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Project Information Document (PID)

Appraisal Stage | Date Prepared/Updated: 30-Nov-2023 | Report No: PIDA0167

**BASIC INFORMATION****A. Basic Project Data**

Project Beneficiary(ies)	Region	Operation ID	Operation Name
Kenya, Kenya, Kenya, Kenya	EASTERN AND SOUTHERN AFRICA	P180465	Kenya Green and Resilient Expansion of Energy (GREEN) Program Phase 2
Financing Instrument	Estimated Appraisal Date	Estimated Approