provide reliable, affordable, and sustainable energy services to consumers in underserved countries, is well placed to assist Kenya in designing and implementing an off-grid energy access program. The proposed project presents an unparalleled opportunity to reach out to a large part of the country bereft of modern energy services.

Financial Analysis of KPLC

82. KPLC will sign contracts with the private sector in Component 1 and Subcomponent 3A, and therefore, it becomes important to understand how the project will affect the financial sustainability of the company. The project is not expected to have a material impact on the finances of the company going forward given that it is financed entirely by the GoK with KPLC simply managing the ongoing operations. However, as a sensitivity analysis, the financial projections below assume a 'stress-case' scenario showing an incremental increase in operating costs and no respective increase in revenues (assuming KPLC is unable to recover the costs through the tariff[24]).

83. The operating expenses for the project will only add an aggregate of 1 percent to the operating expenses of KPLC over the next five years. Therefore, there is minimal impact of the project on the operations of KPLC (Table 4). The financial ratios below indicate that there will be no breach in the five-year projection period in the case where KPLC bears the operating costs of the project with no recovery through the tariff.

Table 4. Base Case-Projected Financial Ratios

	Threshold	FY17	FY18	FY19	FY20	FY21
Debt service coverage ratio	≥1.2	2.4	2.0	1.4	1.8	2.0
Current ratio	≥1.0	1.0	1.0	1.2	1.5	1.7
Gearing ratio	≤2.5	1.2	1.0	0.8	0.7	0.5
Debtor receivable days	≤60 days	46	43	41	38	35

24 A recognition of the need to pass-through the costs of the KOSAP program to the electricity tariffs has already been agreed between KPLC, MoEP, ERC, and the World Bank.

Source: World Bank analysis.

B. Technical

84. The proposed project is part of the implementation road map of the NES, which is underpinned by a comprehensive least-cost geospatial plan. The NES articulates the road map for the provision of electricity for all in a reliable, affordable, and sustainable manner by 2020. The project, therefore, combines the core principals outlined in the NES with a technically sophisticated tool to identify the location of investments in a least-cost and transparent manner. The entire land area will be classified in three groups, according to which the least-cost option is (a) to be electrified through grid extension; (b) to be electrified through mini-grids; and (c) to be electrified through SHS. Off-grid areas are overwhelmingly an SHS market, as a population of only 30,000–40,000 could be reached by mini-grids as estimated by the geospatial plan.

85. The project is divided into geographic lots or service territories based on county-level allocations agreed with the TWG (Figure 6). These service territories, comprising two to three counties each, have a relatively similar scale of challenge (unelectrified structures—population, and community facilities). The private companies can form joint ventures and leverage subcontractors to carry out more than one contract. The existence of a mini-grid contractor in a service territory will also encourage them to bid for stand-alone systems in community facilities and solar water pumps. The vendor conferences have highlighted the benefits of such geographic clustering of consumption points within multiple counties to attract long term private service providers by offering them more than one business opportunity.

86. A few specific principles to note in the technical design of the proposed project are the following. First, the NES recommends Tier 1 service equivalent to a pico-solar system with sufficient capacity to provide 1,000 lumen-hours of light and cell phone charging abilities. Therefore, at least this level of service is ensured for all. Second, mini-grid household consumers will be charged the national uniform tariff so that there is no disparity between tariffs charged across the country for the same consumer type, following the GoK's electricity tariff policy. Third, the private sector is incentivized through a creative use of financing instruments to facilitate its foray into hitherto unknown markets. The IDA resources are strategically deployed to present de-risked opportunities to the private sector and participate in off-grid electrification as contractors and operators. Fifth, the anchor load in the form of community facilities is being harnessed in remote locations where private sector efficiencies can be deployed for supply, installation, operation, and maintenance services.

87. The proposed project also reinforces KPLC's role as a national electricity retailer reaching beyond its core grid-connected market. So far, KPLC has been focusing on densifying and extending its grid network and operating 14 off-grid mini-grids powered by diesel. Recognizing that the National Energy Policy's goal of universal access to electricity will not be realized without a change in KPLC's business-as-usual scenario, in July 2016 KPLC's board urged the company to consider a comprehensive off-grid strategy to be implemented in areas that are not likely to be connected to the national grid within the next 10-year period. KPLC developed a corresponding off-grid strategy that (a) identifies the scope of the unserved potential power market by counties; (b) analyzes the costs and revenues associated with connecting potential new customers in each county; (c) assesses the current regulatory situation faced by KPLC, and (d) identifies pricing strategies required for the success of each connectivity methodology. While KPLC has a limited footprint in the selected 14 counties, the proposed project will introduce a move by the utility

into off-grid markets in the high-cost low-revenue consumer category. Therefore, aligned with the GoK's announced mandate of national uniform tariffs as well as its ability to socialize the cost of reaching remote markets into its tariff requirement to the ERC and managing private sector contracts, KPLC's role will become pivotal in off-grid electrification in Kenya.

C. Financial Management

88. The World Bank's financial management (FM) team conducted an FM assessment of the three IAs—the MoEP, REA, and KPLC in October 2016. REA and KPLC are state corporations under the MoEP. The three agencies have experience in management of World Bank-financed projects. An FM capacity assessment was also conducted on six counties (Garissa, Tana River, West Pokot, Marsabit, Samburu, and Wajir) to establish the capacity-building needs that could be funded from Component 4. The MoEP will competitively select the Facility Manager for Component 2.

89. The objective of the assessment was to determine whether the IAs maintain adequate FM arrangements capable of ensuring that (a) funds channeled into the project will be used for the purposes intended in an efficient and economical manner; (b) the project's financial reports will be prepared accurately, reliably, and on time; and (c) the project's assets will be safeguarded.

90. The FM assessment was carried out in accordance with the World Bank Directive: Financial Management Manual for World Bank Investment Project Financing Operations issued on February 4, 2015, and effective from March 1, 2010, and the World Bank Guidance: Financial Management in World Bank Investment Project Financing Operations issued on and effective from February 24, 2015. The assessment covered the six key FM elements of budgeting, accounting, and internal control including internal auditing, in addition to funds flow, financial reporting, and external auditing arrangements.

91. The FM assessment revealed that the MoEP, REA, and KPLC have adequate fiduciary capacity and experience to effectively implement the proposed project. The three agencies have experience in management of World Bank-financed projects having been involved in the implementation of the following projects: KEEP, KEMP, and GPOBA (Global Partnership on Output-Based Aid) W3: Kenya Electricity. The three agencies have well-staffed FM units headed by qualified project accountants. Budget arrangements were assessed as adequate and will be aligned to country budget processes. The agencies also have detailed FM procedures manuals. The agencies are compliant with the World Bank's financial reporting requirements, with the quarterly interim financial reports (IFRs) and annual audited financial statements being submitted to the World Bank within the stipulated time lines. The three agencies have no outstanding audit issues. However, material in-country disbursement delays were noted in transfer of funds from the Designated Account (DA) from the MoEP to REA and KPLC, which are state agencies. These are being addressed as part of the portfolio reform dialogue. The proposed project will adopt the statement of expenditure (SOE) method of disbursement.

92. The assessment concludes that the FM arrangements which satisfies the World Bank's minimum requirements under Operational Policy (OP)/Bank Policy (BP) 10.00 and therefore is adequate to provide, with reasonable assurance, accurate and timely information on the status of the project, as required by IDA. The overall residual risk rating is Substantial,

D. Procurement

93. Procurement for the proposed project will be carried out in accordance with the 'World Bank Procurement Regulations for Borrowers under Investment Project Financing', dated July 1, 2016, hereafter referred to as 'Procurement Regulations'. The project will be subject to the World Bank's Anticorruption Guidelines, dated July 1, 2016. As per the requirement of the Procurement Regulations, a Project Procurement Strategy for Development (PPSD) sets out the selection methods to be followed by the Borrower during project implementation in the procurement of goods, works, and non-consulting and consulting services financed by the World Bank. As the project does not involve high value and complex contracts, a short form of PPSD has been prepared. The PPSD describes the overall project operational context, market situations, implementing agencies capacity and possible procurement risks. Following the market sounding exercise and information obtained from the industry, the PPSD concludes that there might be no serious supply market risk for the identified procurement activities. Since there are reasonably adequate market players, risk of bid participations/or competition is considered not high, provided that the contract packaging and delivery model takes in to account reasonable incentive mechanisms, including appropriate risk allocation and security improvement arrangements in the target counties. The project preparation has also taken into considerations the fact that Public Private Partnership (PPP) type of supply, installation and operational maintenance contract in solar power system is a new frontier and this may make the implementation more demanding in terms of designing best fit contract delivery arrangements. Grant facility to the private power supply system investors and guarantee of minimum payment at the time of operation has been arranged and to be negotiated and finalized during contracts awarding stage. Appropriate and proportional market approach and procurement methods have been identified in the PPSD and the initial procurement plan has been prepared for those activities that are identified at the project negotiation stage. The underlying Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity. The proposed project will use Systematic Tracking of Exchanges in Procurement (STEP), a planning and tracking system that will provide data on procurement activities, establish benchmarks, monitor delays, and measure procurement performance.

94. A procurement capacity and risk assessment has been carried out by the World Bank for KPLC and REA to review the organizational structure for implementing the project and the interaction between the project's staff responsible for procurement duties and management of the agencies. The Procurement Risk Assessment and Management System (PRAMS) has been finalized, and based on the assessment and taking note of the roles and responsibilities of the agencies responsible for procurement, the procurement risk rating is '**Substantial**'.

E. Environmental & Social (including Safeguards)

95. The proposed project was screened by the World Bank and assigned an Environmental Category B Partial Assessment, on the assumption that no major civil works will be funded and no major physical or economic displacement will take place. Four safeguard policies have been triggered for the project:

96. **The operational policy on Environmental Assessment (OP/BP 4.01)** has been triggered, due to implementation of activities outlined under Components 1–3. The main potential environmental impacts anticipated are (a) civil works that would be limited to construction of the mini-grids in remote areas

(Component 1), installation of stand-alone systems for households (Component 2), installation of solar PV for water pumping (Component 3), and construction of distribution lines to connect new customers; and (b) environmental, health, and safety concerns likely to be associated with recycling and disposal of spent batteries at the end of their useful lives, which is usually 3–5 years after deployment. Rechargeable batteries for storing solar energy may run on nickel-cadmium (Ni-Cad), nickel metal hydride (NiMH), lithium-ion (Li-ion), lead-acid (Pb-A), or lead-gel (Pb-gel). These batteries should not be disposed in standard landfills because they can create long-lasting environmental and human health impacts (for example, headaches, abdominal discomfort, seizures and comas, cancers, irritation of skin and respiratory system, burns and damage to skin and eyes, and corrosion) due largely to the heavy metals such as mercury, lead, cadmium, and nickel and acids. The entire management processes including de-manufacturing, collection, storage, recycling, transport, and disposal may present a challenge and, given the scope of this operation, could result in environmental and social risks and impacts, although these impacts are reversible and localized and can be easily and cost-effectively mitigated.

97. **The operational policy on Natural Habitats (OP/BP 4.04)** has been triggered, on the assumption that project activities under Components 1 and 3 are likely to affect the natural habitats through erection of poles, construction of the mini-grids, and the installation of the solar water pumping equipment.

98. **The project has triggered the Indigenous Peoples Policy (OP/BP 4.10)** due to the known presence of indigenous peoples (IPs)/vulnerable and marginalized groups (VMGs) in all 14 counties targeted by the project. Project counties can be divided into two categories in terms of the IP/VMG communities found in them. The first category, represented by eight of the project counties—Garissa, Mandera, Isiolo, Marsabit, Wajir, Turkana, Samburu, and Narok Counties—are overwhelmingly IP/VMG counties in so far as they are inhabited mainly by nomadic pastoralist communities, with some of them being hosts to a few minority ethnic/tribal groups. The second category, represented by Tana River, Lamu, Kilifi, Kwale, Taita Taveta, and West Pokot Counties, have minority IPs/VMGs living among the more dominant communities in each of the counties. Communities and groups that are in the minority in these counties and that meet the OP 4.10 criteria are the Sengwer in West Pokot County, Wailwana of Tana River, Watha of Tana River, Taita Taveta, and Kilifi Counties, Wakifundi/Wachwaka of Kwale County, Wasanye and Aweer of Lamu County, and Munyoyaya of Tana River County.

99. **The Client has carried out a Social Assessment (SA)** through in-depth free, prior, and informed consultations with both categories of IPs in each of the counties in line with the requirements of OP/BP 4.10. Even though the selection criteria and process for accessing the project benefits are yet to be clearly defined, the IPs/VMGs have been informed that there will be some elements of payment to access the project benefits. In this respect, some of the key social concerns of the VMGs include issues of (a) affordability of the solar or mini-grid installations due to high levels of poverty in the areas; (b) elite capture with potential to influence siting of subprojects away from the VMGs for individual interest and gain; (c) gender considerations in the subprojects among the VMGs; and (d) potential conflict over communal land and natural resources for siting the mini-grids.

100. **The project has triggered the operational policy on Involuntary Resettlement (OP/BP 4.12).** The project does not envisage major physical or economic displacement of people. However, it is likely that the project might acquire land for the construction and installation of mini-grids that may result in either displacement of people or have impacts on trees or grazing/farming land, hence the triggering of OP 4.12.

101. **Safeguard instruments.** At this stage of project preparation, subprojects sites/locations have not yet been identified, and the criteria for participation in the project are yet to be clearly defined. For these reasons, a framework approach has been adopted for this project and on the basis of this, the client has prepared the following frameworks under the project: (a) Environmental and Social Management Framework (ESMF); (b) Resettlement Policy Framework (RPF); and (c) Vulnerable and Marginalized Group Frameworks (VMGFs), all of which have been prepared in consultation with the potential project beneficiaries including VMGs, using the free, prior, and informed consultations approach. A screening process for environmental and social impacts has been included in the ESMF and RPF and will use evaluation tools including (a) an environmental and social screening form to help identify potential adverse environmental and social impacts and (b) an environmental and social checklist that outlines environmental and social mitigation measures for subprojects not requiring a full Environmental and Social Impact Assessment (ESIA) report. The ESMF, RPF, VMGF and SA were cleared by the World Bank and disclosed in-country on March 22, 2017, and by the World Bank portal on March 23, 2017.

102. When the subprojects and their locations/sites are identified for financing under KOSAP, the client will prepare additional supplementary site-specific safeguards instruments including (a) an ESIA; (b) Environmental and Social Management Plans (ESMPs); (c) Resettlement Action Plans (RAPs)/Abbreviated Resettlement Action Plans (ARAPs); and (d) Vulnerable and Marginalized Group Plans (VMGPs). Each of these will be consulted upon, cleared by the World Bank, and disclosed in-country and by the World Bank before commencement of any civil works.

103. In addition to defining the screening process, the RPF provides guidance on procedures and processes to be followed to avoid, reduce, mitigate, or compensate for adverse impacts of the project on project-affected persons (PAPs) in case it is determined through the screening process that a subproject may result in physical or economic displacement or restriction of access to natural resources as a result of the project. These include processes for (a) the preparation of RAPs or ARAPs including the cutoff date; (bi) establishment of entitlements and compensation arrangements under the project; (c) institutional arrangement for RAP implementation; (c) agreements on and preparation of grievance redress mechanisms; and (d) preparation of a monitoring framework for tackling the RAP implementation. Preparation of RAPs/ARAPs will be undertaken in accordance with the provisions of OP/BP 4.12 that require such instruments to be prepared in consultation with the PAPs. Similarly, the VMGF that has been prepared under this project defines the procedures and processes to be followed in undertaking the subproject-specific SA and for preparing subproject-specific VMGPs if such subprojects are to be implemented in areas where VMGs live or have collective attachment to.

104. The MoEP will provide overall coordination of the project and lead the implementation of Component 2, which will include overall responsibility for safeguards due diligence and compliance monitoring. The MoEP will ensure that terms of reference for hiring the Facility Manager contain clauses that relate to safeguards and occupational health and safety competencies and specific tasks related to safeguard monitoring and enforcement. The selected Facility Manager will be responsible for coordinating and supporting the implementation of safeguards and will prepare a Facilities Implementation Manual (FIM) that will include a checklist for subprojects, their potential threats, and mitigation measures as well as capacity building for safeguards implementation and compliance monitoring. The MoEP will submit the FIM to the World Bank for review and clearance. Thus, SSPs that bid for any of the subprojects under this component will have to indicate, in their respective bids, how they intend to address environmental and social sustainability issues that could be associated with the provisions of those services. The selected

SSPs will be responsible for implementing the safeguards on the ground, including ensuring compliance with occupational health and safety imperatives and dealing with de-manufacturing of out-of-use solar devices, e-waste disposal, and recycling. The generation of safeguards reports during project implementation will start from the SSPs and through the Facility Manager to the MoEP. It is expected that the quarterly and annual reports on the Project will include a section on the implementation of all applicable safeguards frameworks and safeguards instruments.

105. KPLC and REA will jointly be responsible for the implementation of Components 1 and 3. Component 1 will be developed under PPPs, and a single contractor will be responsible for construction of the generation system and will prepare appropriate safeguards instruments that will be consulted upon, reviewed, and cleared by the World Bank and locally disclosed. Under Component 3, KPLC and REA will have overall responsibility for safeguards due diligence, and the private sector contractors hired for supply, installation, and maintenance will be responsible for preparing a checklist for subprojects, their potential threats, and mitigation measures as well as for safeguards implementation and compliance monitoring. KPLC and REA will establish their respective PIUs to manage their specific components.

106. Capacity to manage safeguards issues will be built at all agencies that will be implementing the project. The implementation will be led by the MoEP in coordination with the county governments through KPLC and REA. A capacity assessment conducted of the entities/IAs (MoEP, REA, and KPLC) for planning, designing, implementing, and monitoring of the safeguards has revealed standards to be good. However, the number of safeguards experts at post and their competences on safeguards were found to be inadequate. In this regard, the World Bank recommends that (a) REA recruits a social safeguards expert to complement the existing environmental safeguards expert and (b) the MoEP recruits environmental and social safeguards experts to support the PCU in the implementation of the project. To address the limitations in safeguards competences, the World Bank recommends that needs assessments be undertaken for the safeguards teams and a capacity-building plan be prepared to train the teams and ensure their ability to identify and manage environmental and social risks in the project is enhanced.

107. **Gender.** The gender action plan for the project is based on a review of available data and research about the gender situation in Kenya and on consultations with key stakeholders in the MoEP, KPLC, and international and local institutions working on gender and off-grid energy issues (Table 5). The project intends to contribute to closing the relevant gender gaps in Kenya, particularly in access to electricity, by (a) ensuring women's access to solar products and cleaner and more efficient cookstoves; (b) increasing women's awareness about solar energy use and the productive uses of solar power; (c) ensuring women's participation in decision making around the installation and management of the solar systems; (d) providing women with employment opportunities in marketing and installation of solar products; and (e) mitigating potential risks such as displacement or gender-based violence (GBV) that women might face due to project implementation. In addition, the project M&E system will adopt and integrate several results indicators to monitor and assess both progress in implementing gender-related activities and the project benefits for women and men. The MoEP, KPLC, REA, and the World Bank project team will collaborate in their efforts to attain the project's gender objectives, with TA and support from the Africa

Renewable Energy Access (AFREA) Gender and Energy Program.[25] The project team will also ensure close collaboration with other pipeline operations such as Kenya Development Response to Displacement Impacts Project (KDRDIP- P161067) and prevent duplication. KDRDIP will be implemented in Garissa, Wajir, and Turkana counties, and KOSAP will build on the experiences of KDRDIP and will expand good practices to the remaining counties. KDRDIP will also provide important lessons on identifying and addressing social structures and cultural norms that might constrain women's active participation in project activities.

108. Annex 7 presents an overview of specific activities of the gender action plan that are part of the project, those that require incremental efforts, and associated actors that will implement the activities.

Table 5. Gender Action Plan

Project Components/ Subcomponents	Type of Activities					
	Separate Consultations with Women and Men before Implementation	**Facilitate Connection for Poor Female Household Heads**	**Ensure Women's Participation in Decision Making**	**Train and Employ women in Installation, Management, and Sales**	**Build Capacity for Income-Earning Activities**	**Prevent and Mitigate Displacement and Sexual and GBV Risks**
Component 1: Mini-grids for Community Facilities, Enterprises, and Households	√	√	√	√	√	√
Component 2: Stand-alone Solar Systems and Clean Cooking Solutions for Households	√	√	√	√	√	√
Component 3: Stand-alone Solar Systems and Solar Water Pumps for Community Facilities	√	—	√	—	—	√
Component 4: Implementation Support and Capacity Building	√	—	—	√	√	—

109. **Citizen Engagement.** Consumer engagement is vital to the success of the proposed project (Subcomponent 4.1). This project will support a multiyear program for consumer education and citizen engagement in the target areas (households, public facilities, and water facilities in the underserved counties). Consumers in the area are unlikely to be aware of the new technologies being presented and

25 The AFREA Gender and Energy Program is an ESMAP-funded program whose primary objective is to establish a core body of evidence to demonstrate that promoting improved gender equality in energy projects improves development outcomes and state-of-the-art approaches to improve gender equality in energy projects. The program has supported pilot approaches on gender mainstreaming in Senegal, Mali, Benin, Tanzania, and Kenya.

will benefit from information about the services, explanation about how the services can be accessed, and the opportunity to interact with service providers to share their feedback and concerns. The citizen engagement and consumer awareness activities will provide beneficiaries with the necessary guidance on how to get the best out of the products in the way they use and maintain them; these activities will also help service providers better understand the needs and concerns of their customers. The citizen engagement program will employ a variety of messaging tools and personal interaction to reach various audiences while ensuring opportunities for two-way dialogue.

F. World Bank Grievance Redress

110. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit *http://www.worldbank.org/en/projects-operations/products-and-services/grievance-redress-service*. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

VII. RESULTS FRAMEWORK AND MONITORING

Results Framework

COUNTRY : Kenya

Kenya: Off-grid Solar Access Project for Underserved Counties

Project Development Objectives

The Project Development Objective is to increase access to modern energy services in underserved counties of Kenya

Project Development Objective Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: People provided with new or improved electricity service (Corporate Results Indicator)		Number	0.00	1272525.00	Quarterly	KPLC PIU, REA PIU, Facility Manager	MoEP PCU
Description: The indicator measures the number of people that have received new or improved electricity service through KOSAP. The indicator includes direct access to electricity, which is measured as the number of people that benefited from new off-grid household connections via mini-grids and stand-alone solar systems. Throughout the project, the number of households connected to mini-grids and stand-alone solar systems will be monitored. The indicator shown above will use the average number of people per household in each county (as measured by the MTF survey) multiplied by the number of connections in each county to determine an aggregate value of the number of people that have received new or improved electricity service. The baseline MTF survey shows 4.7 people per household in the 14 targeted counties.							
Name: Community facilities provided with new or improved electricity service		Number	0.00	1097.00	Quarterly	KPLC PIU, REA PIU, Facility Manager	MoEP PCU

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: The indicator measures the number of community facilities (schools, health facilities, administrative offices) that have received new or improved electricity service through direct connections to mini-grids or stand-alone solar systems as a result of KOSAP.							
Name: Renewable energy generation capacity (other than hydropower) constructed under the project (MW) (Corporate Results Indicator)		Megawatt	0.00	9.60	Quarterly	KPLC PIU, REA PIU, Facility Manager	MoEP PCU
Description: The indicator measures in megawatts (MW) the generation capacity of renewable energy facilities (including mini-grids and stand-alone systems) constructed through KOSAP. This will be measured as the sum of (1) Renewable energy generation capacity of mini-grids constructed under the project (MW) and (2) Renewable energy generation capacity of stand-alone systems constructed under the project (MW).							

Intermediate Results Indicators

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Name: Households provided with access to electricity by mini-grids		Number	0.00	20750.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU
Households provided with access to electricity by mini-grids, of which		Percentage	0.00	20.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
headed by women (%)							
Description: The indicator measures the number of households that have received new or improved electricity service through direct connections to mini-grids as a result of KOSAP.							
Name: Enterprises provided with access to electricity by mini-grids		Number	0.00	6050.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU
Enterprises provided with access to electricity by mini-grids, of which headed by women (%)		Percentage	0.00	20.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU
Description: The indicator measures the number of enterprises that have received new or improved electricity service through direct connections to mini-grids as a result of KOSAP.							
Name: Community facilities provided with access to electricity by mini-grids		Number	0.00	200.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU
Description: The indicator measures the number of community facilities that have received new or improved electricity service through direct connections to mini-grids as a result of KOSAP.							
Name: Households provided with new electricity connections by stand-alone systems		Number	0.00	250000.00	Quarterly	Facility Manager	MoEP PCU

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Households provided with new electricity connections by stand-alone systems, of which headed by women (%)		Percentage	0.00	20.00	Quarterly	Facility Manager	MoEP PCU
Description: The indicator measures the number of households that have received new or improved electricity service via stand-alone solar systems as a result of KOSAP.							
Name: Renewable energy generation capacity of mini-grids constructed under the project (MW)		Megawatt	0.00	5.00	Quarterly	KPLC PIU, REA PIU	MoEP PCU
Description: The indicator measures in megawatts (MW) the generation capacity of renewable energy mini-grid facilities constructed through KOSAP.							
Name: Renewable energy generation capacity of stand-alone systems constructed under the project (MW)		Megawatt	0.00	4.60	Quarterly	Facility Manager, KPLC PIU	MoEP PCU
Description: The indicator measures in megawatts (MW) the generation capacity of stand-alone solar systems (for both households and community facilities) deployed or installed as a result of KOSAP.							
Name: Volume of debt channeled to private solar companies (USD)		Amount(USD)	0.00	30000000.00	Quarterly	Facility Manager	MoEP PCU

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: The indicator measures the volume of debt (in US$) channeled to private solar companies through KOSAP							
Name: Volume of results-based financing channeled to private solar companies (USD)		Amount(USD)	0.00	12000000.00	Quarterly	Facility Manager	MoEP PCU
Description: The indicator measures the volume of results-based financing (in US$) channeled to private solar companies through KOSAP.							
Name: Community facilities provided with access to electricity by stand-alone systems		Number	0.00	897.00	Quarterly	KPLC PIU	MoEP PCU
Description: The indicator measures the number of community facilities (schools, health facilities, administrative offices) that have received new or improved electricity service via direct connection to stand-alone solar systems as a result of KOSAP.							
Name: Boreholes equipped with solar pumping systems		Number	0.00	380.00	Quarterly	REA PIU	MoEP PCU
Description: The indicator measures the number of boreholes serving community facilities (schools, health facilities, administrative offices) that have been equipped with solar pumping systems as a result of KOSAP.							
Name: Clean and efficient household stoves sold in target counties		Number	0.00	150000.00	Quarterly	MoEP PCU	MoEP PCU

Indicator Name	Core	Unit of Measure	Baseline	End Target	Frequency	Data Source/Methodology	Responsibility for Data Collection
Description: This indicator measures the number of clean and efficient household stoves deployed as a results of KOSAP.							
Name: Citizens in the target area reached through the consumer education and citizen engagement program (%)		Percentage	0.00	65.00	Quarterly	MoEP PCU	MoEP PCU
Description: Relative to the total population (in number of people) in the target counties, this measures the fraction of people educated either through BTL activities (face to face events like market day activations, forums, community events, targeted household visits etc.) or ATL activities (mass media channels like local radio & digital platforms) as a result of KOSAP.							
Name: Annual publication of feedback received from citizens reached through the consumer education and citizen engagement program		Yes/No	N	Y	Annually	REA PIU	MoEP PCU
Description: Feedback from citizens reached through the consumer education and citizen engagement program must be received and published annually. There should be at least a total of five publications over the duration of the project.							
Name: Volume of GHG emissions reduced (tCO2)		Metric ton	0.00	3890000.00	Quarterly	REA PIU	MoEP PCU
Description: This indicator measures the volume of GHG emissions (in tons of CO2) reduced as a result of KOSAP.							

Target Values

Project Development Objective Indicators

Indicator Name	End Target
People provided with new or improved electricity service (Corporate Results Indicator)	1272525.00
Community facilities provided with new or improved electricity service	1097.00
Renewable energy generation capacity (other than hydropower) constructed under the project (MW) (Corporate Results Indicator)	9.60

Intermediate Results Indicators

Indicator Name	Baseline	End Target
Households provided with access to electricity by mini-grids	0.00	20750.00
Households provided with access to electricity by mini-grids, of which headed by women (%)	0.00	20.00
Enterprises provided with access to electricity by mini-grids	0.00	6050.00
Enterprises provided with access to electricity by mini-grids, of which headed by women (%)	0.00	20.00
Community facilities provided with access to electricity by mini-grids	0.00	200.00
Households provided with new electricity connections by stand-alone systems	0.00	250000.00
Households provided with new electricity connections by stand-alone systems, of which	0.00	20.00

Indicator Name	Baseline	End Target
headed by women (%)		
Renewable energy generation capacity of mini-grids constructed under the project (MW)	0.00	5.00
Renewable energy generation capacity of stand-alone systems constructed under the project (MW)	0.00	4.60
Volume of debt channeled to private solar companies (USD)	0.00	30000000.00
Volume of results-based financing channeled to private solar companies (USD)	0.00	12000000.00
Community facilities provided with access to electricity by stand-alone systems	0.00	897.00
Boreholes equipped with solar pumping systems	0.00	380.00
Clean and efficient household stoves sold in target counties	0.00	150000.00
Citizens in the target area reached through the consumer education and citizen engagement program (%)	0.00	65.00
Annual publication of feedback received from citizens reached through the consumer education and citizen engagement program	N	Y
Volume of GHG emissions reduced (tCO2)	0.00	3890000.00

f

ANNEX 1: DETAILED PROJECT DESCRIPTION

COUNTRY: Kenya

Kenya: Off-grid Solar Access Project for Underserved Counties

1. The project is composed of an IDA Credit of US$150 million equivalent.

Geographic Scope

2. Project beneficiaries will be located in 14 of the 47 counties in Kenya that have been defined as 'marginalized areas' by the CRA. The CRA defines these as "communities that have been excluded from social and economic life of Kenya for different reasons" and "geographic locations (county or sub-county) where significant populations of underserved communities live" (CRA 2013[26]).

3. The 14 underserved counties collectively represent 72 percent of the country's total land area and 20 percent of the country's population. Their population is highly dispersed, at a density four times lower than the national average. They represent profound infrastructure deficits, including lack of access to roads, electricity, water, and social services. Many societies were historically nomadic and even today continue to rely on pastoralism. There is also significant insecurity in certain areas, giving rise to substantial numbers of displaced persons and livelihood adaptations that further undermine economic prosperity.

4. The ongoing MTF energy access survey has revealed the following key preliminary results:

   a. Penetration of solar products is increasing, having reached over 30 percent of households, of which about 12 percent are multi-light systems with or without appliances (approximately equivalent of Tier 1 and 2 service level). Majority of systems (both lanterns and larger multi-light and solar home systems) are owned by off-grid households in both urban and rural areas. There is little presence of major distributors of quality-verified products in these 14 counties.

   b. This high penetration of solar products is in contrast to the use of other lighting. Only usage of candles is greater, indicating that solar products are valued by the households in these counties.

   c. PAYG is beginning to find its way into underserved counties, as 37 percent of households that bought a (Tier 1) solar lighting system indicate that they paid in installments.

   d. The satisfaction levels are fairly high—about half of the households report being satisfied or very satisfied with the product. Solar energy is, however, a recent phenomenon; 81 percent of respondents have used solar energy for less than three years and 40 percent less than a year.

26 Commission on Revenue Allocation, Policy on the Criteria or Identifying Marginalised Areas and Sharing of the Equalisation Fund, February 2013

e. On average, cell phone ownership is relatively high; 65 percent of households have at least one cell phone, and 49 percent have more than one phone. Appliance ownership is much lower in solar powered households compared to the grid connected households (with the exception of radios, which are also still relatively common). This confirms that the household demand is likely to concentrate on Tier 1 solutions, providing lighting, cell phone charging, and perhaps a radio, while the demand for larger systems powering TVs is likely to be more limited. Overall some 71 percent of households have an M-PESA[27] account (and the vast majority of those are active users) and about half have access to some form of credit.

f. Consumers are able to afford a Tier 1 solution. Assuming households spend a relatively conservative 5 percent of their overall expenditures on electricity, more than half of the households in the underserved counties would be able to pay at least US$8 per month and more than 20 percent would be able to pay US$16 per month.

5. The project area is divided into six service territories based on county allocations derived from scale of challenge (unelectrified population and community facilities), poverty index, and population density[28] to (a) achieve greatest impact with limited IDA resources; (2) deliver services where the need is the largest; (3) consider additional costs due to low population density; and (4) consider principles of equity such that all the counties should benefit in a similar manner. Such a division into lots allows economies of scale in procurement and elicits private sector contractors to be present in these underserved counties over a long term. All the procurements in the proposed project will be carried out according to these service territories.

27 M-Pesa is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom and Vodacom, the largest mobile network operators in Kenya and Tanzania.

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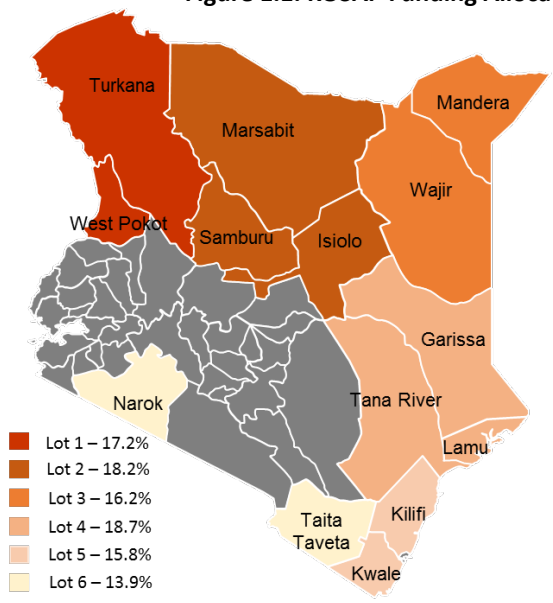
Category/Dimensions	Weight (%)	Indicator	Calculation
Poverty gap	50	x = 5 – wealth index *Source:* DHS 2014	$100 \times \frac{x_i}{\sum_{i=1}^{14} x_i}$
Need for electricity services	35	y = Unelectrified structures (that will not be served by KOSAP mini-grids) *Source:* World Bank Analysis (geospatial study)	$100 \times \frac{y_i}{\sum_{i=1}^{14} y_i}$
Cost premium for Infrastructure development	15	z = 100 – population density *Source:* DHS 2014	$100 \times \frac{z_i}{\sum_{i=1}^{14} z_i}$
Total	100		

Note: DHS = Demographic and Health Survey.

Figure 1.1. KOSAP Funding Allocation and Solutions per Lot/Service Territory



% indicates funding allocation per Service Territory under Components 2 & 3

Lot/ Service Territory	County	Mini-grid Sites	Solar Systems				Solar Pumping Systems	Cook stoves
			Homes	Secondary Schools	Level 2 & 3 Health Clinics	ACC Offices		
1 Northwest	West Pokot	26	42,953	42	165	22	65	34,018
	Turkana							
2 North	Marsabit	29	45,432	28	133	17	69	35,982
	Samburu							
	Isiolo							
3 Northeast	Mandera	32	40,537	23	112	23	62	20,066
	Wajir							
4 East	Garissa	23	46,695	15	127	22	71	23,114
	Tana River							
	Lamu							
5 Southeast	Kilifi	1	39,568	52	104	5	60	19,586
	Kwale							
6 South	Taita Taveta	10	34,815	47	143	17	52	17,233
	Narok							
	Total	121	250,000	207	784	106	380	150,000

Project Components

Component 1: Mini-grids for Community Facilities, Enterprises, and Households (IDA US$40 million equivalent)

6. This component will support the electrification of areas where electricity supply through mini-grids represents the least-cost option from a country perspective, as underpinned by the geospatial plan. Depending on the number of users to be supplied and the service level defined for each type of user (households, enterprises, community facilities, and so on), the generation system of each specific mini-grid will combine solar PV, battery storage, and thermal units running on diesel. Mini-grids will be developed under a PPP whereby private investment and public funds co-finance construction of generation facilities, and public funding is used to construct the distribution network. A single PSP will be responsible for construction (and partial financing) of the generation system and for construction of the distribution network of each mini-grid. The same PSP will sign two long-term contracts with KPLC: (a) a 7–10-year PPA for the O&M of the generation system and recovery of the privately financed part of the investment and (b) a 7–10-year service contract for O&M of the distribution network, including revenue cycle services (as required). Ultimately, after the recovery of the private investments, all assets (both generation and distribution) will be in GoK ownership. All electricity consumers supplied through mini-grids will be KPLC customers and pay the same tariff for each category charged to users connected to the national grid, ensuring effective implementation of a national uniform tariff policy.

7. The component will be implemented in approximately 120 locations throughout the 14 target counties, typically in mini-grids supplying 100–700 prospective users, with an approximate total demand of 20–300 kW. These potential sites, capturing approximately 27,000 consumers in total, have preliminarily been identified as part of the geospatial plan. Each service territory will comprise 20 or more mini-grids located in geographically contiguous areas, with 2,000 or more serviceable customers. There will be a mix of more densely populated sites and less densely populated sites in each lot, where possible,

to enhance their overall commercial attractiveness. PSPs can bid separately for each lot, with multiple lots potentially awarded to the same PSP.

8. REA and KPLC will jointly implement the component, with the procurement of lots divided among them. This component will be complemented by TA, under Subcomponent 4.2, to (a) confirm the sites through further feasibility studies and techno-economic analysis; (b) promote productive and efficient use of energy by users; and (c) provide technical, legal, and procurement support to effectively design the bidding documents and supervise the construction of the mini-grid assets.

Site Identification

9. Approximately 120 mini-grid sites have preliminarily been identified as part of the least-cost geospatial electrification plan (Table 1.1). The mini-grids range in size from 100 to 700 consumers but on average total 230 customers. Additionally, most sites identified have between 100 to 200 consumers. However, each site will need to be confirmed through further feasibility studies and techno-economic analysis. The outcome of this assessment depends on various factors, including population density, demand, number of prospective consumers, and so on.

Table 1.1. Sites and People Covered by Mini-grids

County	Lot #	Number of Mini-grids	Customers	Demand (MWh per year)	Peak Demand (kW)	Array Capacity (kW)	Battery Size (kWh)	CAPEX (US$, millions)
West Pokot	1	26	6,708	1,792	700	1,754	4,942	11.7
Turkana								
Marsabit	2	29	7,364	1,892	740	1,957	5,512	12.1
Samburu								
Isiolo								
Mandera	3	32	5,729	1,679	660	1,547	4,336	10.8
Wajir								
Garissa	4	23	5,056	1,383	540	1,355	3,814	8.6
Tana River								
Lamu								
Kilifi	5	1	643	173	70	167	478	1.1
Kwale								
Taita Taveta	6	10	2,020	552	220	543	1,523	3.5
Narok								
	Total	121	27,520	7,473	2,930	7,322	20,605	47.7

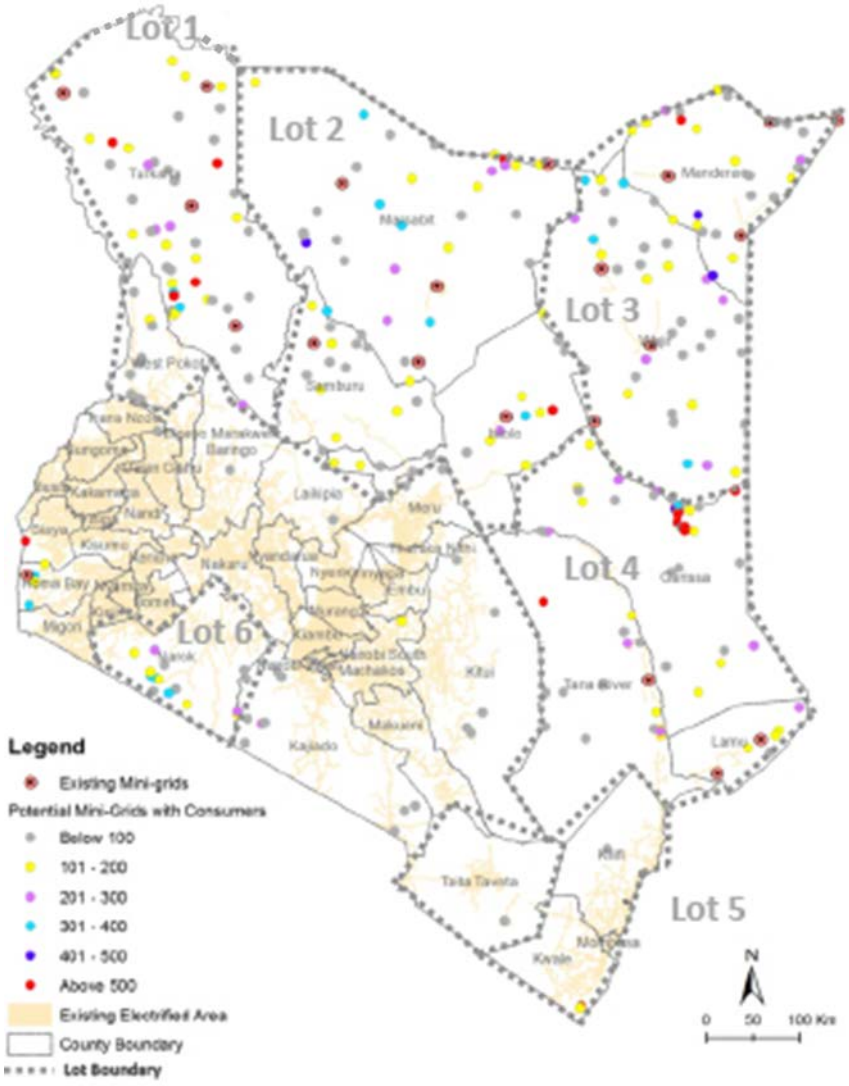
Source: Geospatial plan for Kenya.

10. A typical mini-grid site with 230 consumers, including a primary school as well as a Level 1 health facility, will have a peak demand of approximately 20 kW and energy consumption around 4,250 kWh per month, as estimated in ongoing pre-feasibility studies for 30 potential mini-grid sites (supported by the World Bank's KEEP). This activity includes a baseline characterization of existing KPLC and REA mini-grids, as well as the identification of 30 new sites, including the determination of corresponding load profiles and technical design parameters. Preliminary results[29] show that the average demand per domestic

29 'Pre-feasibility Studies of Private Sector Renewable Energy Mini-grids,' a midterm report, submitted to the MoEP by Economic

customer is 40 kWh per month for existing KPLC/REA mini-grids but was found to be 18 kWh per month at new mini-grid sites. Similarly, the main public sector anchor loads found at the potential mini-grid sites are small health facilities (dispensaries), educational institutions, and government offices. The demand for primary and secondary schools and Level 1 health clinics are 200 W, 800 W, and 500 W, respectively. The capacity of a mini-grid site with 230 consumers is estimated to be around 50 kW.

Figure 1.2. Potential Mini-grid Locations in Kenya



Source: Geospatial plan for Kenya

Consulting Associates, Trama TecnoAmbiental, and Carbon Africa in October 2016.

Box 1.1. Current Mini-grids in Kenya

Mini-grids have been deployed in Kenya to provide service to constituents falling outside the main grid's reach since 1988. At present there are three types of mini-grids in Kenya:

a) **Type 1 (>1,000 kW).** These mini-grids are typically IPPs, usually grid connected, that sell power to an off-taker (typically KPLC) based on a PPA. The ERC license is for captive supply only, although the IPP may step down power to local retail consumers (for social reasons); in this case, tariffs are regulated by the ERC. An example of this is a tea factory that first generates power for internal use and then sells the excess to KPLC under a PPA and may also provide power to its worker families in surrounding villages. It is estimated that the installed capacity of these mini-grids totals 65 MW among roughly nine sites generating for self-consumption and sales to the grid.

b) **Type 2 (100–1,000 kW).** Also known as 'public mini-grids', typically REA constructs these mini-grids, and KPLC operates and maintains the system, providing retail services to customers. The ERC-approved tariff schedule is uniform for all customers of KPLC countrywide, retailing at an average of US$0.20 per kWh. Up to recently, these mini-grids were powered by diesel, but with the support of various donors (including World Bank KEMP), the GoK is integrating renewable energy (solar and/or wind) to offset diesel consumption. However, at present renewables comprise a very small portion (only 4.5 percent) of type 2 mini-grid capacity. There are 20 public mini-grids currently under operation, with operational capacity of 20 MW serving 34,000 customers.

c) **Type 3 (<100 kW).** These mini-grids are typically based on renewable energy, are relatively mobile, cover small radii with low-voltage distribution, and typically provide lower tier of access. Quality of service varies, depending on the provider, from low to utility comparable. Developed by NGOs, communities, and private companies, the revenue and ownership models differ in each case. Previously, they have been unlicensed yet allowed to operate. Tariffs have been unregulated and cost reflective. However, recently Powerhive and Talek Power Company have been given distribution licenses by the ERC for such mini-grids. No more than 10 of these sites exist, with an estimated total capacity of 500 kW serving less than 2,500 customers.

Government-deployed type 2 mini-grids have had the most success in connecting residents in the underserved counties to mini-grids (18 of the 20 existing Type 2 mini-grids fall in the 14 underserved counties) and the World Bank is also supporting a similar approach in ten additional sites as part of KEMP. Private sector-driven activities, on the other hand, have been focusing primarily on Type 3 mini-grids, providing services in small rural towns/large villages.

Business Models

11. The mini-grids within this component will be developed (built, operated, and maintained) by employing a PPP called the Integrated Contract model. The justification for choosing this model emerges from extensive consultation with and feedback from the private sector (through a Vendor Conference held in November 2016) and insight from the geospatial plan, as the proposed sites are much smaller (in number of consumers and level of demand) than the larger, public mini-grids that have been previously constructed in the country.

12. **Integrated Contract.** Through a single procurement process, KPLC or REA will competitively award to a single bidder the three phases of the contract as a single responsibility for the construction, operation, and maintenance of all mini-grid components (generation and distribution network) of all mini-grids in a single lot. The selected Power supply providers (PSP) will construct the generation facilities and operate and maintain those assets over a 7–10-year period. Investment costs to build generation facilities will be

partially financed by the PSP, with the balance (determined through the competitive procurement process) provided by IDA. The selected PSP will also build the distribution network and service connections, using IDA funds, and provide O&M for those assets and, as needed, revenue cycle services (metering, collection, disconnection/reconnection) over a 7–10-year period, on behalf of KPLC. KPLC will be the retailer (provider of electricity service) to consumers supplied through the mini-grids, who will pay the regulated charges set by the competent authorities. KPLC will pay the PSP provider monthly fees under the PPA for generation facilities and under the distribution O&M and revenue cycle services contract. Both contracts will contain specific provisions on scope, expected performance, mechanisms for effective monitoring, and application of penalties.

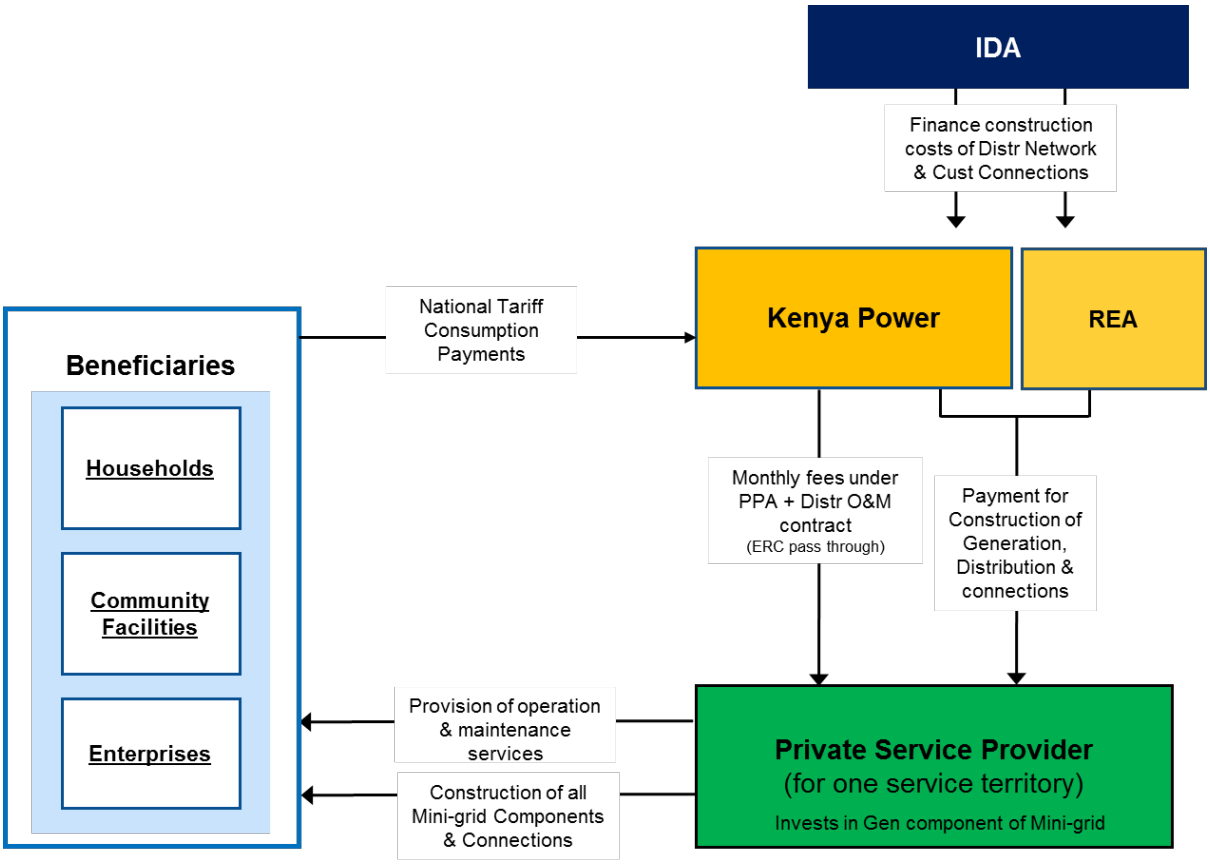
13. A single procurement process will award the three phases of the services as one contract. The evaluated bid price (EBP) for each lot will be computed as the NPV over a 7–10-year period, of the following parameters, to be quoted by each bidder in its financial proposal: (a) charge to be paid upon commissioning of generation facilities (financed by the project); (b) monthly charges of the 7–10-year PPA (to be paid by KPLC; the project could eventually finance payments for the first 1–2 years); (c) price for 'turnkey' construction of the distribution network and service connections (financed by the project); and (d) monthly charges under the service contract for O&M of the distribution network and provision of revenue cycle services. Each lot will be awarded to the qualified bidder having submitted the lowest evaluated (least EBP) substantially responsive bid. This ensures lowest levelized cost of electricity supply.

14. REA and KPLC will jointly prepare the mini-grid contracts for each lot and conduct the tendering process. KPLC will review results and sign the contracts with the PSP. The Energy Regulatory Commission (ERC) will be responsible for approving all components of the contracts and issuing the licenses to the PSP to build and operate the mini-grids.

15. While the Integrated Contract will be the default model, another approach—the Discrete Contract model—will be considered for larger sites located far away from other mini-grid clusters. This approach is conceptually identical to the Integrated Contract described earlier; however, three separate procurement processes are used to award the three contracts instead of a single procurement process. As such, each contract may be awarded to a separate PSP. The Discrete Contract model is the same as that of Type 2 (Box 1.1) and also implemented under the World Bank-supported KEMP.

16. If private sector investment is not realized—due to the security risks of operating in some of the target counties—a fully public model will be considered, whereby both generation and distribution are fully financed by the project.

Figure 1.3. Flow of Funds and Institutional Responsibilities



Source: World Bank analysis.

Principles Underlying Business Models

17. **Affordability.** The proposed business models enable the smooth application of the GoK's announced policy of a uniform national tariff, as well as the policy to set affordable connection charges for low-income consumers. As the potential beneficiaries will be KPLC customers, they are likely to pay the lifeline tariff as well as connection charges as low as US$10 (similar to slum consumers). Recurrent charges to be paid by KPLC to the PSP under the PPA and distribution O&M contract will be passed through KPLC-allowed tariff revenues set by the ERC, allowing the socialization of the operating costs incurred by the utility to serve consumers connected to mini-grids among all customers countrywide.

18. **Sustainability.** Construction and O&M contracts, both for generation and network assets of the mini-grids, will be procured on a competitive basis to ensure long-term service provision of electricity services by KPLC to consumers, in full compliance with applicable standards.

19. **Reliability.** The ERC will establish and monitor quality standards for mini-grids, taking into consideration the recently completed mini-grid regulations study (supported by KEEP). The key elements to be defined by the ERC and included by KPLC/REA in the bidding documents are network design and construction parameters; quality of service standards (for example, allowed frequency and duration of interruptions at the end-user level and allowed voltage drops); and mechanisms to measure quality of

service and enforce compliance. The TA support described in Subcomponent 4.2 will finance the investment costs (equipment, software, training, and so on) to be incurred by the ERC to establish the monitoring unit.

Cost Assumptions

20. The funding allocation of this component is expected to cover the development of all remaining mini-grids sites, as depicted in Figure 1.2, and Table 1.1 reaching approximately 27,000 households or 135,000 people.

21. The average capital cost for solar hybrid mini-grid systems is calculated to be US$5,600 per kW, as a result of recent declining costs, expertise and efficiencies of the private sector, risk reduction, and competition. The cost estimates, in Table 1.2, are based on available data for eight existing[30] solar or solar hybrid mini-grid stations, as well as findings from the recent IFC study 'Kenya Market Assessment for Off-Grid Electrification'. Therefore, the cost for a 50 kW hybrid mini-grid system (solar PV, diesel) is estimated at US$280,000.

Table 1.2. Capital Costs Breakdown of 25 kW Solar Hybrid Mini-grid

Mini-grid Component	Cost (US$ per kW)	% Capital Cost	Financing
Generation (including storage, powerhouse, and conversion)	3,200.00	57	Private finance + IDA
Distribution, services, and logistics	1,200.00	21	IDA
Civil works	1,200.00	21	IDA
Total capital cost	5,600.00	—	—

Source: World Bank Analysis

22. Based upon ongoing geospatial analysis, the total capital costs for 120 sites is estimated to be US$48 million; however, this project will leverage private sector investment in the generation component of the mini-grids. As shown in Table 1.2, generation accounts for approximately 57 percent of total capital costs, resulting in required investment of US$27 million. Due to the risky nature of the investment, it is expected that the private sector will be willing to finance no more than US$5 million in investment for mini-grid generation capacity.

Component 2: Stand-alone Solar Systems and Clean Cooking Solutions for Households (IDA US$48 million equivalent)

Subcomponent 2A: Stand-alone Solar Systems for Households (IDA US$42 million equivalent)

23. This subcomponent will focus on establishing delivery mechanisms for off-grid electrification in the 14 target counties, leveraging market dynamics and innovations of solar off-grid companies currently

30 Data provided by REA, for seven solar and solar hybrid mini-grids, and GIZ for its mini-grid operated by Talek Power Company.

operating in the more densely populated areas of the country, also known as the core market. This approach has been chosen to incentivize fast expansion of off-grid services in the underserved counties. By leveraging market dynamics, efficiency and innovation, and customers' existing willingness to pay, the approach maximizes the number of households that can be reached with available amount of funding.

Figure 1.4. Examples of SHS Offerings in Kenya

Tier 1 offering (M-KOPA IV)
- 2 fixed lights
- 1 portable light
- Radio
- Phone charging capabilities

Tier 2 offering (Mobisol Buffalo)
- 19" flatscreen TV
- 4 fixed lights
- 1 portable light
- Radio
- Phone charging capabilities

24. Kenyan SSPs have supplied households with 2.75 million quality-verified off-grid solar products in the last four years, of which approximately 700,000 are SHS. These are typically small multi-light systems with cell phone charging capabilities, though larger systems capable of powering a TV and other appliances are also increasingly available. Kenya's off-grid solar industry is unique in Africa. By the continent's standards, it has a long history, dating back several decades. However, it is the past decade that has truly set the Kenyan market apart. It became the core market for a new generation of solar products that were developed of a set of technical specifications developed by the World Bank Group's Lighting Africa program back in 2008. Many of these products were solar lanterns and small plug-and-play SHS whose first commercial sales occurred in Kenya. Most of these manufacturers partnered with local distributors to get their product to market, often in existing retail shops in urban, peri-urban, and rural areas. In the last four years, the penetration of SHS also started to increase thanks to the emergence of the PAYG business model. While still in its infancy, the Kenyan PAYG companies are already providing services to over 700,000 users. These systems are largely small multi-light systems with cell phone charging, but larger systems with TVs are steadily increasing their market share.

25. Therefore, today, Kenya's thriving off-grid solar industry translates into robust competition, with companies seeking to differentiate themselves to customers through their product offerings. Products range from small portable task lights that retail for US$5 up to larger SHS that are capable of powering appliances such as TVs, fans, satellite decoders, and refrigerators. Several companies offer entry-level multi-light systems, typically with two–four fixed light points, a portable lantern, a radio, and mobile phone charging capabilities. Many of these companies then offer larger systems capable of powering appliances to their same customers, often using modular systems to scale up their power generation and storage capacity. SHS are built on DC platforms, which are more efficient, robust, and safer than alternating current options. These systems use state-of-the-art components, including polycrystalline silicon PV panels, LEDs, advanced batteries (including lithium ion and gel cell batteries), charge controllers, active (through GSM connections) or passive chipsets (through time-based encryption) to monitor systems and lock them in the event of nonpayment, and super-efficient DC-powered appliances (for

example, TVs that consume less than 10 W of power, which are many times more efficient than conventional appliances).

Box 1.2. PAYG Explained

PAYG companies sell SHS against small installments instead of a lump sum payment and utilize technology that disables the system in the event of nonpayment by the consumer. This innovation makes a previously unattainable cash purchase of an SHS affordable to millions through this lease-to-own platform. The PAYG solar industry is less than five years old but has delivered energy services to over 700,000 households, principally in East African markets.

26. Kenya has also been the birthplace of PAYG solar, a business model and technology that enables customers to pay for their product in monthly installments, rather than a one-off cash sale. Owing to this, one of the greatest barriers to uptake of solar products has been overcome—affordability. M-KOPA, a Kenyan enterprise, was the first to commercialize this approach in 2012. Since that time, they have sold over 450,000 SHS in East Africa, with the vast majority sold into the Kenyan market. Several competitors have also entered Kenya, including other established market players such as BBOXX, Mobisol, and Azuri delivering services on a similar platform. The market-leading manufacturers, including d.light and Greenlight Planet, have recently raised substantial equity financing to enable them to build out their own distribution channels, with Kenya being a key target market for each of them. Beyond these established players, there are approximately two dozen smaller ventures that have either been in the market for some time but have not significantly scaled their operations (most of these are companies doing over-the-counter cash sales) or new enterprises that are looking to scale up rapidly on a PAYG platform.

27. In this competitive environment, Kenyan SSPs offer varied pricing to their customers, with a diverse mix of combinations of down payment at the time of purchase, a fixed monthly fee, and different payback periods. Some companies sell the product on a cash sale basis, whereby the customer makes a one-off purchase. The vast majority of SSPs in Kenya, however, offer some sort of installment-based payments. Not only does this make their offering affordable to significantly more households, but it also enables the company to establish a longer-term relationship with the customer, thereby offering higher-powered systems and ancillary devices powered by them over time—all on credit. Some service providers use the down payment as a proxy for creditworthiness of the household, typically setting this at a high level (equivalent to two to three times the monthly fee), while others require no deposit, conducting credit checks through proprietary risk scoring tools, or doing no initial creditworthiness assessment but having robust protocols in place in the event of payment default (often through repossessing the system). Monthly fees vary widely, though entry-level systems are often priced at a level that is lower than households' incumbent spend on lighting (often through kerosene lanterns, battery-operated flashlights, and/or candles) and phone charging. The final variable in the customer pricing package is the payback term. Again, wide variation is observed in the market, with some companies opting for shorter payback periods (often less than 1 year, especially for smaller multi-light systems), while others offer paybacks up to 36 months. This is particularly true for companies that offer larger, more expensive systems. Longer paybacks allow monthly costs to be more affordable for customers. A final subset of companies offers systems on a perpetual lease, whereby they own the SHS in perpetuity and take responsibility for any technical faults. Their customers pay a monthly fee and pay for appliances and ancillary devices on a lease-to-own basis, purchased from the SSP.

28. On balance, this vibrant market leads to impressive statistics: 30 percent of Kenyan households have a solar product, and 25 percent of all sales of quality-verified products in sub-Saharan Africa happens

in Kenya. What is most striking, however, is the limited geographic area in which these sales occur. Recent analysis by Power Africa shows that the clear majority of product sales occur in Kenya's 'core' market, largely centered in Western and Central Kenya (see Figure 6.1b). Despite their proximity to the grid (around 80 percent of these households live within 5–10 km of the grid), these households are adopting off-grid solutions for their primary means of energy services, with some grid-connected households using these systems as backup solutions given quality of service issues with Kenya Power. Extensive consultations with SSPs point to continued robust demand in the core market, despite increasing competition and a shrinking serviceable market in these localities. This means that without targeted interventions, the Kenya off-grid SSPs are unlikely to expand to underserved counties in foreseeable future.

29. As such, the thesis underpinning Component 2 is to create enabling conditions for existing SSPs in Kenya to expand to underserved counties and compete for customers in these new markets. This approach will build on these existing successful business models and focus on extending their supply chains and sales infrastructure into the poorer and more sparsely populated 14 target counties. The private sector will be provided results-based incentives to serve the customers in these counties, acknowledging that it is more costly and riskier to serve these regions. This market-based approach will be available to all 14 underserved counties, and proportional financing allocations will be made based on lots/service territories (Figure 1.1).

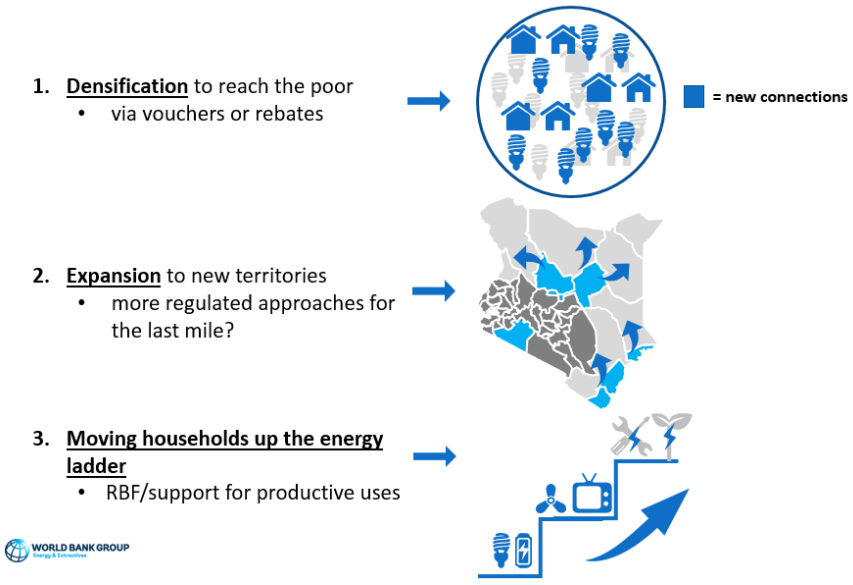
30. The target beneficiaries of this subcomponent are households located in the underserved counties, for whom a stand-alone solar system is the most appropriate technology to deliver energy services. Many of these households derive their livelihoods from pastoralism and have sparsely populated and nomadic settlement patterns as a consequence. They struggle with limited access to social services, very poor infrastructure, and limited economic activities. Many of the underserved counties are prone to drought, and several experience insecurity and conflict, often over livestock and land. Despite these challenges, the willingness-to-pay analysis shows that there is a considerable subset of the population who could theoretically afford a Tier 1-level SHS (in this scenario, a 3-light point system with phone charging capabilities, offered on a monthly cost of KES 500 and paid off over 36 months). Simulations using 2013 FinAccess[31] household survey data show that in a scenario where 7 percent of household expenditures are assumed to be made on stopgap lighting, over 500,000 of the 1.3 million off-grid households could afford this energy service offering.

31 Financial Access (FinAccess) surveys provide information to policy makers about the main barriers to financial access and inclusion, for example, geographic or socioeconomic factors. Three nationally representative FinAccess surveys have been conducted in Kenya: in 2006, 2009, and 2013.

31. Reliability, affordability, and sustainability considerations are at the core of the market-based approach. First, the project will only support service providers that sell quality-verified products, as determined by IEC and Lighting Global specifications. The support provided by the project is designed to match the financing needs of the PAYG companies, which will be expected to extend financing to users. The willingness-to-pay analysis shows there is a considerable serviceable market of over half a million households in the underserved counties for a Tier 1 service offering on a PAYG basis. Beyond these households, SSPs will be incentivized to extend the repayment period to make the product purchases more affordable. By extending the tenor, instead of offering consumer-facing subsidies, the project aims at increasing sustainability of services. The long-term relationship between the customer and the off-grid service providers incentivizes the latter to provide after-sales services, including honoring product warranties that will be required under the project. Since customers pay full market price for energy services, they are also expected to be able to afford parts and system replacements in the future. In fact, this is the core tenet of the PAYG relationship, whereby service providers aspire to become long-term service providers to their customers.

32. The market development in Kenya is likely to follow a three-stage path, following a similar path that was observed in the core market. First, SSPs establish core infrastructure, sales, and after-sales service teams in the regions. Second, they will 'densify' their customer base within these localities. This is likely to occur in peri-urban areas or in villages where there is a concentration of households. From here,

Figure 1.5. Scaling up/out the Market-Based Approach



service providers will then 'expand' further into the territory, establishing a presence in new geographies and beginning the densification efforts afresh in these areas. Established customers will then have the opportunity to participate in the final stage of the rollout, whereby the SSPs move their existing customers up the energy ladder by offering greater energy services through their product offering. This could include TV, ventilation, refrigeration, or productive use appliances.

33. The subcomponent addresses fundamental challenges around both the supply of and demand for energy services in the underserved counties. Households often have no choice other than their current stopgap solutions for lighting and other basic energy services. As such, incentivizing existing SSPs to move into these geographies will remedy this situation, as they compete to deliver energy services to these households. On the demand side, affordability is a major consideration, given the limited purchasing power of households and the unreliable income streams they possess. Enabling households to pay for energy services in installments therefore makes them much more attainable. To address these core supply-side and demand-side constraints, several different instruments were considered to be deployed under the project. Instruments were vetted based on their track record in other markets, feasibility, and sustainability. Extensive consultations were held with key stakeholders as part of the vetting and design process, and there is wide agreement that the selected instruments hold the most promise in unlocking household energy access in the underserved counties.

34. This subcomponent will be accomplished through two financing instruments that eligible SSPs will have access to.

i. **RBF, competitively awarded incentives**, to compensate SHS operators for initial, ongoing incremental, and opportunity costs associated with an expansion of operations in underserved counties. To encourage competition and allow the market to price the risk associated with different localities, counties will be grouped into lots and a total incentive amount allocated based on objective metrics (see Figure 1.1 for details). A percentage cap will be set within each allocation so that multiple service providers will have the opportunity to operate in each locality. A reverse auction approach will be used, whereby service providers will bid based on an incentive amount per household connection, with the lowest incentive requirements winning. The RBF will specify installment payments based on the achievement of pre-agreed connection milestones and satisfactory after-sales service support.

ii. **Debt facility, debt financing to SSPs**, to support up-front costs associated with getting hardware inventory into the market and medium-term consumer financing to enable households to pay off the systems over time. The debt financing will only be available in Kenya Shillings. Two typologies of business models underpin the majority of SSPs that operate in the Kenyan market. First are service providers that sell solar products (both lanterns and SHS) on an over-the-counter (cash sale) basis. These service providers require shorter-term debt to finance costs associated with hardware manufacture and transit to Kenya (typically from China) before the product sale. This cycle typically lasts anywhere from 6 to 9 months and is best covered through U.S. dollars or other hard currency denominated debt, matching the currency of the product purchase. Given that GoK has decided to only provide debt in local currency, any loans used by solar service providers to cover shorter term inventory finance needs will give rise to foreign exchange risk that must be borne by the service providers themselves. A second prevailing business model is PAYG, whereby customers pay for the systems in monthly installments (typically between 12 and 36 months), and SSPs carry the default risk during the payback period. These businesses typically require debt financing that is commensurate with the lending terms that they extend to their customers. Given that service providers' revenues are in local currency, the debt instrument will offer loans in Kenyan shillings. This instrument addresses a critical

failure in the market at present—the limited debt financing that is available for the industry is denominated in hard currency, and the cost of hedging instruments is too high to be borne by the service providers. As such, using IDA to deliver local currency debt constitutes a major incentive for the industry and will also hopefully create a demonstration effect that can later be followed by local commercial banks.

35. These two financing instruments have been selected based on extensive market soundings of a long list of instruments. The team met with commercial banks, microfinance institutions, and several venture capital and debt funds specialized in the off-grid market. The targeted service providers are still at an early stage, reinvesting all their operating profits into growth, which does not make them good candidates for commercial bank funding. In addition, this financing package will be mobilized following certain principles: (a) an integrated package, that is, SSPs can bid for the RBF, the debt, or for both components in one single bid; (b) having 'skin in the game', that is, SSPs that bid for the RBF will have to show that they have been able to/are in the process of leveraging equity or debt financing to support their growth in their core market; and (c) appropriate pricing, through a reverse auction of the RBF and risk-based pricing for the debt. Detailed design of the instruments, based on the elaboration of term sheets, was also informed by extensive market consultations, including bilateral working sessions with 15 SSPs, and an equal number of entities that have experience managing RBF and debt facilities targeting the off-grid solar industry.

36. Institutional arrangements for this subcomponent involve several different actors but have been streamlined to mitigate interface risks and improve efficiencies. The facility will be managed by a competitively selected consortium or single entity, with the MoEP playing a key oversight role. Setting up and administering the RBF instrument is a complex and time-intensive undertaking that requires specialized expertise. In the case of the debt financing, an experienced, specialized facility manager will be used to administer the funds on behalf of the GoK. Assessing the risk profile of SSPs is challenging, given how nascent many of them are, the scope and nature of their financing needs, and the risk profile of their customers, technology, and operating contexts. There are, however, several existing specialized investment funds (debt, equity, and blended) that have gained expertise in providing equity and/or debt financing to SSPs in Kenya's core market and are under consideration for this role. Given the significant overlap associated with assessing the capacity of candidate SSPs to manage both instruments, along with downstream portfolio supervision, the remits for the two instruments will be combined into a single contract, and qualified firms are expected to associate with one another as part of the bidding process (or demonstrate that a single firm has suitable qualifications to manage both specialized instruments).

37. The Facility Manager will be competitively selected. The Facility Manager will also be required to satisfy financial intermediary financing requirements that are prescribed under OP/BP 10.00. These include a competitive selection process, clear selection criteria and scope of work for the Facility Manager, market-based pricing of the project proceeds that will be lent to SSPs, and assurances that the foreign exchange risk will not be passed on to final beneficiaries. These requirements underscore the importance of responsible lending that operates in a context conducive to efficient resource allocation.

38. SSPs will submit a single proposal (for either RBF or debt or a combination of both) to the Facility Manager, who will be responsible for making decisions regarding eligibility of applications for support under the RBF and debt instruments. A first screening by the Facility Manager will filter out proposals that do not meet prequalification criteria. In the case of RBF, those service providers will then be eligible to

compete for funds under the Facility. Detailed guidelines for the RBF facility will be codified in the FIM, which will be developed by the Facility Manager and signed off on by the MoEP and IDA. In the case of debt financing, service providers that meet the eligibility criteria will then be subject to detailed due diligence by the Facility Manager(s) and a downstream decision made regarding the debt proposal. The Facility Manager will provide quarterly updates to the project TWG along with periodic updates to the Steering Committee. The MoEP will supervise the activities under the subcomponent, including hiring the Facility Manager and ensuring satisfactory reporting to the TWG by the Facility Manager.

39. As shown in Figure 1.6, project flow of funds will follow established norms in Kenya in order to transit into a Facilities account, into which at least 50 percent of the subcomponent proceeds will be placed in an advance payment. The Facility Manager will then authorize withdrawals from this account for the purpose of making eligible RBF and debt payments to SSPs.

40. SSPs will be responsible for delivering energy services to households through their product offerings. This will include educating customers around how to operate and maintain the product, collecting payments from customers if they are extending credit to them, offering and honoring any warranty claims that may arise, and in some cases offering to upsell larger SHS or ancillary devices (that is, TVs, satellite decoders, fans, radios, and mobile phones) that are powered by them. The duration of this service commitment will be contractually bound by either the payback period, if the system is sold to the consumer on credit, or the warranty period (whichever is longer).

41. Given that the GoK ultimately bears the default risk, the potential moral hazard, which may result in service providers not repaying the loans, will be managed at several levels:

i. At the Facility Manager level: (i) a reputable manager with demonstrated track record will be contracted to manage funds on behalf of the GoK; (ii) the Facility Manager's compensation will include a variable component that will be dependent on successful repayment of loans and demonstrated results on the ground (number of connections); and (iii) the Facility Manager will also want to mitigate its reputational risk by ensuring the successful oversight of the facilities.

ii. At the participating SSPs level: (i) disbursements of RBF and loans will be results based and verified by an independent verification agent; (ii) service providers will be required to co-finance the expansion to the underserved counties with their own funds; (iii) service providers will be required to repay the loans; a default will cut off their access to debt financing under the project ; and (iv) large-scale default under the facility will also undermine the future viability of the entity, given that this will likely negatively affect their ability to either borrow debt from other lenders or raise equity financing.

iii. At household level: (i) the SHS of customers who default on repayment will be remotely disabled by the SSP until payment arrears are made current; and (ii) if the customer is unwilling or unable to make their accounts current with the SSP, the system can be repossessed, refurbished, and redeployed to a new customer.

Subcomponent 2B: Clean Cooking Solutions for Households (IDA US$6 million equivalent)

42. Solid fuels—notably wood and charcoal—constitute the largest share of Kenya's energy balance. The International Energy Agency estimated that traditional biomass fuels constituted 71 percent of Kenya's net energy consumption in 2014. The majority of these biomass fuels are used for household cooking, in the form of either firewood (fuelwood) or charcoal. Work on improving the efficiency of Kenya's household cooking stoves began in the 1980s with the importation of a ceramic-lined Thai bucket stove. Over the years, this stove—now called the Kenya Ceramic Jiko—has become the dominant baseline alternative for households cooking with charcoal in the urban and peri-urban regions of the country. For a well-built and well-managed Kenya Ceramic Jiko, the efficiency of use is estimated at roughly 20 percent, nearly double that of the older, metal-only Jiko (stove). More commonly used in the rural households, the traditional three-stone hearth remains the most common stove used to burn firewood for cooking. Its efficiency rarely exceeds 12 percent.

43. Recently, international attention has refocused on the continued cooking with solid fuels as it has been linked to high rates of respiratory tract infections among the people using them. In addition, the use of traditional and even ceramic-lined cookstoves has lagged behind the innovation in the marketplace. New stoves are being produced that can raise the energy efficiency by 100 percent, thereby reducing exposure to ground-level pollutants and reducing household expenditures on fuel supplies. Following this international trend, the GoK has recently removed all import duties and value added tax from improved stoves. Not only has this helped reduce the retail price of the improved stoves being sold in Kenya, but it has also shown the industry that the GoK will listen to the stove industry and values the contribution that these products can make to national development.

44. However, such stoves have not yet become widely disseminated in the underserved counties of Kenya. The reasons for this failure of the stove market to disseminate cleaner, improved cookstoves to these counties are many: they contain a larger share of poor people than the core or central counties, the logistics of transporting goods to these remote regions are challenging, and there has been market spoilage because some relief agencies have been giving away stoves that are not appealing to the target population. Due to the relatively low population density and limited size of urban settlements in these counties, the population has been less exposed to and has had fewer opportunities to purchase these improved efficiency stoves, despite their economic and environmental health benefits.

45. Cookstove efficiency can be classified by tiers according to the International Workshop Agreement developed by the International Standards Organization and the Global Alliance for Clean Cookstoves. Table 1.3 summarizes the International Workshop Agreement tier structure with respect to energy or fuel efficiency.

Table 1.3. Tier System for Rating Cook Stove Efficiency

Tier	High-Power Thermal Efficiency (%)	Examples
Tier 0	<15	Three-stone stoves
Tier 1	≥15	Kenya Ceramic Jiko
Tier 2	≥25	Rocket stoves
Tier 3	≥35	Industrially manufactured stoves
Tier 4	≥45	Liquefied petroleum gas (LPG), ethanol, combination of pellets with gasifier stove

Source: Global Alliance of Clean Cookstoves.

46. The objective of this subcomponent is to transform the cookstove market in the underserved counties from a focus on low-efficiency baseline stoves (Tiers 0–2) to cleaner, higher-efficiency, improved stoves (Tiers 3-4).

47. To accomplish this objective, activities will be focused on the market for cleaner household cooking appliances. This subcomponent will pilot this approach in four underserved counties in the northwest of Kenya (West Pokot, Turkana, Isiolo, Samburu, and Marsabit Counties) and will replicate the successful elements of this pilot in three other underserved counties (Kilifi, Kwale and Taita-Taveta) using the funds from KOSAP. In addition, funds are currently being solicited from the Green Climate Fund to further replicate these market transformation activities in the remaining underserved counties of Kenya.

48. The assessment, undertaken by consultants with support from ESMAP, to-date has shown that most charcoal-consuming households can reduce their consumption by as much as 60 percent through the use of one of these improved stoves. The payback period for purchasing an improved stove costing about US$40 is roughly two to three months with regard to reduced charcoal purchases. The stoves come with product guarantees of up to two years, meaning that barring unreasonable take-back or rebound effects, the households using these stoves can reduce energy expenditures considerably by using these improved stoves. In addition, they emit little or no smoke and provide for a cleaner kitchen, giving them also a modern or ‘aspirational’ appeal.

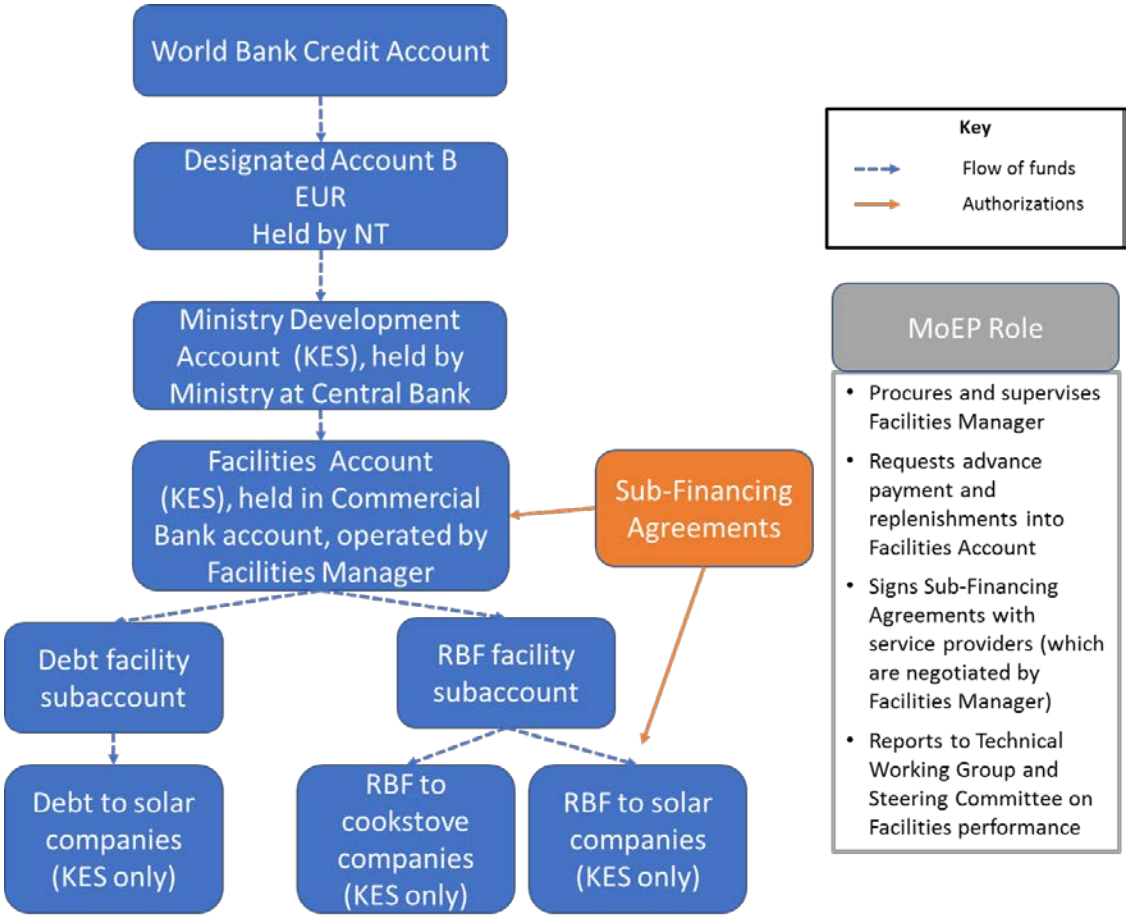
49. A Stove-Market Testing Program will be undertaken with support of ESMAP in the municipal, town, and densely settled parts of Turkana County. The stoves to be included will be determined following a call for Expressions of Interest from stove manufacturers wanting their products to be exposed to these new markets. To be eligible, a woodstove must prove that its efficiency tests it as a Tier 2 stove (roughly 30 percent efficient) and a charcoal stove should prove that its efficiency tests as a Tier 3 stove (roughly 40 percent efficient) to be eligible for inclusion in the market tests. These tests will involve exposing both consumers and suppliers (retailers, wholesalers, and distributors) in the urban areas of Turkana County to these improved stoves. The results will be shared with the communities and interested parties. Field testing for additional stoves models may be considered during the project implementation as a second set of tests will be undertaken for the southeastern underserved counties (Kilifi, Kwale, and Taita-Taveta).

50. The project will provide financing initially in the form of the RBF facility, and at a later stage, the debt facility may be considered to support sales of eligible stoves in targeted counties. This will be a sub-window within in the RBF and debt facilities under the component. Approximately one half of the funding for household clean cooking (US$2.5 million) will be allocated for RBF financing for selected supply consortia and the other half (US$2.5 million) will be allocated to the debt facility. A Call for Proposals will be issued to cookstove suppliers (wholesaler and retailer consortia in the target counties) to develop business plans and commit to selling a large number of the stoves in the targeted counties. The RBF facility will provide the winning service providers with financial support on a results-based approach to enable them to market their stoves locally within the target counties, to transport them to the target communities in number, and to sell them to willing buyers in the communities. The exact details of the support will be determined based upon the final market evaluation of the selected counties and the results of the Stove-Market Testing Program.

51. During project implementation, the scope may widen to include institutional cookstoves. In the more commercial areas of Kenya, the market for institutional stoves has grown steadily as more schools,

clinics, and even restaurants have realized the value of the cash savings available to them from utilizing improved institutional cookstoves.

Figure 1.6. Flow of Funds and MoEP role under Component 2



Source: World Bank Analysis.

Component 3: Stand-alone Solar Systems and Solar Water Pumps for Community Facilities (IDA US$40 million equivalent)

Subcomponent 3A: Stand-alone Solar Systems for Community Facilities (IDA US$25 million equivalent)

52. This subcomponent will support a regulated provision of electricity services to community facilities in remote areas in underserved counties. The project area will be split into multiple geographic service territories based on geographic proximity, to optimize costs of field operations. A PSP will be competitively selected (through International Competitive bidding) for each service territory to supply and install SHS and to provide maintenance services of the installed SHS in the service territory. The principle underpinning this subcomponent is that the private sector efficiencies can be harnessed for public sector provision in truly remote areas—the community facilities provide the anchor load and economies of scale are realized in reaching as many consumption points as possible in selected service

territories. Depending on the results of the geospatial plan and remoteness of communities, households could be included in some of these service territories.

53. Electrification of community facilities is a strategic priority for the GoK. REA, on behalf of the GoK, has undertaken a recent large-scale program to provide solar electrification to primary schools. The effort is associated with an ambitious distance literacy program.

54. Devolution tremendously affects the delivery of services. With regard to the assignment of functions to the county governments, a change that marks a significant departure from the past is the transfer of the management of services (especially for health services) from the National Government to the county governments. The National Government is assigned the responsibility over the national policy (relating to health, education). The summary of the specific functions of the National Government and the county governments in the health and education sectors post the devolution is provided in Table 1.4:

Table 1.4. Functions of National and County Governments Post devolution

Sector	Functions	
	National Government	**County Government**
Health sector	• Health Policy • National referral health facilities[a]	• County health facilities[b] • Pharmacies • Ambulance services • Promotion of primary health care
Education sector	• Education policy • Primary schools	• Pre-primary education (early childhood centers) • Technical training institutes

Note: a. National referral services comprise all secondary and tertiary referral facilities that provide highly specialized services such as (a) general specialization, (b) discipline specialization, and (c) regional specialization.
b. Excluding national referral hospitals such as Kenyatta National Hospital in Nairobi County and Moi Teaching and Referral Hospital in Uasin Gishu County.

55. The community facilities considered in this subcomponent are (a) health facilities (Kenya Essential Package for Health [KEPH] Levels 2 and 3); (b) educational facilities (secondary schools); and (c) administrative offices of county governments and of Ministry of Interior (Assistant County Commissioner offices). Based on research and dialogue with the Ministry of Health, Ministry of Education, and Ministry of Interior and Coordination (MoIC), community facilities in Kenya are classified as follows:

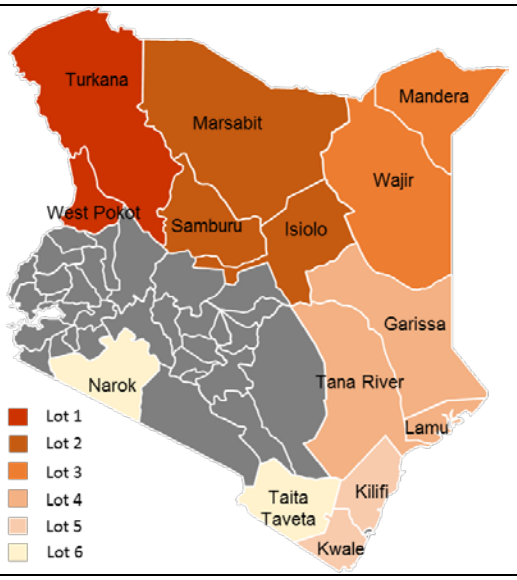
Table 1.5. Classification of Community Institutions

Educational Institutes	Health Facilities (KEPH)	Public offices (Under MoIC)
Early childhood education covering three years of kindergarten school	KEPH Level 1: Community facilities	Police posts/stations
Basic education covering lower and upper primary school	KEPH Level 2: Dispensaries KEPH Level 3: Health centers	Office of Chiefs Other public offices managed by the MoIC
Basic education covering secondary school		Administrative offices—county government offices and/or Assistant County Commissioners
Technical training schools	KEPH Level 4: Primary referral facilities KEPH Level 5: Secondary referral facilities	County Commissioners
Professional training schools	KEPH Level 6: Tertiary referral facilities	
University programs		

Note: Categories of community facilities shaded in grey are covered under the KOSAP.

56. Total unelectrified community facilities in the project area (14 underserved counties) include 207 secondary schools, 784 health facilities (of which 642 are Level 2 and 142 are Level 3), and around 106 Assistant County Commissioner offices. (Figure 1.7). It is expected that 100 schools and 100 health facilities will be electrified under Component 1 through mini-grids; the remainder will be reached through this subcomponent.

Figure 1.7. Number of Unelectrified Community Facilities



Lot/ Service Territory	County	ACC offices	Dispensaries (Level 2)	Health Centers (Level 3)	Secondary Schools
1 Northwest	West Pokot	7	72	8	32
	Turkana	15	73	12	10
2 North	Marsabit	10	48	12	2
	Samburu	4	42	2	16
	Isiolo	3	25	4	10
3 Northeast	Mandera	15	24	10	11
	Wajir	8	54	24	12
4 East	Garissa	10	41	16	5
	Tana River	7	46	7	6
	Lamu	5	16	1	4
5 South East	Kilifi	2	37	2	29
	Kwale	3	56	9	23
6 South	Taita Taveta	4	34	18	9
	Narok	13	74	17	38
	Total	106	642	142	207

57. While the study to determine an optimum range of demand for each of the different types of community institutions is under way, the following assumptions have been made regarding average demand (size of the stand-alone system providing electrification) for each consumer class.

Table 1.6. Average Capacity of Stand-alone Systems

Type of Community		Average Capacity of Stand-alone Systems (W)
Education facilities	Secondary schools	800
	Vocational training + others	1,000
Health facilities	KEPH Level 2	1,200
	KEPH Level 3	3,600
Administrative offices	County government/Assistant County Commissioner offices	3,000

58. This approach entails the following main features:

A. **Overall approach**

a. Project area will be split into multiple geographic service territories.

b. Single PSP will be competitively selected for each service territory for supply and installation of SHS and provision of maintenance services over a period of 10–15 years.

c. Selection of the PSP will be based on the lowest NPV of total supply, installation, and maintenance costs over the period of the contract.

B. **Contractor responsibilities**

a. The PSP will supply and install SHS for each service territory under a 10–15-year supply and installation contract with KPLC

b. The PSP will provide maintenance services of SHS in the service territory under a 10–15-year maintenance contract with KPLC.

c. The PSP will not assume any retail activities and the facilities will be KPLC customers.

d. The PSP will be accountable to KPLC for the performance of the SHS installed. KPLC is responsible for quality of electricity services provided to the facilities.

e. All grievances related to the services received by the facilities will be handled by KPLC, which will in turn require the PSP to resolve it on KPLC's behalf (as outlined in the contract).

C. **Terms of payment to contractor**

a. IDA financing under KOSAP will cover the supply and installation costs.

b. KPLC will pay for recurrent fees under the maintenance contract with tariff revenues (costs of maintenance contracts passes through into tariff revenues by the ERC recognized by the ERC.

c. Payments for supply and installation and for maintenance services will be made upon verification of compliance with contract conditions (by the ERC).

D. **Risks and Mitigation**

a. Supply and installation works will be financed through project funds (IDA).

b. Risk of nonpayments or delayed payments by KPLC under the maintenance contract will be mitigated through funds set aside for an amount equivalent to 6–12 months' fees that KPLC can draw upon in case of inadequate allocation from beneficiaries to pay the contractor.

c. Risk of noncompliance by the contractor will be mitigated as contractors will be required to submit a performance security for both supply and installation and maintenance contracts.

59. The core principles of reliability, affordability, and sustainability is upheld in the following manner:

- **Reliability.** The service quality standards for the electricity service provision will include parameters on reliability that measure duration of service provision, duration of service interruptions, backup time, and quality of service (lumen-hours), among others.

- **Affordability.** Tariff paid for community facilities connected through this project will be determined by the ERC and will consider the capacity of these community facilities to pay in

such remote and underserved areas.

- **Sustainability.** The contract signed between the PSP and KPLC will be a long-term (10–15 years) contract, with the cost of service provision by KPLC included in the revenue requirements, that is recognized by the ERC. This is to ensure that sustainability of service provisioning is maintained post World Bank project life.

60. PSPs that maintain outstanding levels of quality of service will be entitled to receive additional revenues through carbon credits upon verification by the ERC.

Subcomponent 3B: Solar Water Pumps for Community Facilities (IDA US$15 million equivalent)

61. This subcomponent will support the 14 project counties in investing in solar-powered pumps to increase sustainable access to water supply. The contracting for supply, installation, and maintenance (as in Component 3) will occur across the geographic lots/service territories. This subcomponent will be implemented by REA.

62. The proposed activities will focus on providing sustainable access to water supply to the following community facilities: (a) health facilities; (b) educational facilities; and (c) administrative offices.

63. The literature on the cost-benefit analyses between diesel- and solar-powered pumping clearly indicates that the life-cycle costs are significantly lower for solar-powered water schemes. When analyzing the cost components further, it is clear that the operating cost for PV, specifically, is very low. In the rural water sector, the operating cost is essential as it guides the cost of ownership for the benefitting communities and often the price of water at the tap. Solar-powered water schemes can consequently offer a lower price of water to the benefitting communities.

64. Solar water pumping systems are reliable and have become much more affordable due to much more inexpensive PV modules. Their system costs have dropped by 80 percent since 2009 and many systems installed 20 or more years ago are still operational, such as Estación Torres in Sonora, Mexico. Off-the-shelf capabilities of solar water pumping have grown from 2 kW in 2002 to 38 kW as of 2016 and will soon exceed 100 kW**.** Fueled by declining costs and high reliability, solar water pumping is poised to grow tremendously over the next decade and will soon become the pumping technology of choice for off-grid rural communities.

Box 1.3. Solar Water Pumps Explained

A solar-powered water pumping system is similar to any other pumping system, only the power source is solar energy. The use of solar energy for water pumping has been possible since the late 1970s. However, for decades the systems were exceedingly expensive, required specialized maintenance, and were essentially only feasible for small villages with shallow wells. Over the last seven years, the price of solar power has plummeted by 80 percent and the industry for submersible pumps has seen a growing market preference towards solar water pumps. A corresponding increase in research and development has brought along smarter and more efficient solar pumps with a more than tenfold expansion in pump performance. Features such as maximum power point tracking, variable speed drive, soft starter, and remote monitoring have been standardized, and the durability and reliability of the technology are proven by the five-year warranties increasingly becoming an industry norm.

65. This subcomponent is designed to allow counties the flexibility of investing in equipping new boreholes or replacing existing diesel-powered generators with solar PV. All the boreholes are associated with community facilities (located within or near the premises). Each of the 14 underserved counties will be able to choose between the following interventions in potable water supply or a blend of the three options:

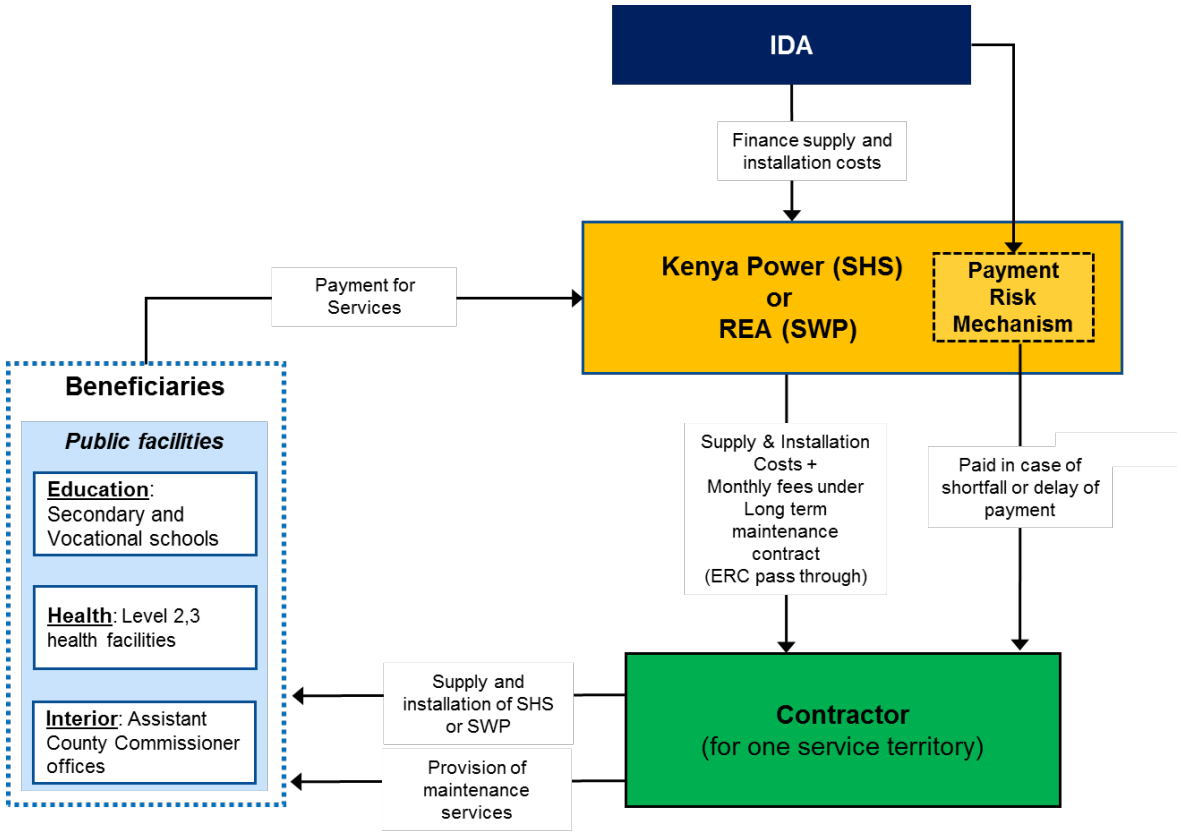
66. The subcomponent supports the core principles of reliability, affordability, and sustainability in the following manner:

a) **Reliability.** The county governments are currently allocating significant resources for the drilling of boreholes and for the construction of water infrastructure. Less attention is given to the quality of the water (well) source development and understanding the groundwater resources. The Water Resource Management Authority (WRMA) is a state corporation under the Ministry of Environment, Water, and Natural Resources established under the Water Act 2002 and charged with being the lead agency in water resources management. The WRMA has noted examples of (i) poorly sited boreholes; (ii) poor design and construction of boreholes; (iii) poor choice of material; (iv) poor execution of test pumping; and (v) a general lack of supervision and inspection of drilling activities. Given the current environment, the project will set minimum criteria for borehole quality to ensure that the solar pump systems are installed in productive and sustainable wells. Each borehole will be examined for its quality of construction and sustainable productive capacity of water of known quality. For existing boreholes, the project will obtain the original borehole completions reports that include test pumping reports and water quality analysis reports. A borehole camera inspection will be mandatory and test pumping may be required but decided upon on a case-by-case basis. TA under the project will build the capacity of county governments to inspect boreholes and supervise borehole drilling.

b) **Affordability.** To the benefitting community, possibly the main advantage of solar water pumping is the low cost of water extraction. Other things held constant, the price of water, relative to diesel power, is lower for solar-powered water schemes; levelized cost analysis and anecdotal evidence show that the price of water can be reduced by more than 50 percent when switching from diesel to solar power generation. This constitutes a substantial saving for the benefiting communities, especially considering the scarce water resources in the 14 arid and semiarid counties.

c) **Sustainability.** A long-term contract will be signed between the contractor and REA to ensure service delivery over a period of time.

Figure 1.8. Flow of Funds and Institutional Responsibilities for Component 3



Note: SWP = Solar Water Pumping.

67. A payment risk mechanism will be available to REA, to which the proposed project will set aside funds equivalent to 6–12 months of maintenance fees that REA can draw upon in case of inadequate allocation from the beneficiary facilities to pay the contractor.

Component 4: Implementation Support and Capacity Building (IDA US$22 million equivalent)

Subcomponent 4A: Consumer Education and Citizen Engagement (IDA US$2 million equivalent)

68. This subcomponent will support the consumer education and awareness under the program's key delivery areas, namely, households, public facilities, water facilities, and farmers. The consumer education campaign is proposed to address the following: (a) initial reservation in the adoption of a new technology for consumers and (b) buyer inability to make informed purchasing decisions and decipher quality in the market.

69. Market research by the World Bank Group's Lighting Africa program in 2015 highlighted the fact that consumer awareness is one of the top three factors (in addition to access to finance and product availability) that influence the growth of the solar market in Kenya. The consumer education will thus target potential consumers under all of the proposed project's components.

70. In the current underserved areas, it is essential to run a consumer education campaign as, first, consumers in the area are unlikely to be aware of the new technologies being presented and hence will benefit from information about the advantages of the services and about how to access them. For those who have some knowledge on the products, the campaign will provide them with the necessary guidance on how to get the best out of the products in the way they use and maintain them. Finally, in such target areas, acceptance and sustained demand are generated when the buy-in of key opinion leaders is obtained. The campaign will thus target these opinion leaders and they will serve as champions for the program on the ground leading to further success. As much as possible, the campaign will incorporate existing county communication tools to ensure acceptance by both the county governments and their citizens.

71. The target audience segmentation across the components will be based on the following key considerations: (a) demographic (who?); (b) geographic and sociocultural environment (where?); (c) behavioral (what?); and (d) psychographic (why?). Indicative target audience segments presented in the following paragraph will be confirmed after pre-exposure consumer insight gathering studies in each county. The responses to the abovementioned considerations will define the target audience, the messages, and the appropriate channels to use to reach them. Targets audiences may differ by solution (though there will be likely overlaps such as the opinion leaders).

72. Examples of the identified target groups could be as follows:

a. For the household target audience, the primary target will be men/household heads and the secondary target will be the women (users). First, in nearly all the underserved counties in Kenya, men dominate family and community decision taking, making them a priority target audience for the project's consumer education campaign. The men will be engaged in age sets as is the custom to achieve peer influence and behavior change traction.

b. Second, while prioritizing men as a prime target audience, it is in the project's interest to reach women who will be the end users of the proposed solar solutions. The culturally and religiously defined role of women in most of the underserved counties is to be the homemaker. Men are therefore hardly involved in domestic matters such as lighting and water sourcing, among others.

73. The consumer education and awareness program will employ both ATL and BTL channels in reaching out to different target audience. ATL communication is where mass media is used to promote brands and reach out to the target consumers. These include conventional mass media tools such as TV, radio, print, and Internet. This targets a wider spread of audience and is not specific to individual consumers. BTL communication is more one-on-one and includes group forums, the distribution of pamphlets, handbills, stickers, promotions, brochures placed at point of sale, and on the roads through banners and placards. It could also involve product demos and samplings at busy places such as market

places or residential areas. For certain markets, such as rural markets where the reach of mass media such as print or TV is limited, BTL marketing with direct consumer outreach is preferred (Manral 2011[32]).

Table 1.7. Consumer Education Level/Channel Mix

Level	ATL Channel	BTL Channel	Support Channels
Mass awareness	Community radio talk shows, drama series, and presenter promotions	Market day activations (road shows), community events	Out of home, branded merchandise, billboards, wall branding, banners, flyers, and posters
Advocacy	Radio interviews with key stakeholders and opinion leaders	Key opinion former workshops, community forums	Solar energy champions
Community	Radio talk shows, drama series, live links to on-the-ground activities	Market storms, small group forums, community dialogue days (existing forums, for example, chiefs' barazas.)	Out of home, branded merchandise, billboards, wall branding, banners, flyers, and posters
Individual	Radio talk shows, live links to BTL activities	Interpersonal Communication through targeted household visits, peer-to-peer communication, small group forums	Out of home, branded merchandise, billboards, wall branding, banners, flyers, and posters

74. A common messaging platform will be created for the 14 counties; however, customized messages will be designed across the channels for each of the counties. All message development work will rely on target audience insights to be collected through a pre-exposure dipstick survey with representatives from the counties.

75. The success of the consumer education piece will depend on evidence-based approaches to channel selection, messaging, and execution of the strategy. This will be supported by innovative M&E mechanisms and feedback loops. Consumer education M&E will focus on the following activities: (a) setting up and deploying tools to assess target audience pre-exposure attributes; (b) setting up and deploying tools for tracking increase in knowledge, perception, and adoption (conversion) (quantitative and qualitative); (c) tracking channel adoption/commercial acceptance to inform the supply side; and (d) measuring campaign reach through the different channels.

76. Specific measurement tools and areas will be designed to monitor the success of these campaigns. Specifically, the following will be considered: (a) pre-post exposure questionnaires to assess increase in knowledge; (b) activity registers with participants' contacts to track reach and enable follow-up number of radio engagement activities, talking walls, and print material issued; and (c) conversion records from direct implementer and manufacturing associates. Project feedback will be internal up/down and lateral feedback platforms as well as agency-client dissemination and progress status discussions. Feedback process will include the daily, weekly, monthly, and annual reports that will summarize results achieved

[32] Manral, Kiran. (2011). *Difference between 'above the line' and 'below the line' advertising*. The Advertising Club. Retrieved from *http://www.theadvertisingclub.net/index.php/features/editorial/3256-difference-between-above-the-line-and-below-the-line-advertising*

and learning gathered within the period in review. Event reports will be shared for evaluation of special events within two weeks of every event.

Subcomponent 4B: Implementation Support and Capacity Building (IDA US$20 million equivalent)

77. This subcomponent will support a program of activities designed to strengthen the capacity of the MoEP, KPLC, REA and sector agencies for project management, implementation and coordination, monitoring and evaluation, including:

a. Financing the fees for managing and operating the RBF Facility and Debt Facility;
b. Provision of technical assistance and undertaking sector studies;
c. Establishing a strategic planning and program management unit within MOEP and supporting project implementation in MoEP, KPLC, and REA;
d. Provision of technical assistance for sector County capacity building;
e. Establishment of a quality of service monitoring unit in the Energy Regulatory Commission; and
f. Capacity building of underserved Counties.

78. Specifically, county capacity building is an integral part of this subcomponent and vital for the effective implementation of the project. This subcomponent will therefore support the counties to build and strengthen their capacity to undertake the energy mandates effectively by the end of the project. The capacity building will target county executives and management and technical staff and will prioritize crucial areas that are relevant to specific mandates of the counties under the law such as respective roles of county governments and the National Government in energy, county energy planning, resource mapping, energy regulation, electricity tariffs and pricing, energy metering, project management and development options, distribution network design, construction, O&M, project management and development options, and environmental and social management.

79. The capacity-building activity will be coordinated by the PCU for KOSAP. The counties will submit to the PCU their training proposals by December 31 of every year. The PCU will consolidate and prepare an annual counties' training proposal for discussion and approval by the technical committee. The World Bank's approval of the annual training program shall be obtained before the commencement of the financial year and implementation of the training program. Each county will be required to submit quarterly, to the PCU, a report of its staff trained and capacity gained and to maintain records of payments made to staff for review and audit.

ANNEX 2: IMPLEMENTATION ARRANGEMENTS

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

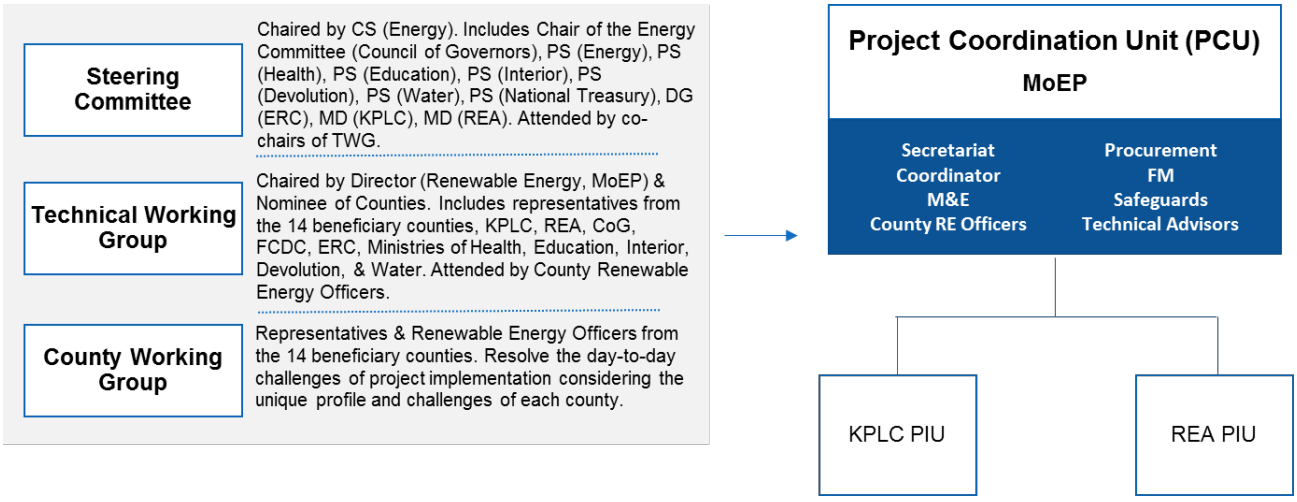
Project Institutional and Implementation Arrangements

1. The MoEP will be responsible for the overall coordination of the project. KPLC and REA will jointly implement Components 1 and 3; REA will also be responsible for managing the carbon finance. The MoEP will oversee all the TA and capacity building, including technical analysis to support the investment components and studies in the broader interest of the sector.

2. The role of the PCU will include the following: (a) defining, jointly with the respective county governments, the project areas based on technical and policy development priorities; (b) resolving, in consultation with the county governments, challenges requiring high-level intervention facing the project; (c) monitoring the implementation of the project in consultation with the counties; and (d) consolidating information from IAs on progress of implementation and evaluating the project. The project will support an SPPM unit (Subcomponent 4.2) that will bring together PIUs of donor-funded programs.

3. The project was guided by a TWG in the preparation phase that deliberated on the technical details, business models, and implementation arrangements of the various components. The TWG has met five times (July 2016, September 2016, November 2016, January 2017, and March 2017) during project preparation in Nairobi.

Figure 2.1. Project Implementation Arrangements



4. During the implementation phase, the following structures are envisaged to ensure effective coordination among the IAs and counties. At the top level is the steering committee, chaired by the Cabinet Secretary of the MoEP. This committee will meet twice a year to review progress, provide policy guidance, and resolve any high-level challenges facing the project. At the second level is the TWG that will continue to remain active and provide technical feedback and solutions to challenges facing all counties.

The TWG will meet twice a year and organize the list of issues to be brought to the attention of the steering committee. Finally, at the county level is the county working group that will resolve the day-to-day challenges of project implementation considering the unique profile and challenges of each county.

5. The MoEP will establish a PCU reporting to the Director of Renewable Energy. This unit is expected to be part of the new SPPM unit to be set up in the MoEP, supported by this project and envisaged to possess a broader mandate. All the World Bank-funded PIUs in the MoEP will be merged into one, responding to the directive by the National Treasury (NT). Therefore, the project coordinator of the KOSAP PCU will be the same as for the ongoing World Bank projects. The PCU will be the secretariat for the steering committee, TWG, and county working group. The PCU will be strengthened with a procurement specialist, an FM specialist, an M&E specialist, a communications specialist, an environment and social safeguards specialist, two technical advisors, and 14 county renewable energy officers. The county renewable energy officers will be located in each county and will be the project liaison person during the project implementation. The county project coordinator will work under the guidance of the PCU project coordinator and the county executive for energy and will be responsible for organizing the county working group meetings.

6. **KPLC and REA PIUs.** Each agency will have a specific PIU for project implementation seconded from their existing staff cadre. The KPLC PIU will be led by Chief Engineer (Rural Electrification) and will include procurement specialist, project economist, project finance specialist, and project engineers. The REA PIU will be led by a project manager and will include a renewable energy officer, procurement officer, project engineers, and environmental and social safeguards specialist.

7. Each of the IAs will prepare an implementation manual that will be a condition for effectiveness.

Financial Management

8. A summary of the FM issues according to the six FM elements of budgeting, funds flow, accounting, internal control, financial reporting, and audit are as explained below.

Budgeting

9. The project funds will be factored in the national annual budget under the MoEP and captured in the International Financial Management Information System (IFMIS) on the basis of the GoK SCOA. KPLC and REA will also capture the project activities in their respective annual budgets. The assessment revealed the challenges of inadequate budget allocation, delays in capturing project activities in a supplementary budget, and slow exchequer releases, especially during the first quarter of every year, which affects project implementation and overall absorption rate of funds.

Funds Flow Arrangements

10. The National Treasury will open two EUR-denominated DA (DA-A for component 1 and 2 and DA-B for component 3) in the Central Bank of Kenya (CBK). The DA-A will be for MoEP and REA/KPLC activities and DA-B will be for the facilities managers. From the DA-A, the funds will flow through the MoEP's ministry development account to a segregated Project Account (PA) at the MoEP opened in a financial institution acceptable to IDA or in the CBK. The PA will also be used to make payment for activities

implemented by the MoEP. In addition, the PA will make payments related to county-level activities. The Ministry Development account will be used to transfer funds to sub-project account in REA and KPLC opened in a financial institution acceptable to IDA.

11. From DA-B the funds will flow through the Ministry Development account to a Facilty Manager's main account opened in a commercial bank acceptable to the World Bank. From the Facility Manager's main account, the funds will be transferred to the debt and RBF sub-accounts opened in commercial bank acceptable to the World Bank. The Main Facility sub-account (see Figure 2.2) and the sub-accounts for debt and RBF instruments will be managed by the Facility Manager on behalf of the MOEP on the basis of the sub-financing agreement signed between the MOEP and the Facility Manager. The Project can also make direct payments for transactions above the threshold as stipulated in the disbursement letter (DL).

12. The assessment revealed material in-country disbursement delays in the transfer of funds from the DA in the NT to the PA in the MoEP as well as from the PA in the MoEP to REA and KPLC. This will also affect the transfer of funds to the facilities management accounts. The delays run into months and this can affect project implementation. However, this is a portfolio-level challenge that is being addressed as part of the policy dialogue with the GoK. At the project level, however, service standards will be agreed between the MoEP, KPLC, REA, and the NT to address the funds flow delays. These will provide an agreed time line for efficient disbursement of funds at each stage and the person responsible and will be monitored as part of project implementation.

13. REA will also manage the community-level activities for installation of solar water solutions in schools and health facilities. The activities will consist mainly of contracts and consultancies. There will also be payment for monthly service contracts for maintenance of the solar equipment (mainly solar pumps) installed. The risks involved will include (a) selection of beneficiary schools and health centers; (b) risk of double-dipping whereby equipment may be installed in sites already financed by other donors; (c) confirmation that payment is made for actual work done; (d) recovery of monies for maintenance from beneficiary institutions; and (e) exposure of the project to risks inherent in the health and education sectors, including weak fiduciary capacity at schools and health centers. To mitigate these risks, an independent third-party verification agent will undertake verification of the work done and its report will be used as a basis for making payments. In addition, periodic technical audits will be conducted and the findings used as a basis for strengthening any weaknesses identified.

14. The GoK is undertaking a competitive selection of experienced entities to administer facilities under Component 2. The setting up and operationalizing of the facilities with the relevant FM staff and guidelines are disbursement conditions of for this component. The funds for this component will flow in tranches to a Kenyan shilling-denominated account opened in a commercial bank acceptable to IDA, and transiting via a Designated Account and Ministry Development Account. These facilities will be set up with the following objectives:

a. **Provide incentives to the private sector solar service providers** to get engaged in selling their products to consumers in the 14 counties.

b. **Provide debt to enable SSPs to cover** (i) short-term inventory financing needs and (ii) medium-term receivables financing, in the event they sell solar products on credit, necessitating customer payback over a period of several months.

c. Provide **incentives to private sector cookstove service providers** to sell their products to consumers in the underserved counties.

15. The project will adopt the SOE method of disbursement.

16. The key fiduciary risks for the Component 2 instruments are as follows:

i. **Selection of eligible beneficiaries and private sector contractors/suppliers** to ensure the funds are disbursed to the right beneficiaries/suppliers and in the right amounts.

ii. **Proper management of the facilities** to ensure the facilities are managed properly in line with the set objectives.

iii. **In-country funds flow delays** through the CBK and the exchequer procedures at the NT and line ministry. In the case of Component 2, where delayed availability of funds could put achievement of the PDO at risk, this risk will be closely monitored by IDA and MoEP.

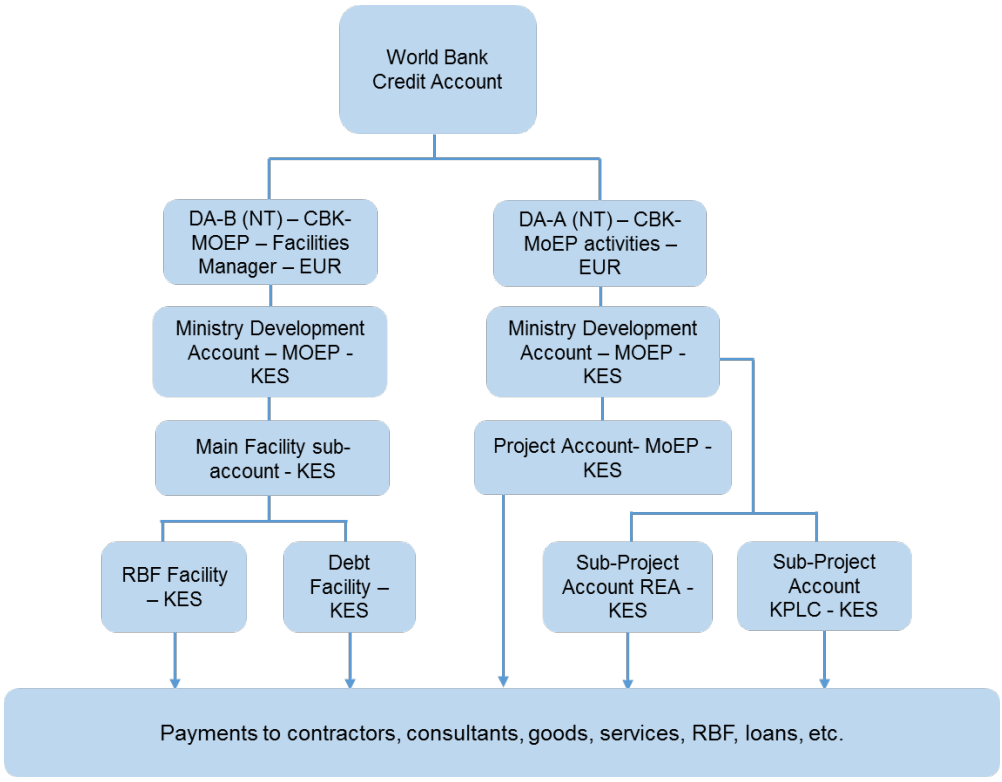
iv. **Follow-up on recoveries/repayment** under the debt facility since these funds have to be paid back to the facility.

v. **Eligibility criteria for the RBF facility** to ensure that these funds are disbursed strictly in line with the qualifying criteria including meeting (and measurement) of the agreed outcomes/outputs.

vi. **Foreign exchange, financial, and credit risks.** These could deplete the facility's initial capital. In addition, under Kenya public financial management (PFM) rules, all project funds have to be converted to local currency to flow through the exchequer if budgeted for under revenue.

To mitigate this risk, RBF and debt provided under the facilities will be required to be denominated only in KES.

Figure 2.2. Funds Flow



17. Proposed structure and mitigation measures:

i. **Hiring of a professional Facility Manager.** This will ensure the debt facility is economically viable and sustainable and a portion of the Facility Manager's fees will be pegged on performance. The Facility Manager will be responsible for the recovery/collection of the funds disbursed to the private sector service providers under the debt instrument.

ii. **Opening of two facility operating bank accounts for the RBF and debt facilities.** These will be in commercial banks and under the control of the Facility Manager. The funds will be held in Kenyan shilling-denominated accounts.

iii. **Quarterly financial reports to be provided to the World Bank and MoEP by the Facility Manager.** The format of the reports will be same as provided for by the Kenya Public Sector Accounting Standards.

iv. **Annual audited financial statements to be submitted the World Bank as part of the annual project audit reports.** The facilities will be subject to audit as part of the annual audited financial statements conducted by the Office of the Auditor-General (OAG).

v. **In-year fiduciary review of the facilities.** The facilities will also be subject to the in-year fiduciary reviews by the World Bank and GoK internal auditors.

Accounting Arrangements

18. The three IAs have adequate accounting capacity. REA and KPLC have SAP accounting software that is adequate for project accounting and financial reporting. The MoEP is on the IFMIS but the project management module has not been activated. However, financial reports for World Bank projects in the three agencies are prepared using Excel spreadsheets, which is deemed adequate. There are qualified project accountants in the three agencies that also have comprehensive FM manuals.

Internal Controls

19. The three IAs have developed FM manuals for the project. The agencies also have functioning internal audit departments. The MoEP, REA, and KPLC internal audit departments will conduct internal audit review of project activities as part of their annual internal audit plan. The World Bank FM team will also conduct FM reviews at least once every year, which will include on-site reviews to selected project sites at national and county levels.

Financial Reporting

20. The three IAs have adequate capacity to meet the World Bank's financial reporting requirements. They have been submitting IFRs for the existing projects within the stipulated time lines. The quarterly IFRs will be submitted to the World Bank within 45 days after the end of each calendar quarter and also to the National Treasury by the 15th day of the following month. The annual financial statements will be submitted to the OAG by not later than September 30 being 3 months after the year end. The format of the financial reports will remain the same as that being used for the current World Bank-financed projects being implemented currently by the three agencies.

Audit Arrangements

21. The agencies have been submitting their project audit reports on a timely basis and received clean/unqualified audit reports for FY15. However, the MoEP received qualified audit report for FY14/15. This was because of anomalies in the accounts, noncompliance with PFM procedures, incomplete/inaccurate fixed assets registers, and unsupported expenditures. The project audit report and Management Letter for KOSAP will be submitted to the World Bank six months after the end of the financial year. There is a risk of inadequate scope of audit for decentralized operations and delays by the OAG in county level audits. These can be addressed by availing project funds to support the project audit by the OAG.

Risk Assessment

22. The analysis of the assessment is as shown in Table 2.1.

Table 2.1. Risk Assessment and Mitigation Measures

Type of Risk	Initial Risk Rating	Brief Explanation	Risk Mitigation Measures Incorporated in Project Design	FM Condition	Residual Risk Rating
Inherent Risk					
Country level	S	This is based on the country PFM environment and considers overall history of the country governance environment and corruption concerns.	A more robust PFM Act 2012 is now in place, ongoing PFM reforms including the rollout of the IFMIS to the 47 counties, introduction of electronic funds transfer (EFT) payments through G-Pay, and major judicial reforms including establishment of the Supreme Court.	No	S
Entity level	S	Adequate capacity but there may be challenges of coordinating county-level activities. Risk related to beneficiaries in health and education that are not under direct control of the MoEP.	Well-staffed PCU under REA, MoEP, KPLC to ensure adequate coordination of project activities. Regular capacity-building training to be conducted for the project accountants.	No	S
Project level	S	Challenges of coordinating the three agencies. The debt and RBF facilities yet to be set up. Capacity challenges at school and health facilities levels	Regular capacity-building training to be conducted for the project accountants.	Yes, disbursement condition Category 3 is: Facility managers have been appointed, and prepared and adopted the Facilities Implementation Manual.	S
Overall	**S**				**S**
Control Risk					
Budgeting	S	Insufficient budget allocation, late uploading in the IFMIS in first quarter.	Service standards/ time lines to be agreed and monitored as part of project implementation.	No	M

Accounting	H	Adequate accounting capacity for national level but RBF and debt facilities FM structures yet to be set up.	Capacity-building training for project accountants.	No	S
Internal controls	H	Challenge of ineligible expenditures on Kenya portfolio. Unique fiduciary risks for revolving funds in Kenya could affect the debt and RBF facilities. Capacity challenges at schools and health facilities.	FM assessment to be conducted of the Facility Manager as soon as they are identified. Internal audit functions to conduct mid-year risk-based fiduciary review of the project. Use of third-party verification agent and technical audits for community activities by REA at school and health facilities levels.	No	S
Funds Flow	S	Material in-country disbursement delays.	Service standards/time lines to be agreed and monitored as part of project implementation.	No	S
Financial Reporting	S	Adequate financial reporting capacity but risk of delays in financial reporting.	Capacity-building training for project accountants at the national level.	No	S
Auditing	H	No outstanding audit issues, but limitation of scope in audit of decentralized operations and delays in county audits.	Project funds to support audit process for the OAG.	No	S
Overall	**H**				**S**
			Overall project FM risk	**S**	

Note: H = High; S = Substantial; M = Moderate; L = Low.

FM Action Plan

23. The plan in Table 2.2 indicates the actions to be taken for the project to strengthen its FM system and the completion dates.

Table 2.2. FM Action Plan

	Action	Due Date
1	Opening of a DA and PA and communicating the details of the bank account and signatories to IDA	Immediately on signing of the Financing Agreement
2.	Training project FM staff on World Bank Financial Management and Disbursement Guidelines	Annually
3.	Internal audit review by GoK internal auditors	Annually

Conclusion of the FM Assessment

24. The results of the assessment indicate that the overall FM arrangements satisfy the World Bank's minimum requirements under OP/BP 10.02 and are therefore adequate to provide, with reasonable assurance, accurate and timely information on the status of the project as required by the World Bank. The FM residual risk for the project is Substantial.

Disbursements

Effectiveness/Disbursement FM Conditions and Financial

25. **Effectiveness conditions** are (a) the Subsidiary Agreements have been executed on behalf of the Recipient and the respective project implementing entities and (b) the PIM has been prepared and adopted by the Recipient.

26. **Disbursement conditions.** Fund managers for Debt Facility and RBF Facility have been appointed, and fund managers prepared and adopted the FIM (disbarment condition for Category 3).

27. **Other financial covenants.** Financial covenants are the standard ones as stated in the Financing Agreement on FM, financial reports and audits, and the general conditions.

28. The following table specifies the categories of Eligible Expenditures that may be financed out of the proceeds of the Financing ("Category"), the allocations of the amounts of the Financing to each Category, and the percentage of expenditures to be financed for Eligible Expenditures in each Category:

Category	Amount of the Financing Allocated (expressed in EUR)	Percentage of Expenditures to be Financed (inclusive of Taxes)
(1) Goods, works, non-consulting services, consultants' services, training and operating costs for Parts 1 and 3 of the project	71,400,000	100%

Category	Amount of the Financing Allocated (expressed in EUR)	Percentage of Expenditures to be Financed (inclusive of Taxes)
(2) Goods, non-consulting services, consultants' services, training and operating costs for Part 4 of the project	19,600,000	100%
(3) Goods, works and non-consulting services for Part 2 of the project provided under the RBF Facility and the Debt Facility	42,800,000	100%
TOTAL AMOUNT	**133,800,000**	

Procurement

29. Procurement for the project will be carried out in accordance with the 'World Bank Procurement Regulations for Borrowers under Investment Project Financing', dated July 1, 2016, hereafter referred to as 'Procurement Regulations'. The project will be subject to the World Bank's Anticorruption Guidelines, dated July 1, 2016.

30. As per requirements in the Procurement Regulations, a PPSD was developed and finalised. The Procurement Plan sets out the selection methods to be followed by the Borrower during project implementation in the procurement of goods, works, and non-consulting and consulting services financed by the World Bank. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

Box 2.1. Summary of the PPSD

The project procurement will be carried out by the MoEP, KPLC, and REA. The project procurement will apply the World Bank's Procurement Regulations for IPF borrowers, July 2016, and 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants', dated July 2016. Based on the forgoing analysis in the PPSD, the identified activities' procurement approach and methods will not involve any less than open competition or use of any new procurement techniques.

The procurement approach and methods for (a) mini-grids and stand-alone solar systems for community and public institutions; (b) solar water pumps; (c) cooking stoves; and (d) hiring Facility Manager and TA consultants will follow standard approaches and methods (approved selection methods and market approach options in the regulations). No activity is envisaged to involve departure from policy thresholds or need of additional oversight or OPRC review levels. Since the project implementation does not involve high value and complex contracts, a short form of PPSD has been prepared. Following the market sounding exercise, solar systems supply market situation in Kenya and information obtained from the industry, the PPSD concludes that there might be no serious supply market risk for the identified procurement activities. Since there are reasonably adequate market players, the GoK has already prior experience of off-grid solar power systems procurement, risk of bid participations/or competition is considered not high. As the current contracting strategy includes Operations and Maintenance by the private suppliers the contracts packaging and delivery model would take in to account reasonable incentive mechanisms, including appropriate risk allocation and security improvement arrangements in the target counties. The project preparation has also taken into considerations the fact that Public Private

Partnership (PPP) type of supply, installation and operational maintenance contract in solar power system is a new frontier and this may make the implementation more demanding in terms of designing best fit contract delivery arrangements. Grant facility to the private power supply system investors and guarantee of minimum payment at the time of operation has been considered and to be negotiated and finalized during contracts awarding stage. Appropriate and proportional market approach and procurement methods have been identified in the PPSD and the initial procurement plan has been prepared for those activities that are identified at the project negotiation stage.

Though the envisaged procurement activities are of small value, due to the limited implementation capacity of the IAs and the investment activities being a new area of business (off-grid solar access project for underserved counties that will involve private suppliers including O&M contracts), there will be risks associated with procurement and contract management to delivery of value for money in achieving the PDO.

The IAs' procurement capacity assessment carried out by the World Bank reveals that the agencies have got some capacity limitations. KPLC is in a better capacity situation while the others (Ministry & REA) have got weaknesses to undertake the full procurement cycle efficiently. The following table summarizes risks and proposed mitigation measures.

Sr No.	Issue/Risk	Recommended Mitigation Measures	Owner and Time Frame
1	Except KPLC, the IAs staff have less experience in handling World Bank-financed projects' procurement (including procurement planning, processing, and implementation management)	1. Training and familiarizing with the World Bank's Procurement Regulations and training on the use of STEP during the early stage of project implementation commencement 2. Recruitment of professional advisors or individual consultants to be based at the MoEP and supporting all the IAs for the first one to two years of implementation	1. World Bank Jointly with the Project Borrower (already completed) 2. MoEP/IAs (by project effectiveness)
2	Procurement processing and decision making are slow and implementation can be delayed	1. Use of the PPSD to facilitate advance and up-front implementation readiness 2. Performance-based incentive mechanisms and motivations of staff are to be implemented by respective management of the IAs (details may be included in PIM); 3. Advance procurement documents preparation; 4. The client to establish business delivery standard and this is to be defined in the project implementation manual (PIM)	1. Respective IAs (by project effectiveness); 2. Borrower
3	Lack of contract management skills and practices including weak reputation for making contractual payments on time is a critical risk area for achieving value of money and objectives	1. Proper budgeting and timely contract payment commitment from the Borrower/NT and regular monitoring of the same 2. In addition to training of client staffs, use of consultants to	1. Borrower 2. Respective IAs (by project effectiveness)

		support the client in managing the smaller but complex contracts 3. Use of information technology for remotely managing the vendors' performance and well-structured and defined involvement of local authorities may reduce the risks	
4	All IAs lack adequate experience of designing and managing commercial and business arrangement with private investors in solar energy supply area	1. Deployment and use of sector-specific management consultant or use of professional advisors	3. MoEP/IAs (by project effectiveness)
5	Proper record keeping, monitoring, and timely reporting will be another weakness and risk area	1. Improved project implementation governance including staff incentives and motivation measures and defined accountability systems need to be in place by the agencies 2. Use full advantage of STEP	1. Respective IAs (by project effectiveness)
The initial Procurement Plan has been finalized and appended to the Project Appraisal Document.			

31. **STEP.** The project will use STEP, a planning and tracking system, which will provide data on procurement activities, establish benchmarks, monitor delays, and measure procurement performance.

32. **Procurement risk assessment.** A procurement capacity and risk assessment has been carried out by the World Bank for the IAs, KPLC and REA, to review the organizational structure for implementing the project and the interaction between the project's staff responsible for procurement duties and management of the agencies. The Procurement Risk Assessment and Management System (PRAMS) has been finalized. Based on the assessment and taking note of the roles and responsibilities of the agencies responsible for procurement, the procurement risk rating is likely to be **'Substantial'**.

33. The proposed project will be coordinated by the MoEP and implemented by the PIUs in KPLC and REA, which have experience in World Bank-financed procurement. The agencies have staff with a varied level of expertise in procurement and contract management in conducting procurement in accordance with World Bank policies and procedures. KPLC and the ministry do have reasonable acceptable capacity, having successfully handled procurement activities under World Bank-funded projects while the capacity of REA is still weak. Since the implementation of this project will follow the New Procurement Framework and the Procurement Regulations, all the IAs need initial induction on the application of the Procurement Regulations. KPLC has substantial institutional capacity and experience in planning, procuring, and negotiating with private sector developers of power generating plants. REA has experience in implementing the mini-grid electrification component under KEMP that includes procurement of private sector investors to develop the power generation plants, but its implementation capacity remains weak.

34. The key issues and risks concerning procurement for implementation of the project include systemic weaknesses in the areas of (a) accountability of procurement decisions; (b) procurement processing delays including bid/proposal evaluation and signing of contracts; (c) procurement record

keeping; (d) capacity of procurement staff; (e) procurement planning; (f) procurement process administration up to and including award of contracts; (g) contract management; and (h) procurement oversight.

35. Preliminary risk mitigation measures based on the findings and discussion conducted with the client include: (a) hiring of a procurement consultant or deploying competent procurement staff from the utilities to PIUs in KPLC and REA that are well versed in World Bank-funded procurement activities; (b) training new and current staff in World Bank procurement regulations. (c) more proactive planning and implementation monitoring actions including introducing incentives and business delivery standards (details to be set in the PIM).

36. While the decision-making process and primary responsibility for the successful implementation of the project will rest with KPLC and REA, the support and close involvement of county administration and the MoEP will be critical.

37. **Use of national procurement procedures.** All contracts following the national market approach shall follow the procedures set out in the Public Procurement and Asset Disposal Act of 2015 (PPDA). The PPDA governs purchase of works, goods, and services using public resources by the national and county government entities, local authorities, state corporations, education institutions, and other GoK institutions. Under the PPDA, the Public Procurement Regulatory Authority (PPRA) has been established, in addition to the Public Procurement Directorate in the NT. The PPDA sets out the rules and procedures of public procurement and provides a mechanism for enforcement of the law. The new constitution has devolved some of the key functions of the National Government to the counties. In this respect, the Government is expected to issue the Public Procurement and Disposal Regulations of 2016, which will cover the National Government, county governments, and parastatals. The procurement function is decentralized to individual procuring entities. The PPRA has oversight and regulatory function including undertaking procurement reviews and audits. There is a Public Procurement Complaints Review and Appeals Board (Appeal Board) under the secretariat of the PPRA that deals with complaints received from bidders or consulting firms. The provisions of the PPDA are consistent with the World Bank Procurement Regulations Section V - Paragraph 5.4, National Procurement Procedures.

38. **Procurement of works including supply and installation.** Procurement of mini-grids and electrification of community and public institutions will be done following the supply and installation type of contracts, with O&M for a period of time. Contract for the Supply, Installation, network construction, connections and O&M of the mini-grids, will be awarded as a single contract. The preparation of bidding Documents and evaluation process will consider Design, supply, installation, distribution network construction and connection services as one-time contract price while the Monthly charge of power supply (based on minimum rate in PPA) services and O&M monthly charges are to be assessed and computed as the NPV over a 10-year period. Therefore, the bidders will be requested to quote for these different services and award will be made to most advantageous bid to the client. Details will be set in the bidding document to be issued. Each lot will be awarded to the qualified bidder having submitted the most advantageous substantially responsive bid. This approach may ensure lowest levelized cost of electricity supply;

39. **Procurement of goods.** Goods to be procured under this project will include solar PV for water

pumping.

40. Procurements while approaching the international market will be done using the World Bank's Standard Procurement Documents. Procurements while approaching the national market will be done using the National Standard Bidding Documents with an additional annex to address the World Bank's Anticorruption Guidelines and to ensure universal eligibility.

41. **Procurement of consultancy services.** Consulting services to be procured under the project include hiring of firms to manage Component 2 activities and carry out studies, assessments, designs, supervision of works, and related activities. Hiring of individual consultants will be limited to international consultants required for project implementation. Any other staff required for project implementation support will be recruited/selected following Project Implementation Support Personnel, paragraph 7.32 of Procurement Regulations.

42. **Operating costs.** These items will be procured using the Borrower's national procurement and administrative procedures acceptable to the World Bank including selection of project implementation support personnel. The Borrower will also pay for costs associated with any resettlement, land acquisition, compensation, and relocation of services from counterpart funds.

43. **Record keeping.** All records pertaining to award of tenders, including bid notification, register pertaining to sale and receipt of bids, bid opening minutes, bid evaluation reports and all correspondence pertaining to bid evaluation, communication sent to/with the World Bank in the process, bid securities, and approval of invitation/evaluation of bids will be retained by respective agencies and also uploaded in STEP.

44. **Disclosure of procurement information.** The following documents shall be disclosed on the agencies websites: (a) a Procurement Plan and updates; (b) an invitation for bids for goods and works for all contracts; (c) Request for Expression of Interest for selection/hiring of consulting services; (d) contract awards of goods, works, and non-consulting and consulting services; (g) a monthly financial and physical progress report of all contracts; and (h) an action taken report on the complaints received on a quarterly basis.

45. The following details shall also be published in the United Nations Development Business and the World Bank's external website: (a) an invitation for bids for procurement of goods and works following open international market approaches; (b) Request for Expression of Interest for selection of consulting services following open international market approaches; and (c) contract award details of all procurement of goods and works and selection of consultants using open international market approaches.

46. **Fiduciary oversight by the World Bank.** The World Bank shall prior review contracts according to prior review thresholds set in the PPSD/Procurement Plan.

47. All contracts not covered under prior review by the World Bank shall be subject to post review during implementation support missions and/or special post review missions, including missions by consultants hired by the World Bank. To avoid doubts, the World Bank may conduct, at any time,

independent procurement reviews of all the contracts financed under the loan.

48. **Contract management.** The high-risk and high-value procurements have been identified for increased contract management support and indicated in the Procurement Plan. The agencies will develop key performance indicators (KPIs) for such identified contracts and the KPIs will be monitored during actual execution of contracts. The World Bank team will provide additional due diligence and independent review of the contract performance of such identified procurements. A fully staffed PIU of the respective agencies will be responsible for overall project/contract management. The team will be ably assisted by a multi-skilled project management team that will be engaged to provide overall implementation support and monitor all works, goods, and consultancy contracts.

Environmental and Social (including Safeguards)

49. The proposed project was screened by the World Bank team and assigned an Environmental Category B Partial Assessment, on the assumption that no major civil works will be funded and no major physical or economic displacement will take place. Four safeguard policies have been triggered for the project. They include (a) OP/BP 4.01 (Environmental Assessment); (b) OP/BP 4.04 (Natural Habitats); (c) OP/BP 4.10, (Indigenous Peoples); and (d) OP/BP 4.12 (Involuntary Resettlement).

50. The World Bank operational policy on Environmental Assessment (OP/BP 4.01) has been triggered, due to the implementation of the activities outlined under Components 1–3. The main potential environmental impacts anticipated for the project are (a) civil works that would be limited to construction of the mini-grids in remote areas (Component 1), installation of stand-alone systems for households (Component 2) installation of solar PV for water pumping (Component 3), and construction of distribution lines to connect new customers and (b) environmental, health, and safety concerns are likely to be associated with recycling and disposal of spent batteries at the end of their useful lives, which is usually 3–5 years after deployment. Rechargeable batteries for storing solar energy may run on Ni-Cad, NiMH, Li-ion, Pb-A, or Pb-gel. These batteries should not be disposed in standard landfills because they can create long lasting environmental and human health impacts (for example, headaches, abdominal discomfort, seizures and comas, cancers, irritation of skin and respiratory system, burns and damage to skin and eyes, and corrosion) due largely to the heavy metals such as mercury, lead, cadmium, and nickel, and acids. The entire management processes including de-manufacturing, collection, storage, recycling, transport and disposal may present a challenge to this project and, given the scope of this Bank operation, could result in environmental and social risks and impacts, although these impacts are reversible and localized and can be easily and cost effectively mitigated.

51. The operational policy on Natural Habitats (OP/BP 4.04) has been triggered, on the assumptions that the project activities under Components 1 and 3 are likely to affect the natural habitats through erection of poles, construction of the mini-grids, and the installation of the solar water pumping equipment.

52. The project has triggered the Indigenous Peoples Policy (OP/BP 4.10) due to the known presence of IPs/VMGs in all 14 counties that are targeted by the project. The project counties can be divided into two categories in terms of the IP/VMG communities found in them. The first category, represented by eight of the project counties—Garissa, Mandera, Isiolo, Marsabit, Wajir, Turkana, Samburu, and Narok Counties—are overwhelmingly IP/VMG counties in so far as they are inhabited mainly by nomadic

pastoralist communities, with some of them being hosts to a few minority ethnic/tribal groups. The second category, represented by Tana River, Lamu, Kilifi, Kwale, Taita Taveta, and West Pokot Counties, have minority IPs/VMGs living among the more dominant communities in each of the counties. Communities and groups that are in the minority in these counties and that meet the OP 4.10 criteria are the Sengwer in West Pokot County, Wailwana of Tana River, Watha of Tana River, Taita Taveta, and Kilifi Counties, Wakifundi/Wachwaka of Kwale County, Wasanye and Aweer of Lamu County, and Munyoyaya of Tana River County.

53. The Client has carried out an SA through in-depth free, prior, and informed consultations with both categories of IPs in each of the counties in line with the requirements of OP/BP 4. 10. Even though the selection criteria and process for accessing the project benefits are yet to be clearly defined, the IPs/VMGs have been informed that there will be some elements of payment to access the project benefits. In this respect, some of the key social concerns of the VMGs include issues of (a) affordability of the solar or mini-grid installations due to high levels of poverty in the areas; (b) elite capture with potential to influence siting of subprojects away from the VMGs for individual interest and gain; (c) gender considerations in the subprojects among the VMGs; and (d) potential conflict over communal land and natural resources for siting the mini-grids.

54. The project has also triggered the operational policy on Involuntary Resettlement (OP/BP 4.12). The proposed project does not envisage major physical or economic displacement of people. However, it is likely that the project might acquire land for the construction and installation of mini-grids that may result in either displacement of people or have impacts on trees or grazing/farming land, hence the triggering of OP 4.12.

55. At this stage of project preparation, subprojects' sites/location have not yet been identified, and the criteria for participation in the project are yet to be clearly defined. For these reasons, a framework approach has been adopted for this project and on the basis of this, the client has prepared the following frameworks under the project: (a) the ESMF; (b) RPF; and (c) VMGFs, all of which have been prepared in consultation with the potential project beneficiaries including VMGs, using the free, prior, and informed consultations approach. A screening process for environmental and social impacts has been included in the ESMF and RPF and will use evaluation tools including (a) an environmental and social screening form to help identify potential adverse environmental and social impacts and (b) an environmental and social checklist that outlines environmental and social mitigation measures for subprojects not requiring a full ESIA report. The ESMF, RPF, VMGF and SA were cleared by the World Bank and disclosed in-country on March 22, 2017, and was disclosed at the World Bank's InfoShop/external website on March 23, 2017.

56. When the subprojects and their locations/sites are identified for financing under KOSAP, the client will prepare additional supplementary site-specific safeguards instruments including (a) an ESIA; (b) ESMPs; (c) RAPs/ARAPs; and (d) VMGPs. Each of these will be consulted upon, cleared by the World Bank, and disclosed in-country and on the World Bank's InfoShop/external website before commencement of any civil works.

57. In addition to defining the screening process, the RPF provides guidance on procedures and processes to be followed to avoid, reduce, mitigate, or compensate for adverse impacts of the project on PAPs in case it is determined through the screening process that a subproject may result in physical or economic displacement or restriction of access to natural resources as a result of the project. These

include processes for (a) the preparation of RAPs or ARAPs including the cutoff date; (b) establishment of entitlements and compensation arrangements under the project; (c) institutional arrangement for RAP implementation; (d) agreements on and preparation of grievance redress mechanisms; and (e) preparation of a monitoring framework for tackling the RAP implementation. Preparation of RAPs/ARAPs will be undertaken in accordance with the provisions of OP/BP 4.12 that require that such instruments are prepared in consultation with the PAPs. Similarly, the VMGF that has been prepared under this project defines the procedures and processes to be followed in undertaking the subproject-specific SA and for preparing subproject-specific VMGPs if such subprojects are to be implemented in areas where VMGs live or have collective attachment to.

58. The MoEP will provide overall coordination of the project and lead the implementation of Component 2, which will include overall responsibility for safeguards due diligence and compliance monitoring. The MoEP will ensure that terms of reference for hiring the Facility Manager contain clauses that relate to safeguards and occupational health and safety competencies and specific tasks related to safeguard monitoring and enforcement. The selected Facility Manager will be responsible for coordinating and supporting the implementation of safeguards and will prepare an FIM that will include a checklist for subprojects, their potential threats, and mitigation measures as well as capacity building for safeguards implementation and compliance monitoring. The MoEP will submit the FIM to the World Bank for review and clearance. Thus, SSPs that bid for any of the subprojects under this component will have to indicate, in their respective bids, how they intend to address environmental and social sustainability issues that could be associated with the provisions of those services. The selected SSPs will be responsible for implementing the safeguards on the ground, including ensuring compliance with occupational health and safety imperatives and dealing with de-manufacturing of out-of-use solar devices, e-waste disposal, and recycling. The generation of safeguard reports during implementation of project activities will start from the SSPs and through the Facility Manager to the MoEP. It is expected that the quarterly and annual reports on the project will include a section on the implementation of all applicable safeguards frameworks and safeguards instruments.

59. KPLC and REA will jointly be responsible for the implementation of Components 1 and 3. Component 1 (Mini-grids for Community Facilities, Enterprises, and Households) will be developed under PPPs, and a single contractor will be responsible for construction of the generation system and will prepare appropriate safeguards instruments that will be consulted upon, reviewed, and cleared by the World Bank and locally disclosed. Under Component 3 (Stand-alone Solar Systems and Solar Water Pumps for Community Facilities), KPLC and REA will have overall responsibility for safeguards due diligence, and the private sector contractors hired for supply, installation, and maintenance will be responsible for preparing a checklist for subprojects, their potential threats, and mitigation measures as well as for safeguards implementation and compliance monitoring. KPLC and REA will establish their respective PIUs to manage their specific components.

60. Capacity to manage safeguards issues will be built at all agencies that will be implementing the project. The implementation will be led by the MoEP in coordination with the county governments through KPLC and REA, which have been implementing similar projects funded by World Bank. A capacity assessment conducted of the entities/IAs (MoEP, REA, and KPLC) for planning, designing, implementing, and monitoring of the safeguards has revealed standards to be good. However, the number of safeguards experts at post and their competences on safeguards were found to be inadequate. In this regard, the World Bank recommends that (a) REA recruits a social safeguards expert to complement the existing

environmental safeguards expert and (b) the MoEP recruits environmental and social safeguards experts to support the PCU in the implementation of the project. To address the limitations in safeguards competences, the World Bank recommends that needs assessments be undertaken for the safeguards teams and a capacity-building plan be prepared to train the teams and ensure their ability to identify and manage environmental and social risks in the project is enhanced.

Safeguards Policies Triggered

61. The following safeguards policies are triggered:

Safeguard Policies	Triggered	Explanation
Environmental Assessment (OP/BP 4.01)	Yes	The project is assigned as a Category B Partial Assessment, assigned to projects that are likely to have limited and reversible environmental impacts, that can readily be mitigated. There are no significant and /or irreversible adverse environmental issues anticipated from the project subcomponents to be financed under the project. The main potential environmental impacts anticipated for the project are (a) civil works that would be limited to construction of the mini-grids in remote areas (Component 1), installation of solar PV for water pumping (Subcomponent 3B), and construction of low-voltage lines to connect new customers and (b) environmental, health, and safety concerns that are likely to be associated with recycling and disposal of spent batteries at the end of their useful lives, which is usually 3–5 years after deployment. Rechargeable batteries for storing solar energy may run on Ni-Cad, NiMH, Li-ion, Pb-A, or Pb-gel. These batteries should not be disposed in standard landfills because they can create long-lasting environmental and human health impacts (for example, headaches, abdominal discomfort, seizures and comas, cancers, irritation of skin and respiratory system, burns and damage to skin and eyes, and corrosion) due largely to the heavy metals such as mercury, lead, cadmium, and nickel and acids. The entire management processes including de-manufacturing, collection, storage, recycling, transport, and disposal may present a challenge to this project, given the scope of this World Bank operation. In view of anticipated challenges associated with recycling and disposal of spent batteries However, the physical interventions could result from low to moderate negative impacts on the environment, depending on the location and nature of investment. A screening process will be followed to ensure that potential negative impacts can be appropriately mitigated and subprojects are not located in critical natural habitats. Since the scope and the specific locations and sites of the subprojects are unknown at this stage of project preparation, the framework approach was proposed and the Borrower has prepared an ESMF in a participatory manner and it has been consulted upon. The ESMF contains an environmental and social screening process and includes guidelines for contractors. If determined through screening that a

		subproject would require a full environmental assessment, National Environmental Management Authority approval and license will be sought. Based on the ESMF, ESIA and ESMPs will be prepared for the specific subprojects. The ESMF document was disclosed in March 2017. Consultations with stakeholders have been undertaken during the preparation of the ESMF report, and the minutes for the stakeholder meetings and measures proposed to address grievances have been included as annex to the report. The Borrower has prepared the RPF report and SA report for the 14 counties targeted by the project where the overwhelming majority of the project beneficiaries are people considered as VMGs.
Natural Habitats (OP/BP 4.04)	Yes	Predicated on the assumption that natural habitats may be affected by erection of poles and mini-grid stations, the Borrower will assess if the subprojects are within critical natural habitats such as wildlife habitats and corridors and will avoid these areas or liaise with Kenya Wildlife Service (KWS) to propose mitigation measures.
Involuntary Resettlement (OP/BP 4.12)	Yes	Since the subprojects locations/sites have not been identified at this stage of project preparation, it is assumed that the proposed Component 1 of the mini-grids would result in land take and displacement (both physical and economic) of people. Therefore, the client has prepared an RPF, which was disclosed in March 2017. Based on RPF guidance each subproject will be screened, and if RAPs/ARAPs are found to be necessary, these will be prepared, cleared by the World Bank, disclosed in-country, and implemented before commencement of civil works, according to the World Bank's OP/BP 4.12 (Involuntary Resettlement).
Indigenous Peoples (OP/BP 4.10)	Yes	The 14 counties targeted by this project are considered as marginalized areas in Kenya. The project has identified that the overwhelming majority of project beneficiaries in 8 of these 14 counties are considered vulnerable and marginalized. Therefore, the Borrower has prepared an SA report to identify and avert any potentially adverse effects from project interventions on VMGs and to ensure that project benefits that are culturally appropriate reach these groups in an equitable manner. For the remaining 6 counties, a VGMF is prepared where marginalized groups are not a majority. The final versions of SA and VGMF was disclosed in March 2017.

ANNEX 3: IMPLEMENTATION SUPPORT PLAN

COUNTRY: Kenya

Kenya: Off-grid Solar Access Project for Underserved Counties

1. The innovative design of the proposed project will require a substantial level of implementation support particularly in the early years. Technical specialists and consultants from the World Bank will continue to be involved in the design of the project and provide implementation support. At least three full team missions and continuous hand-holding support is anticipated in the initial couple of years.

Time	Focus	Skills Needed	Annual Resource Estimate (US$, thousands)
Years 1–2	Preparation of procurement documents for Components 1 and 3 Supporting a functioning operating arrangement for facilities manager for Component 2 Supporting the design of a functioning regulatory environment for rollout of Component 3 Supporting the detailed design and rollout of a consumer awareness program in a phased manner in Subcomponent 4A Supporting a functioning operating arrangement for a facilities manager for Subcomponent 2B Supporting the establishment of an SPPM unit for Subcomponent 4B Supporting the rollout of program of activities of sector and county capacity building for Subcomponent 4B Implementation of the ESMF and RPF	Engineering, solar technology, communications, procurement, environmental and social	250
Years 3–5	Monitoring the performance of contracts and construction works for Components 1 and 3 Supporting a functioning operating arrangement for facilities manager for Component 2 Supporting the implementation of the consumer awareness program in Subcomponent 4A Supporting the rollout of program of activities of sector and county capacity building for Subcomponent 4B Supporting a functioning operating arrangement for a facilities manager for Subcomponent 2B Supporting a review of midcourse correction of project design Implementation of the ESMF and RPF	Engineering, sector regulatory and planning, M&E specialist, financial analyst, environmental and social	150

2. Frequency of procurement supervision. Three missions a year, at an interval of four months, are envisaged for procurement supervision of the proposed project.

3. Frequency of FM supervision. The World Bank FM supervision review will be conducted at least once every year based on the risk assessment of the project. The mission's objectives will include ensuring that strong FM systems are maintained for the project throughout its life. Reviews will be carried out regularly to ensure that expenditures incurred by the project remain eligible for IDA funding.

Activity	Frequency
Desk reviews	
IFRs review	Quarterly
Audit report review	Annually
Review of other relevant information such as internal audit reports	Quarterly
On-site visits	
Review of overall operation of the FM system	Annually during implementation support missions
Monitoring of actions taken on issues highlighted in audit reports, auditors' Management Letters, and internal audit and other reports	Continuous
In depth transaction reviews	As required
Capacity building	
FM training	Before project start and thereafter annually
TA	Continuous

ANNEX 4: ECONOMIC AND FINANCIAL ANALYSIS

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

1. This annex discusses the rationale for public financing of the program, the value added from World Bank support, and the economic analysis of the program's development impact with regard to expected benefits and costs. The evaluation of the components is confined to the activities that generate benefits for which an economic value can be clearly identified and measured, notably benefits associated with investments under Components 1, 2, and 3. Component 4 (TA) is excluded because of the difficulty in valuing the outcomes of TA.

Rationale for Public Sector Provision/Financing

2. Achieving the GoK's goals of universal electrification by 2020 requires substantial scale-up of resources in the off-grid space in the underserved counties. Public financing of this project is necessary not only to reach these hitherto far-flung areas, but also to leverage private sector financing and support considerably de-risked opportunities for the private sector in a traditionally commercially unattractive sector. Marginalized counties are characterized by low density of population, high levels of poverty, and nomadic lifestyles. Grid connectivity in these areas is not economically feasible and the private sector footprint is extremely limited as there are only a handful of mini-grids or solar off-grid private players. Therefore, public resources will be used to harness private sector efficiencies, as retailers and operators, by creating appropriate incentives to mitigate the risks of doing business in these counties deemed commercially unattractive by the private sector. Further, public support and financing for solar technologies are also necessary to reduce the financial costs of solar power and to enable it to be competitive with thermal generation—so that the full externalities of solar power can be captured. Finally, public support is necessary to demonstrate the applicability of innovative business models that maximize public and private sector strengths. Kenya has already been a beacon of innovation in off-grid space, and the proposed project, by pushing the boundaries of innovation to benefit consumers largely out of mainstream for decades, will have important lessons and customization opportunities for millions of nonelectrified customers in Sub-Saharan Africa.

Value Added of the World Bank's Support

3. The World Bank, with its ability to design a customized electrification program drawing on decades of global experience and to harness recent technological advancements to provide reliable, affordable, and sustainable energy services to consumers in underserved countries, is well placed to assist Kenya in designing and implementing an off-grid energy access program. The proposed project presents an unparalleled opportunity to reach out to a large part of the country bereft of modern energy services.

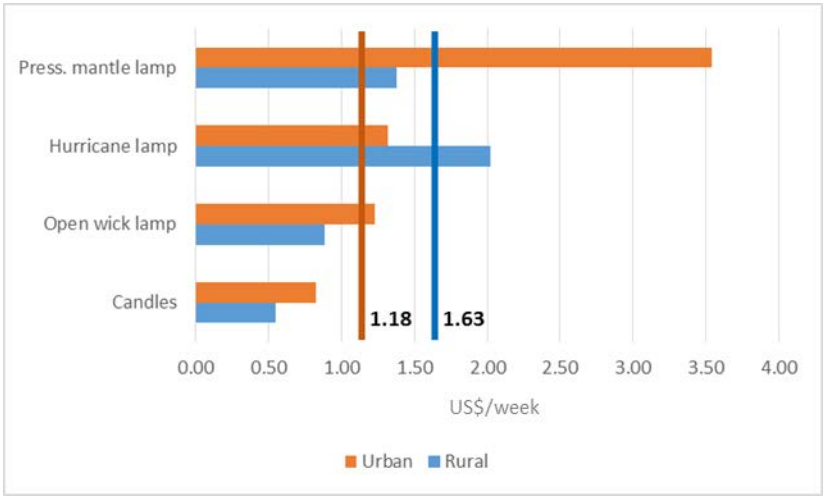
Background

4. The project aims at providing electricity access to underserved counties of Kenya hosting the rural, poor, and largely indigenous population. Therefore, understanding the socioeconomic characteristics of the target population becomes key to estimating the potential economic benefits of the project.

5. While current consumer demand data are under development as part of the implementation of the MTF, preliminary review of the data from marginalized counties extracted from the EED-SEI[33] Kenya Energy Access Survey shows that more than 50 percent of the households in the marginalized areas of Kenya still rely on fuel-based lighting options (including candles, hurricane lamps, mantle lamps, and so on) while 22 percent use solar lanterns to cover their lighting needs; the rest of the households surveyed satisfy their lighting needs through more advanced SHS with a small fraction using small diesel generators or other alternatives such as rechargeable batteries.

6. Weekly expenditure in fuel-based lighting options largely depends on the source use for lighting. Candles represent the cheapest alternative, with families expending between US$0.54 and US$0.84 per week even though candles also provide one of the lowest sources of light output (in lumens). On the other hand, households demanding higher levels of lighting spend between US$2.0 and US$3.5 per week on kerosene for hurricane or pressurized mantle lamps. On average, the survey shows that rural families spend US$1.63 per week on fuel-based lighting while urban households spend US$1.18 per week.

Figure 4.1. Weekly Expenditure on Fuel-Based Lighting



Source: Kenya MTF Energy Access Survey (preliminary results).
Note: Orange/blue solid lines show the weighted average expenditure in urban/rural areas respectively.

Methodology and Assumptions

7. The economic viability of the proposed project was assessed using a standard cost-benefit methodology. Net benefits for the project were calculated by comparing total system costs and benefits for the 'with project' and 'without project' scenarios. Economic costs were estimated based on the preparatory studies developed for the project and adjusted to remove duties and taxes while economic benefits were based on a conservative approach using an avoided cost methodology derived mainly from survey results. The proposed project is also expected to have a number of additional benefits that are either uncertain or difficult to quantify such as (a) employment generation; (b) health benefits derived from the displacement of some sources of energy for lighting, such as kerosene or wood; (c)

[33] EED-SEI is a consortium comprised of EED Advisory Ltd and the Stockholm Environment Institute.

improvements in the provision of education and health services; and (d) a range of environmental and social externalities. As such, the results of the economic analysis can be considered a conservative estimation of the total economic benefits for the society.

8. Table 4.1 presents a summary of the macroeconomic assumptions used in the economic and financial models.

Table 4.1. Modeling Assumptions

Variable	Value	Comment and Source
Exchange rate	KES 101 per US$	
U.S. Inflation	n.a.	Modeled in real US$
Diesel price (base year – market price)	KES 84.57 per liter	ERC
Diesel price (base year – economic)	KES 56.38 per liter	World Bank based on ERC data
Crude oil price (base year)	US$40.2 per bbl	World Bank Group Commodity Price Forecast October 2016
Economic discount rate	6%	

Project Costs

9. The project will invest in providing off-grid electricity solutions to those areas in Kenya where the provision of grid electricity services is not economically or technically feasible in the medium term. The technical solutions include (a) the development of around 120 solar hybrid mini-grids including diesel generation sets as well as distribution lines and household connections for an average village of 223 households, a community facility, and a small workshop; (b) the distribution of 200,000 Tier 1 and 50,000 Tier 2 SHS including their installation and maintenance service (including battery replacement) over an extended period of time; (c) the provision of 1,030 stand-alone solar systems for community facilities; (d) the replacement of 380 diesel water pumps with solar PV water pump systems; and (e) the replacement of 150,000 cookstoves with higher efficient ones.

10. The estimated economic capital investment costs (CAPEX) of the components as well as the yearly economic cost for the O&M (OPEX) activities for each individual project component is summarized in Table 4.2.

Table 4.2. Estimated Economic Costs per Project Component (excluding Taxes and Duties)

		Mini-grids	SHS		Stand-alone Solar Systems				Solar Water Pumps	Cookstoves Domestic
					Schools	Health Centers Level 2	Health Centers Level 3	Assistant County Commissioner Offices		
Description		65 kW solar hybrid mini-grid	Tier 2 system	Tier 1 system	800 W peak demand system including batteries	1.2 kW peak demand system including batteries	3.6 kW peak demand system including batteries	3.0 kW peak demand system including batteries	12.7 kW solar water pump system	Higher tier stove for domestic use
CAPEX	US$	276,870	375	93.8	10,209	14,810	44,431	37,026	32,577	33
	Number	120	50,000	200,000	202	615	141	72	380	150,000
	Total (US$, millions)	33.2	18.8	18.8	2.1	9.1	6.3	2.7	12.4	5.0
OPEX (per unit and year)	Fixed (US$)	8,000	5% CAPEX		149	217	650	542	5,460	—
	Variable	5% CAPEX gen	Battery replaced every 3 years		1% of the batteries replaced every year				Pump replaced every 10 years	—
	Fuel	5,480 l	—		—	—	—	—	—	299 kg

11. The total economic cost of the investment component is estimated at US$108.2 million that is assumed to be disbursed over a five-year period across the different project components. The economic costs of the CAPEX and the OPEX have been estimated on an individual (per project component) basis; however, for the project implementation, it is expected that the different components will be bundled and tendered based on geographical clusters as this will maximize the economies of scale in the provision of the installation and maintenance activities, thereby representing a conservative cost estimation.

Economic Benefits

12. The project aims at providing electricity access to underserved counties of Kenya hosting the rural, poor, and largely indigenous population. The approach followed to estimate the economic benefits of the beneficiaries of the project is to conservatively calculate them on the basis of avoided costs. With this methodology, the estimated economic benefits for households are defined by the amount that they actually pay today for energy services that can be substituted by electricity.

13. Enterprises, schools, health centers, and other institutions will replace or will need to replace (if not electrified) the use of diesel generators. The levelized cost of diesel generation largely depends in the fuel price scenario used for which the oil price forecast prepared by the World Bank Group (Commodity Price Forecast October 2016) has been used. Assuming standard parameters for small diesel generators,[34] the avoided cost of diesel generation is estimated at US$0.36 per kWh for the base year. Similarly, the estimations of the economic benefits derived from the replacement of diesel water pumps are estimated

[34] CAPEX: US$650 per kW; fuel consumption: 2.28 kWh/L; load factor: 35 percent.

as the avoided cost of the diesel generator required to run the water pumps included in the project. To simplify the analysis, the modeling assumes that a standard water pump system to be replaced within the marginalized areas of Kenya has the characteristics listed in Table 4.3.

Table 4.3. Avoided Economic Costs (excluding Environmental) of Water Pump Systems

Diesel Water Pump System	
CAPEX (excluding taxes and duties)	US$11,811
OPEX (excluding fuel cons)	US$6,006
Diesel consumption (liter per year)	7,624
Pump set lifetime (years)	7
Annual water delivered (m^3)	38,106

14. The levelized cost of this water pump can be estimated at US$0.31 per m^3 assuming a 20-year lifetime of the project. The project estimates that 380 diesel water pumps will be replaced by solar PV systems.

15. For households either connecting to a mini-grid or receiving an SHS, the benefits are calculated as the avoided cost of fuel-based lighting options in urban areas, estimated at US$1.18 per week, annually adjusted using the oil price forecast prepared by the World Bank Group.

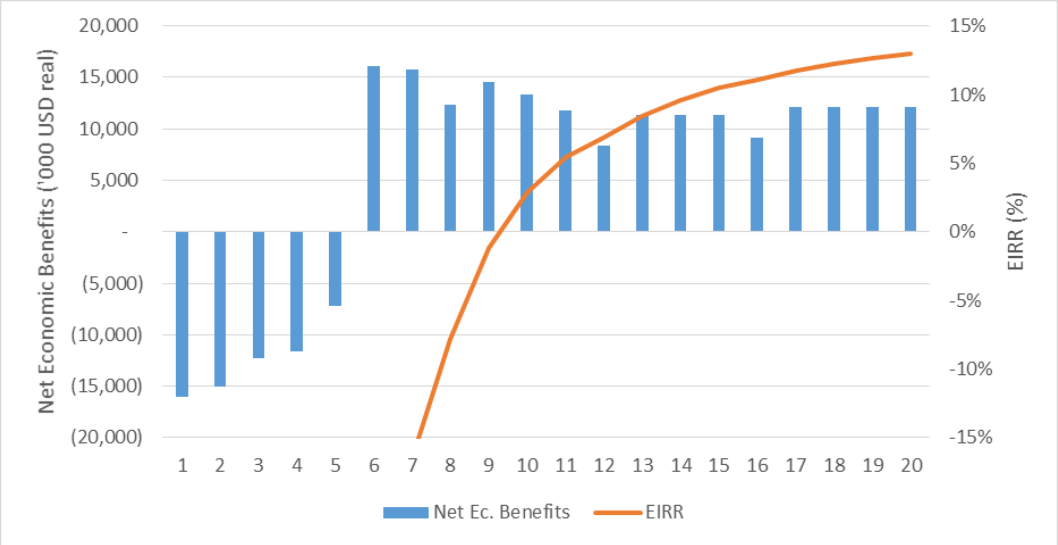
Economic Analysis

16. The economic analysis shows that the project is economically viable without any consideration of environmental externalities. The baseline NPV of the proposed project is US$40.1 million (at 6 percent discount rate) with an EIRR of 13 percent (see Table 4.4).

Table 4.4: Summary of Economic Analysis

EIRR	
EIRR (excluding CO_2) (%)	13.0
EIRR (including CO_2) (%)	22.2
Composition of NPV	
NPV (excluding CO_2) (US$, thousands)	40,085
NPV (including CO_2) (US$, thousands)	103,629

Figure 4.2. Project's Net Economic Benefits and EIRR Evolution (excluding CO_2)



Sensitivity Analysis

17. A sensitivity analysis in the form of switching values has been performed to the economic analysis to test the robustness of the economic results to changes in the cost components of the project. The analysis is performed as a stress case scenario, assuming all CAPEX or OPEX components increase at the same time. This scenario is estimated to be a low probable one since the proposed project consists of four different investment components that are not directly interlinked, except for the fact that they could be bundled to maximize the economies of scale during project implementation. Nonetheless, this stress case will provide valuable information on the overall resilience of the economic analysis to changes in the cost components of the project. The results show that the project remains economically viable as long as the CAPEX increase remains below 41.7 percent or the OPEX increase falls below 38.2 percent.

18. The economic benefits are mainly driven by the substitution impact created by the deployment of 250,000 SHS, with 53 percent of the economic benefits, followed by the replacement of diesel water pumps that heavily rely on expensive diesel to operate—with 22 percent of the economic benefits (in NPV). Therefore, economic benefits of the project are largely dependent on the diesel price scenario as well as on the penetration level for SHS. A switch value analysis shows that maintaining the current diesel price scenario (that is, a constant diesel price of US$0.56 per liter) is enough to maintain the project economically viable at 8.7 percent EIRR. On the other hand, the project will also be affected by a smaller penetration of SHS; in this sense, the economic analysis proves to be also resilient as a 31 percent decrease in the deployment of SHS will be required to make the project economically unviable.

GHG Accounting

19. GHG accounting has been undertaken for this project, which will result in significant GHG emission avoidance by replacing household usage of candles, kerosene, and charcoal fuels as well as diesel and firewood consumption in public facilities and farms. Most project activities will not directly emit GHG due to the use of solar technologies, except for mini-grids that will be partially fueled by diesel as well as

cookstoves that will continue to use renewable biomass fuels. For systems such as mini-grids, household SHS, community SHS, and solar pumps, GHG emissions over 20 years have been analyzed. For household cookstoves, GHG emissions have been analyzed over 5 years due to their shorter economic life. Total baseline emissions are estimated to be 5,096,218 tCO_2, whereas the project emissions total 1,198,829 tCO_2. Therefore, the project will result in 3,897,389 tons of avoided CO_2 emissions.

Table 4.5. Economic Flows of the Project

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Economic Benefits																					
Mini-grids	000 US$	296	702	1,130	1,568	2,015	2,102	2,153	2,199	2,244	2,289	2,325	2,352	2,369	2,377	2,377	2,377	2,377	2,377	2,377	2,377
Solar Home Systems	000 US$	2,260	5,004	7,506	10,009	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511	12,511
Standalone Solar Systems	000 US$	325	738	1,150	1,561	1,985	2,023	2,059	2,098	2,138	2,181	2,181	2,181	2,181	2,181	2,181	2,181	2,181	2,181	2,181	2,181
Solar Water Pumping	000 US$	504	1,538	2,749	3,960	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172	5,172
Clean Cookstoves	000 US$	215	646	1,293	2,370	3,663	4,310	3,879	3,448	2,586	1,293	-	-	-	-	-	-	-	-	-	-
Total Benefits	**000 US$**	**3,600**	**8,629**	**13,828**	**19,468**	**25,346**	**26,117**	**25,774**	**25,426**	**24,650**	**23,444**	**22,188**	**22,215**	**22,231**	**22,240**	**22,240**	**22,240**	**22,240**	**22,240**	**22,240**	**22,240**
Economic Costs																					
CAPEX																					
Mini-grids	000 US$	(5,537)	(6,922)	(6,922)	(6,922)	(6,922)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Home Systems	000 US$	(7,500)	(7,500)	(7,500)	(7,500)	(7,500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Standalone Solar Systems	000 US$	(4,020)	(4,020)	(4,020)	(4,020)	(4,020)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Solar Water Pumping	000 US$	(1,205)	(2,476)	(2,899)	(2,899)	(2,899)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Clean Cookstoves	000 US$	(500)	(500)	(1,000)	(1,500)	(1,500)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal	***000 US$***	***(18,762.92)***	***(21,418)***	***(22,341)***	***(22,841)***	***(22,841)***	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OPEX																					
Mini-grids	000 US$	(221)	(737)	(1,317)	(1,900)	(2,485)	(2,795)	(2,809)	(2,821)	(2,833)	(2,845)	(2,856)	(2,864)	(2,870)	(2,873)	(2,873)	(2,873)	(2,873)	(2,873)	(2,873)	(2,873)
Solar Home Systems	000 US$	(375)	(750)	(1,125)	(4,500)	(4,875)	(4,875)	(4,875)	(7,875)	(4,875)	(4,875)	(4,875)	(7,875)	(4,875)	(4,875)	(4,875)	(7,875)	(4,875)	(4,875)	(4,875)	(4,875)
Standalone Solar Systems	000 US$	(59)	(118)	(176)	(235)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)	(294)
Solar Water Pumping	000 US$	(202)	(617)	(1,103)	(1,588)	(2,074)	(2,074)	(2,074)	(2,074)	(2,074)	(2,074)	(2,414)	(2,772)	(2,891)	(2,891)	(2,891)	(2,074)	(2,074)	(2,074)	(2,074)	(2,074)
Subtotal	***000 US$***	***(857)***	***(2,222)***	***(3,721)***	***(8,223)***	***(9,728)***	***(10,039)***	***(10,053)***	***(13,064)***	***(10,076)***	***(10,089)***	***(10,439)***	***(13,805)***	***(10,930)***	***(10,933)***	***(10,933)***	***(13,116)***	***(10,116)***	***(10,116)***	***(10,116)***	***(10,116)***
Total Costs	**000 US$**	**(19,620)**	**(23,640)**	**(26,063)**	**(31,065)**	**(32,569)**	**(10,039)**	**(10,053)**	**(13,064)**	**(10,076)**	**(10,089)**	**(10,439)**	**(13,805)**	**(10,930)**	**(10,933)**	**(10,933)**	**(13,116)**	**(10,116)**	**(10,116)**	**(10,116)**	**(10,116)**
Net Economic Benefits	**000 US$**	**(16,020)**	**(15,011)**	**(12,234)**	**(11,597)**	**(7,224)**	**16,078**	**15,721**	**12,362**	**14,574**	**13,356**	**11,749**	**8,409**	**11,301**	**11,307**	**11,307**	**9,124**	**12,124**	**12,124**	**12,124**	**12,124**
Project total net emission	**tnCO_2**	**(31,456)**	**(66,531)**	**(37,455)**	**(55,742)**	**(200,104)**	**(200,104)**	**(196,485)**	**(189,247)**	**(178,390)**	**(163,914)**	**(162,524)**	**(161,135)**	**(159,746)**	**(158,357)**	**(156,968)**	**(156,968)**	**(156,968)**	**(156,968)**	**(156,968)**	**(156,968)**
Social price of CO_2	USD/tn	30	30	30	35	35	35	35	35	35	35	35	35	35	50	50	50	50	50	50	50
Net Ec Benefits w/CO_2	**000 US$**	**(15,076)**	**(13,015)**	**(11,110)**	**(9,646)**	**(220)**	**23,082**	**22,598**	**18,986**	**20,817**	**19,093**	**17,437**	**14,049**	**16,892**	**19,225**	**19,155**	**16,972**	**19,972**	**19,972**	**19,972**	**19,972**

KPLC Financial Analysis

20. KPLC will be the project IA to sign contracts with the private sector in Components 1 and 3; therefore, it becomes important to understand how the project will affect the financial sustainability of the company. This financial analysis was performed based on KPLC's audited financial statements for the fiscal years ended on June 30 of 2011–2016.

21. KPLC is majority owned and controlled by the GoK through a 50.1 percent direct equity interest. The balance of the company's shares is owned by private parties, either directly or through nominees. KPLC's shares are listed at the Nairobi Securities Exchange. Its main business activity is the distribution and retail sale of electricity to consumers in Kenya. KPLC operates as a commercial company aiming for full cost recovery through a regulated tariff structure. The company does not receive any subsidies and its revenues are fully dependent on the regulated tariff and electricity sales/market demand. Costs associated with fuel and foreign exchange are passed through and recovered from customers.

22. Table 4.6 summarizes KPLC's financial highlights for the period from July 1, 2010, to June 30, 2016.

Table 4.6. Financial and Operational Highlights

KES, millions (unless otherwise indicated)	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Number of customers (thousands)	1,753	2,039	2,331	2,728	3,611	4,812
Electricity sales	42,486	45,008	47,916	62,597	77,836	87,081
Units purchased (GWh)	6,895	7,197	7,562	8,254	8,629	9,159
Power purchase cost (ex-fuel)	20,214	21,080	24,761	30,659	44,460	51,399
Fuel costs	26,151	42,789	32,297	38,973	25,835	12,690
Foreign exchange cost	3,425	6,094	5,120	3,008	2,820	6,175
EBITDA	10,517	14,286	14,655	20,892	23,443	25,932
Finance cost	415	1,216	2,495	4,009	4,965	5,811
Profit	4,220	4,617	3,446	6,456	7,432	7,556
Total assets	121,171	134,132	184,213	220,109	272,286	297,542
Total debt (including overdrafts)	39,514	29,452	57,837	73,676	111,600	113,869
Total liabilities	89,085	78,257	120,974	147,222	213,082	231,926
CAPEX	24,714	25,950	42,631	26,651	39,761	47,363

Note: EBITDA = Earnings before interest, tax, depreciation, and amortization.

23. Overall, KPLC's financial position has strengthened over the past six years with an increase of 105 percent in electricity sales and 174 percent in the customer base. Meanwhile, the company has benefited from lower fuel costs leading to an overall improvement in the bottom line of 80 percent in the same period.

24. Finance costs (interest on loans) multiplied during the period, increasing from the equivalent of US$5 million in FY11 to over US$50 million in FY16, a tenfold increase in six years. This change reflects the substantial increase in KPLC's debt during the same period, from the equivalent of US$395 million in FY11 to US$1,127 million in FY16. The incremental debt was applied to finance approximately 75–80 percent of a large capital investment program associated mostly with new connections and service improvement investments such as expansion and upgrading of the distribution network. These investments required

expenditures equivalent to US$291 million in FY11, US$305 million in FY12, US$500 million in FY13, US$300 million in FY14, US$400m in FY2015, and US$469 in FY16.

25. KPLC's FY16 indebtedness level, although high, is still acceptable: net leverage of 66 percent and debt to EBITDA of three times. However, KPLC's ability to generate cash to repay its debt as due while implementing service improvement investments is a matter of concern. Due to the development nature of the investments, these do not produce an immediate and proportional revenue increase and instead demand prolonged amortization periods. Furthermore, KPLC's cash reserves have been fully depleted to fund the accelerated investment program.

26. Given the changes in the company's debt and investment profile over the past six years and the basis of the recent debt refinancing, it is important to ensure that KPLC continues to be financially sustainable in the future. Any new capital investments financed using KPLC's own balance sheet need to be evaluated on a financial basis to ensure covenants articulated in KEMP (P120014) are not breached.

27. Given the project is financed and implemented entirely by the GoK with KPLC simply managing the ongoing operations, it is not expected to have a material impact on the finances of the company going forward. The financial projections in Table 4.7 assume a 'stress case' scenario showing an incremental increase in operating costs and no respective increase in revenues (assuming KPLC is unable to recover the costs through the tariff[35]).

Figure 4.3. Impact of the Proposed Project on KPLC Operating Expenses

28. The operating expenses for the project only add an aggregate of 1 percent to the operating expenses of KPLC over the next five years. Therefore, there is minimal impact of the proposed project on the operations of KPLC. The financial covenants below indicate that there will be no breach in the five-year projection period in the case where KPLC bears the operating costs of the project with no recovery through the tariff.

[35] A recognition of the need to pass through the costs of KOSAP to the electricity tariffs has already been agreed between KPLC, the MoEP, the ERC, and the World Bank.

Table 4.7. Base Case Projected Financial Ratios

	Threshold	FY17	FY18	FY19	FY20	FY21
Debt service coverage ratio	≥1.2	2.4	2.0	1.4	1.8	2.0
Current ratio	≥1.0	1.0	1.0	1.2	1.5	1.7
Gearing ratio	≤2.5	1.2	1.0	0.8	0.7	0.5
Debtors receivable days	≤60 days	46	43	41	38	35

ANNEX 5: SUMMARY OF GLOBAL EXPERIENCE IN OFF-GRID ELECTRIFICATION

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

1. As much as 1.1 billion people worldwide still have no access to electricity, according to the latest available statistics (Global Tracking Framework 2015). The new SDG7 calls for achieving universal access to reliable, affordable, and modern energy services by 2030 (Target 7.1.). However, many of those who do not have electricity access today are unlikely to be reached by the conventional grid extension solutions by then. In the case of Kenya, as in several other parts of Africa, the development and rollout of affordable, sustainable, and scalable off-grid electrification solutions could accelerate the achievement of the SDG.

From 1990s to 2010s

2. Over the past decades, the World Bank and other development partners have supported various off-grid electrification projects providing access to modern energy services to more remote households, businesses, and institutions that could not be reached by conventional grid expansion. Among the most cited successful examples are Sri Lanka,[36] Bangladesh,[37] Mongolia,[38] Bolivia,[39] Peru,[40] and Argentina[41] projects.

3. Until recently, however, off-grid electrification has failed to play a major role in the drive toward universal electricity access. It is estimated that by around 2000, only about 1.3 million systems had been installed worldwide—reaching only about 0.1 percent of the total off-grid population.[42] Even the achievements of the abovementioned successful World Bank projects in the 2000s and early 2010s (with the noteworthy exception of Bangladesh) were relatively modest compared to the overall needs of the global off-grid population.

[36] Govindarajalu, C., Raihan Elahi, and Jayantha Nagendra. 2008. *Electricity Beyond the Grid: Innovative Programs in Bangladesh and Sri Lanka*. ESMAP, World Bank.
[37] Sadeque Z., Raihan Elahi, and Dana Rysankova. 2014. *Scaling up Access to Electricity: The Case of Bangladesh*. World Bank Livewire.
[38] Jayawardena M., Salvador Rivera, and Chrisantha Ratnayake. 2012. *Capturing the Sun in the Land of the Blue Sky: Providing Portable Solar Power to Nomadic Herders in Mongolia.* World Bank.
[39] Reiche K., Dana Rysankova, and Susan Goldmark. 2007. *Output-Based Aid in Bolivia: Balanced Tender Design for Sustainable Energy Access in Difficult Markets*. OBA Approaches, GPOBA.
[40] http://www.worldbank.org/en/results/2014/09/24/peru-brings-electricity-to-rural-communities
[41] Argentina, Renewable Energy in the Rural Market Project, Implementation Completion Report, 2013.
[42] Nienwenhout at al. 2000.

Table 5.1. Results of the Main World Bank Off-grid Operations Implemented between 2000 and 2015

	Project Start	Project End	Number of Beneficiaries (as of FY15)
Sri Lanka (Renewable Energy for Rural Economic Development, RERED)	2002	2007	418,003
Bangladesh (RERED I, including Additional Financing)	2002	2013	10,198,019
Mongolia (Renewable Energy for Rural Access Project)	2007	2012	201,672
Bolivia (IDTR including GPOBA)	2003	2013	170,243
Peru (Rural Electrification I)	2006	2013	27,690
Argentina (PERMER 1)	1999	2013	107,180

Source: Projects results based on Implementation Completion and Results Reports as reported by Energy and Extractives Global Practice for the World Bank Group Corporate Scorecard.

4. One of the main challenges for scaling up during the 1990s to 2010s period was the relatively high costs of off-grid electricity solutions compared to the capacity of the target rural populations to pay—typically the more remote and poorer households. To deal with the affordability constraints, successful off-grid electrification models either managed to attract microfinance institutions to allow households to spread out the payment for SHS (Box 1.2) or secured sizable Government subsidies, often covering both the investment and the O&M cost. None of these models, however, have taken root in Sub-Saharan Africa,[43] where (a) less developed microfinance institutions were unwilling to take additional risks and the complexities of SHS financing and (b) Governments, focused on larger energy sector issues, lacked resources, motivation, and capacity to develop and implement fairly complex regulated, subsidized off-grid electrification approaches.[44]

5. Achievements were even more meager on the mini-grid side. While several countries succeeded in developing sizable mini-grid programs (Sri Lanka, Mali, Nepal), overall mini-grid deployment in rural electrification remained limited—partly due to resource constraints.

6. Mini-grids built during this period were mostly diesel powered. This typically resulted in sustainability issues (that is, when the price of diesel went up, tariffs became unaffordable). Hydropower solutions have also been pursued. However, their applicability has been limited to the availability of suitable resources and often required significant subsidies to buy down the high up-front costs of investments—particularly since the mini-grids would typically be owned and operated by communities (Sri Lanka and Nepal) or local small and medium enterprises (Mali) with limited financial resources.

7. Still, the off-grid electricity projects of 1990s to 2000s have provided electricity to millions of people living in poorer and more remote regions—areas that would otherwise have remained unelectrified—and they have generated important lessons for future operations.

[43] With the exception of South Africa, which pursued off-grid concessions for SHS (see Bardouille: Toward Universal Energy Access: Designing a New Household Electrification Strategy for South Africa, IFC Smart Lessons, 2014)

[44] These Government-driven approaches were most successful in middle-income countries with relatively high electrification rates (for example, in Latin America), which could afford to provide sustainable subsidies for this last-mile effort (either through public budgets or as cross-subsidies from grid users).

8. These lessons are well captured in 'Terrado, Ernesto; Cabraal, Anil; Mukherjee, Ishani: Operational Guidance for World Bank Group Staff: Designing Sustainable Off-Grid Rural Electrification Projects: Principles and Practices (2008)'. Despite much recent innovation in the off-grid markets (see below), the key principles established in this Guidance Note still hold and are reflected in the present project design.

a) The conception and implementation of the off-grid project must be consistent with the overall rural electrification plan for the region.

b) Project design must not be technology driven.

c) Efforts must be made to maximize community awareness, involvement, and support.

d) Both the Government and IA must take full ownership of the project.

e) Competence of the local Project Management Unit is critical to project success.

f) The design must reflect the capabilities of the service providers, adequately address their risks, provide TA, ensure appropriate technical standards and performance requirements, establish access to adequate financing, and ensure the timely disbursement of funds.

g) The Government must put in place light-handed regulatory measures that simplify operations for private sector participants and limit the cost of doing business, while adequately protecting consumers.

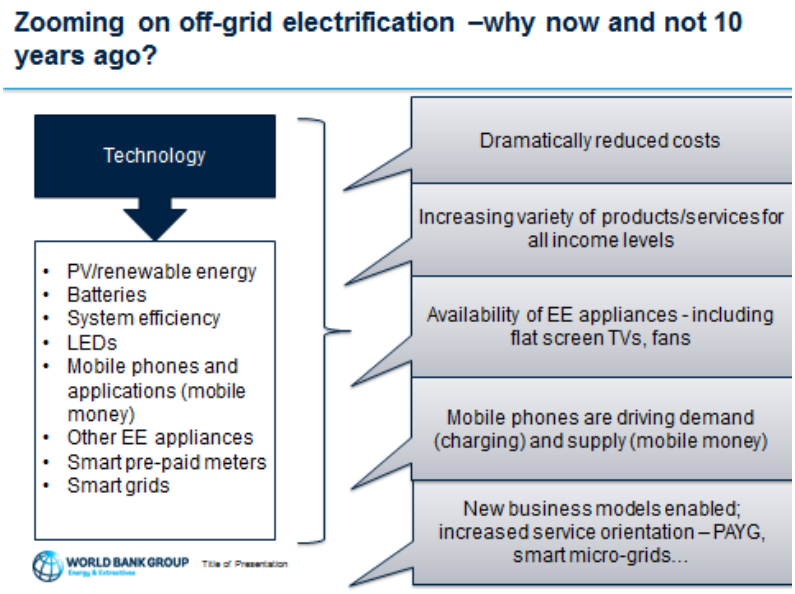
h) Appropriate training should be provided to participants of off-grid projects at various levels, including Government staff, potential service providers, and consumers.

i) Opportunities must be maximized for productive and institutional applications that complement the provision of household service and institutional and community applications that improve livelihood opportunities and generate revenue.

Technology Revolution of the Last Decade

9. During the last decade, however, there have been tremendous developments in off-grid electrification technologies and business models that change some of the past paradigms. Figure 5.1 illustrates how a combination of parallel technology changes has allowed dramatic improvements in (a) costs; (b) energy efficiency; (c) variety; and (d) usability of off-grid electrification products; which in turn has paved the way for (e) the emergence of new private sector business models; and (f) fundamental changes in the menu of options for national off-grid electrification planning.

Figure 5.1. Combination of Parallel Technology Changes Has Allowed Dramatic Improvements in Off-grid Electrification



Note: EE = Energy Efficient

10. As a result, there is now a broad spectrum of proven electrification options available to satisfy the varied needs, geographic distribution, spending patterns, and capacity to pay of unelectrified populations across the world. Even for the poorest segments of the population, small solar lighting solutions (which usually come with a much-desired phone charger included) are in most cases less expensive than their base case alternative (kerosene, candles, and/or traditional flashlights). In fact, Lighting Global[45] is reporting that on average consumers save US$3.15 for every dollar spent on pico-PV in Africa.[46]

11. The emergence of PAYG (see Box 1.2) and other 'smart meter' solutions, which mirror the cell phone prepayment systems, further increased affordability and attractiveness of off-grid electrification for rural users, as they allow them to (a) buy electricity in small quantities, fitting the traditional expenditure patterns they are used to; (b) test the new technology before committing large financial resources; (c) pay only for the use of the system when/if it works; and (d) upgrade to larger systems whenever they are ready due to the modularity of these new generation solar kits. At the same time, embedded information technology solutions allow businesses to implement professional sales strategies and build intelligence about their customers, at radically reduced cost.

[45] Lighting Global is the World Bank Group's platform supporting sustainable growth of the international off-grid solar market. Through Lighting Global, IFC and the World Bank work with the Global Off-Grid Lighting Association, manufacturers, distributors, other development partners, and end users to develop the off-grid lighting market. Lighting Global support Lighting Africa, Lighting Asia, and Lighting Pacific, which work along the supply chain of off-grid lighting products and systems to reduce market entry barriers and first-mover risks.

[46] For example, running a simple wick kerosene lantern for a year in Kenya costs US$54 (including the purchase of the lantern and ongoing payments for kerosene). A solar light providing comparable service retails for less than US$15 in Kenya, resulting in a payback period of three months. Assuming a lifetime of two to three years for a quality product, customers can enjoy lighting at no cost for the same two to three years after purchasing the lantern.

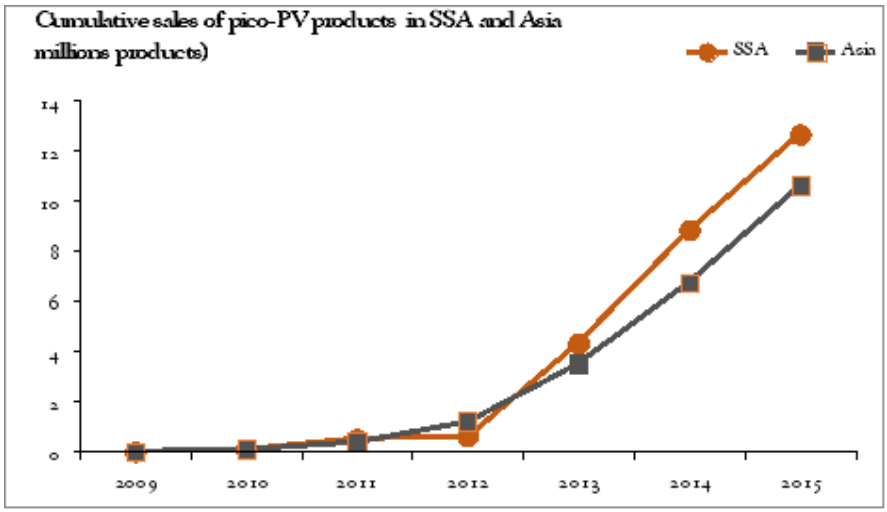
12. These technology advances also benefit mini-grids. The dramatic reduction in the costs of solar PV has opened the door to solar/battery or solar/diesel hybrid mini-grids, which take advantage of the solar resource—the most available energy resource in the off-grid markets. The low-cost smart-meter/smart-grid solutions are also now available for mini-grids, improving supply and demand balance and therefore reducing both the investment costs (reducing the need for overinvesting in generation capacity) and the O&M costs (remote monitoring and metering, better user-system interaction, better theft control, and so on).

Results: Significant Acceleration in Off-grid Electrification

13. These new technology trends have resulted in the significant acceleration of the adoption of off-grid electricity solutions globally. It is estimated that today about 90 million people in the developing world have at least one solar lighting product in their household. While this is still less than 10 percent of the off-grid population, it is estimated that by 2020 (based on the current trends), one in every three off-grid households will use an off-grid solar system.[47]

14. Sales of pico-PV products, in particular, have skyrocketed in the last five years, partly owing to the Lighting Africa/Lighting Global support. Figure 5.2 presents the cumulative sales of branded products in Sub-Saharan Africa and Asia. In addition to the branded products (which are a proxy for quality products),[48] it is estimated that at least as many non-branded products were sold during the same period.

Figure 5.2. Sales of Solar Lighting Products Are Taking Off



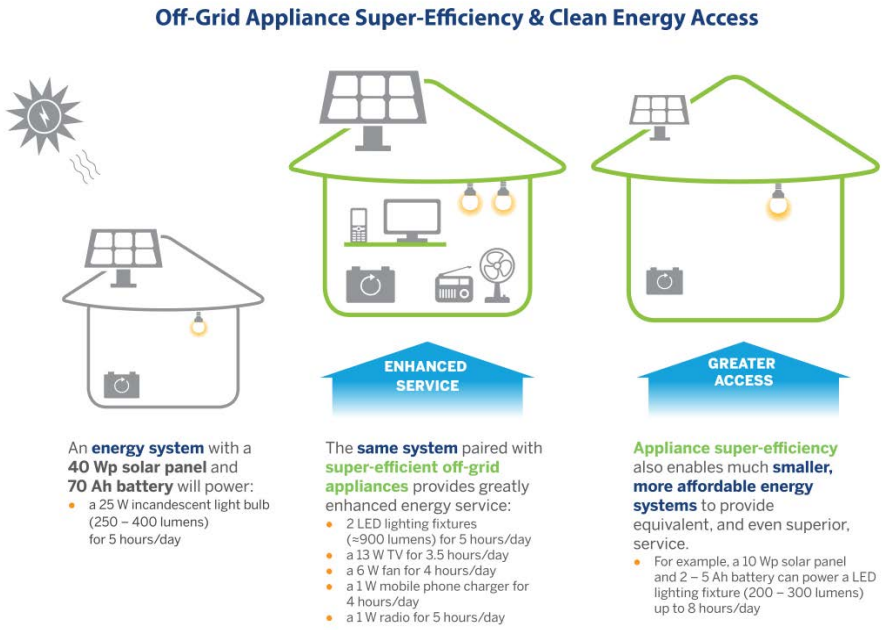
Source: World Bank Group and Lighting Global, Bloomberg New Energy Finance: Off-grid Solar Market Trends Report 2016.

15. It should be noted that while pico-PV products (typically ranging from 1 to 10 Wp) are smaller than the SHS supported in the past projects of 1990s and 2000s, they are not necessarily inferior in the services provided. For example, 10 Wp system can now offer better service (ambient lighting and cell

[47] Bloomberg Off-grid Market Trends Report 2016, financed both by Lighting Global and the World Bank.
[48] About 80 percent of the branded products sold are Lighting Global quality verified.

phone charging) than what 40 Wp system could deliver 10 years ago.

Figure 5.3. Technology Advances Are Providing Users with More Energy Services at a Lower Price



Source: Global LEAP Initiative. Analysis courtesy of Humboldt State University's Schatz Energy Research Center.

16. The majority of systems sold, however, still remain in the lower range (3 Wp and below), although higher-value system sales are rising, especially in the more mature markets, such as Kenya— for example, average retail price of pico-PV products sold in Kenya is US$49.7, compared to US$13.5 in neighboring Tanzania. Larger, high-value products are in particular promoted through the PAYG business models. PAYG companies offer a wide range of systems; some specialize in serving a large number of clients with a basic lighting kit, and others prefer serving a smaller number of clients with larger, higher-value systems (up to 300 Wp).[49]

17. Correspondingly, the off-grid sector has started attracting larger-scale financing, including from the private sector. Annual investments into the sector (including specialized intermediaries) have risen 15-fold since 2012, reaching US$276 million in 2015. Investments to PAYG companies account for the majority of this amount. While the majority of funding has come from impact investors and donors, private capital, especially strategic investments from large multinational players such as Total, Schneider Electric, Engie, Solar City, and so on, has been on the rise.

18. There is also a growing number of mini-grid companies with significant scale-up ambition, operating primarily in East Africa and South Asia, focusing on providing services in rural towns with adequate density and productive loads. Some mini-grid companies have also attracted significant investments, including from strategic investors, such as Caterpillar, Total, First Solar, and Schneider Electric. Some larger multinational companies, such as E.On and Engie, are currently piloting their own

[49] Market trends report.

mini-grid programs in Tanzania.

Past and Emerging Business Models

19. The technologies described earlier are also disrupting the conventional off-grid electrification business models. Much of the debates of the early 2000s among off-grid practitioners have centered around the relative pros and cons of the two prevailing off-grid electrification business models: (a) the sales model (also called 'dealer' model, often supported with microfinance—mostly used in Asia) and (b) the fee-for-service model (usually implemented through regulated concessions—mostly used in Latin America and the Caribbean).

Table 5.2. Traditional Business Models in Off-grid Electrification

Sales Model	The Fee-for-Service Model
In the sales/dealer model, the consumer purchases the system either with cash or financing. Beyond warranty service, the consumer assumes responsibility for all operational and replacement costs. In World Bank projects, the dealer model often features microfinance assistance, which addresses the issue of high up-front costs. Typically, there are several service providers that are competing for the clients (competition in the market) Examples: Bangladesh and Sri Lanka	In the fee-for-service model, the consumer is provided electricity service, the level of which depends on system capacity. The company, which retains ownership of the equipment, is responsible for maintenance and providing replacement parts over the life of the service contract. Typically, there is explicit or implicit exclusivity for the service provider for the defined territory—for example, concessions are awarded through a competitive process (competition for the market) or to the incumbent (for example, a utility already holding a concession for grid service provision) Examples: Argentina and Peru
Hybrid models - countries that do not have up-front conditions for either (a) the competition in the market or (b) financial or implementation capacity to electrify all remaining households through regulated concessions, for example, sparsely populated countries that imply natural monopolies, but with still a large number of unelectrified users, countries with limited private sector and/or government capacity, and so on. Examples: Mongolia, Bolivia	

Source: Based on Terrado, Ernesto; Cabraal, Anil; Mukherjee, Ishani. 2008. *Operational Guidance for World Bank Group Staff: Designing Sustainable Off-Grid Rural Electrification Projects -: Principles and Practices*.

20. The sales model had best results in relatively densely populated countries, with a relatively large number of unelectrified households (large markets that can be served by competing companies at reasonable costs). Not surprisingly, it has yielded best results in South Asia. The fee-for-service model was used mostly in regulated environments, with Governments subsidizing provision of off-grid services for a relatively small but hard-to-reach population. This model was used primarily by the Latin American and Caribbean countries, which required off-grid solutions for a relatively small number but hard-to-reach off-grid households and generally had competent regulatory agencies to oversee the process.

21. Over time, hybrid approaches emerged for countries that did not fall into any of the two categories. For example, Mongolia's project was originally designed as the traditional sales model but had to be modified to reflect the specific country needs—low population density, low capacity of private service providers, and a nomadic population. The project still supported (subsidized) sales of the SHS but

also carried out other measures to enhance sustainability of service provision, such as setting up an extensive network of sales and service centers throughout rural areas, developed as a PPP. Similarly, the Bolivia project design leveraged elements from both the sales and the fee-for-service approaches.

22. The PAYG approach is now also breaking this business model dichotomy. The PAYG business model has elements of both the sales/microfinance approach and the fee-for-service approach, as although in most PAYG cases, the ownership of systems ultimately passes to users (as in the sale model), the focus of PAYG companies is on the long-term servicing of their clients—offering additional services, upgrades, and even additional products—such as cookstoves and so on. In fact, PAYG companies need to invest substantial resources in building this client base (with their credit history) and servicing infrastructure—and it is therefore in their interest to leverage these assets to the maximum.

23. The PAYG model is currently emerging primarily as a private sector-driven solution, with several companies competing in the market (a variation on the sales model). However, its key features—long-term service-oriented approach, ability to service households remotely, and availability of real-time data on quantity and quality of services provided to users—also make it a suitable candidate for PPP approaches for the more remote, sparsely populated, and commercially unattractive ideas (a variation on the regulated fee-for-service model).

Implication of the Recent Off-grid Electricity Trends on the Design of Off-grid Electricity Projects

24. This new off-grid electrification dynamic has several direct implications for 'modern' off-grid electrification program design:[50]

- There is an opportunity and a need to support a much wider range of solutions and flexible business models in one country (in parallel or sequentially) that respond to the diverse needs of varied population of different characteristics, the geographic population density, and housing patterns, as well as income segments. Most off-grid electrification projects of the early 1990s (technology demonstration) and 2000s (initial scale-up of individual technology solutions) typically focused on 1–2 locally promising technologies (for example, SHS), each with one 'pre-wired' business case (for example, microfinance institution -backed dealer sales). Today however, national off-grid programs are realizing that there is an opportunity to reach a much wider spectrum of population by catering to a much broader range of technology options, business approaches, and intervention mechanisms at once. This also allows leveraging transaction costs over larger disbursement volumes and scaling up of off-grid project ambitions—universal access to electricity now becoming an achievable goal.

- Given the extremely dynamic (takeoff) phase of several off-grid market segments and the resulting continued stream of technology and business model innovations, it is important to design national access programs with enough flexibility[51] to allow users to benefit from the best available options at any given time and the private sector to bring forth innovations during one project cycle. For instance, specifications should not overprescribe technical

[50] Adapted from: Haiti Modern Energy Services for All, Project Appraisal Document, 2015. Lessons learned and integrated in the project design.
[51] One of the performance criteria for energy subsidies proposed by GIZ 2010 (Energy Subsidies: When. Where and How?).

parameters, and credit or grant vehicles should remain open to innovative proposals—but without sacrificing qualification criteria.

- The emerging service-oriented approaches and payment schemes provide an opportunity to link incentives more closely to the level of services provided[52] rather than the traditional 'input-focused' generator (nameplate) capacity approach, which in turn will encourage more energy efficiency improvements, both on the system side and the appliances side.

- There is an opportunity to leverage increasing volumes of private sector investments. Even though public support remains essential for the time being, project design should maximize this opportunity, better incentivizing private sector involvement as opposed to crowding out existing private sector efforts, and create conditions for gradual phasing out of the public support in favor of private investments, as the market gains more confidence in the new off-grid electricity solutions and business models.[53]

[52] Fraunhofer ISE (the Fraunhofer Institute of Solar Energy System). 2001. *Energy Service Quality in Jujuy - Argentina*, World Bank Group BBL presentation; World Bank Group. 2006. "Electrification and Regulation." *Energy and Mining Sector Board Paper No. 18*; Mohua Mukherjee. 2012. *SREP Pilot Country Meeting presentation*; GSMA. 2013. *Service over Technology: Defining the Role for Mobile in Energy Access.*

[53] See, for example, Bardouille, Muench: How a New Breed of Distributed Energy Services Companies can reach 500 mm energy-poor customers within a decade.

ANNEX 6: GRID AND SHS MAPS OF KENYA

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

Figure 6.1a. Grid Map of Kenya[a]

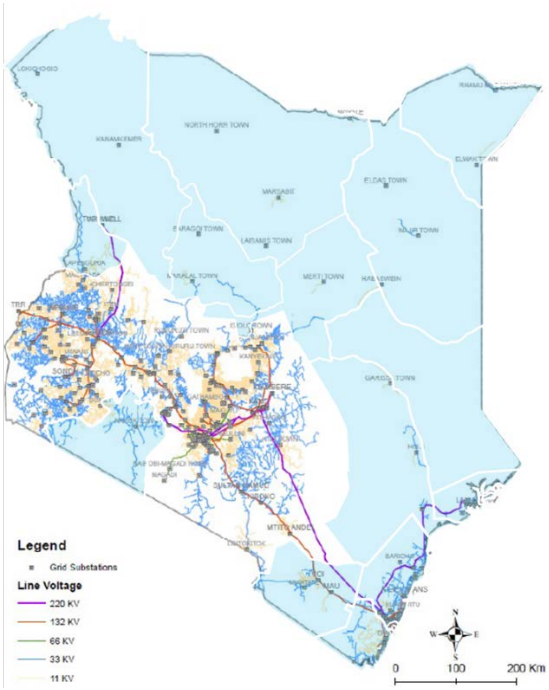
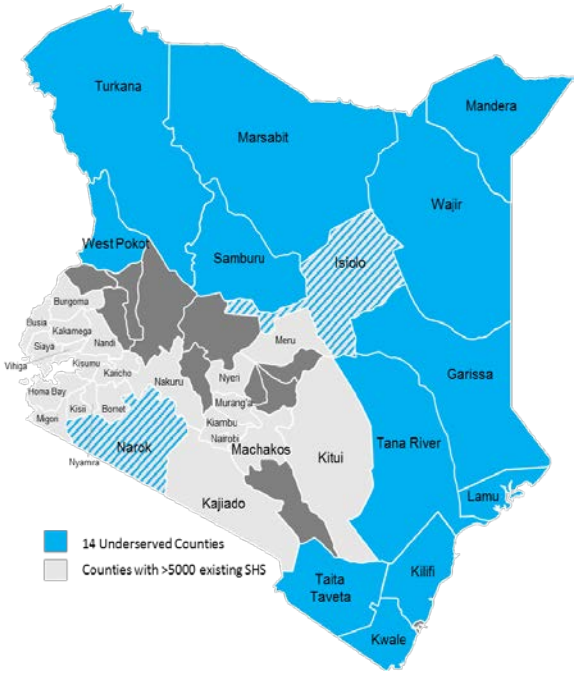


Figure 6.1b. Geographic Distribution of SHS Connections



Note: a. Areas shaded in light blue represent areas with limited grid connectivity.

ANNEX 7: GENDER ACTION PLAN

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

1. Table 7.1 provides an overview of specific activities of the gender action plan that are innately a part of the project, those that require incremental efforts, and the associated actors that will implement the activities.

Table 7.1. Gender Action Plan Activities

Activities	Part of the Project or Incremental?	Who Will Do Each?
1. Conduct separate consultations with women and men before implementation to identify their different situation, needs, and concerns	Part of the project's communications and awareness raising	Project communications and awareness raising staff; public and private sector service providers AFREA Gender and Energy team TA
2. Increase women's awareness about solar energy use and the productive uses of solar power by designing and implementing gender-targeted communications and awareness building campaigns	Part of the project's communications and awareness raising	Project communications and awareness raising staff; public and private sector service providers AFREA Gender and Energy team TA
3. Prevent and mitigate displacement and sexual and GBV risks that may emerge as part of project implementation	Part of the project's social safeguards	Social development staff in charge of safeguards AFREA Gender and Energy team TA
4. Facilitate connection for poor female household heads to ensure women's access to solar products and efficient cookstoves	Part of project design and implementation Incremental—may require additional staff, funding, and training for staff dealing with vulnerable women and the women themselves	Public and private sector service providers AFREA Gender and Energy funded trainers/consultant
5. Ensure women's participation in decision making related to the installation and management of the solar systems—at the local level	Part of the project's institutional development and strengthening Incremental—may require additional training for project staff, community leaders, and target women	Project staff in charge of institutional capacity building for public and private entities AFREA Gender and Energy funded trainers/consultant
6. Build capacity for income-earning activities by training and employing women in installation, management, and sales of solar products	Part of the project's educational activities Incremental—-may require additional funding for separate training for women and men	Project education staff AFREA Gender and Energy trainers/consultants
7. Adopt and integrate several results	Part of the project's M&E system	Project M&E staff

indicators in the project's M&E system to monitor and assess both progress in implementing gender-related activities and the project benefits for women and men	Incremental—may require additional training, staff time, developing forms and mechanisms to capture sex-disaggregated and gender-relevant data on progress, results, and impact, and using qualitative methods	AFREA Gender and Energy team and trainers/consultants

ANNEX 8: KENYA NATIONAL ELECTRIFICATION STRATEGY

COUNTRY: Kenya
Kenya: Off-grid Solar Access Project for Underserved Counties

1. **The proposed project is part of the implementation road map of the National Electrification Strategy[54] (NES), underpinned by a geospatial plan** that lays out the technical, financial, and institutional road map to universal electrification in Kenya by 2020. The draft NES, expected to be finalized in September 2017, proposes mechanisms to balance KPLC's consumer intensification with service provision beyond the grid. The people inhabiting the underserved areas are largely cash poor, nomadic, and pastoralist—in contrast with those living in grid-connected areas—also known as the core market. Roughly 80 percent of households currently with SHS are located within 5–10 km of the national grid, with the footprint in off-grid areas negligible (Annex 6). Therefore, the challenge is to create mechanisms to incentivize the private sector to deliver services in these areas in a sustainable manner; dovetail with anchor loads such as community facilities to reach remote households; and ensure affordability for consumers and adequacy of revenue for service providers.

2. **The NES articulates the following challenges to be addressed for effective scale-up of off-grid solutions in Kenya:**

a. **Defining a service level.** Unlike a grid electrification, where network economies allow all consumers to have full benefits of electric service, off-grid service is characterized by different levels of services offered through systems of varying capacities and configurations. Specifically, solar products have not gained recognition as electricity access in Kenyan power statistics, though a recent estimate[55] indicates that such products have potentially added about 8 percent of connections to the country's overall access rate. The NES defines access as a Tier 1 service (of the MTF) equivalent to pico-solar system with sufficient capacity to provide 1,000 lumen-hours of light and cell phone charging abilities.

b. **Planning for electrification.** The grid infrastructure covered by KPLC is now mapped at the distribution transformer level, but there is no equivalent effort made to assess the potential and services provided in off-grid areas. Therefore, it is not possible to articulate the extent of potential grid densification and expansion and mix of solutions for the off-grid areas. The World Bank (with Energy Sector Management Assistance Program [ESMAP] funding) is supporting Phase I of a geospatial platform that will map the grid and off-grid access delivery modalities and technology choices, including deployment of cost-effective renewable energy supply, where appropriate, and the corresponding sector wide investment and operating cost requirements. Such geospatial mapping lays out a prioritized least-cost and sequential investment plan and define the investments under this proposed project.

c. **Understanding the off-grid market.** There is limited understanding of the households and economic activities, including income, and consumption patterns, in the counties outside the core market. This lack of recent data increases the uncertainty over the true purchasing power of consumers.[56] Older data suggest not only substantially lower incomes of the population and high seasonality patterns, but also

54 Supported by KEMP (P120014).
55 Power Africa.
56 The most recent household survey with income data dates to 2009.

widespread asset (livestock) ownership. Solar operators anecdotally report a strong demand at isolated sales events in these counties. Nevertheless, few solar companies view these counties as core to their growth plans. The ongoing MTF survey (preliminary results presented in Annex 1) provides detailed baseline information on the household energy access situation, including quantity and quality of services offered by all available (main and backup) sources of electricity, lighting, and cooking; energy demand and expenditures; and ability and willingness to pay.

d. **Articulating the rules of the game.** The policy and regulatory oversight for off-grid service provision has lacked clarity, which particularly affects mini-grids. For SHS, the prices of the solar lighting products are market driven, not regulated by the ERC, and the solar companies, therefore are free to charge any price. The Kenya Bureau of Standards has, however, recently adopted International Electrotechnical Commission (IEC) standards (modelled on Lighting Global standards) for solar lanterns and SHS, although their enforcement is still lagging.[57] For mini-grids, as in many other countries, the regulatory framework is catching up with the increased private investments in this sector, which is a relatively new phenomenon. Consequently, the rules related to tariffs, licensing, service quality, and interconnection with the grid are still evolving. For mini-grids, the lack of clarity is compounded by the GoK's announcement of application of national uniform tariff for electricity services implying any other distributor or provider cannot charge a price aligned with cost recovery—they must be compensated for the gap (between cost and uniform national tariff) through a subsidy mechanism. There is no clear strategy to develop mini-grids or even how to operationalize them. A mini-grid regulations study[58] has recently been completed by the GoK that lays out recommendations on business models, tariffs, coordination among stakeholders, and quality of service.

e. **Rationalizing institutional arrangements.** There is a lack of institutional clarity in rural electrification compounded by the devolution process. At the national level, REA is tasked with building distribution lines in the rural areas and then hands them over to KPLC, which retains its monopoly status as electricity distributor in Kenya. The 2010 devolution, enshrined in the Energy Bill (to be passed by the senate in 2017), established energy as a shared mandate between the National Government and county governments. The National Government has the mandate for "energy policy including electricity and gas reticulation and energy regulation." The county governments' mandate is provided as "county planning and development, including—electricity and gas reticulation and energy regulation." As such, some rural electrification activities are viewed as a component of county planning; however, counties have limited engagement capacity in electrification programs. Extensive coordination is now required between REA and county governments, who have become critical stakeholders for electrification. The NES is expected to provide direction on institutional arrangements for electrification, and a complementary consultancy for REA's business plan[59] has been launched to establish the skills, resources, and coordination frameworks required to fulfill its mandate and work with a broader group of stakeholders.

57 Kenya Bureau of Standards adopted Lighting Global standards up to 10 Wp, but enforcement may still be an issue.
58 Supported by IDA-financed Kenya Electricity Expansion Project (P103037).
[59] Funded by ESMAP.

ANNEX 9: MAP

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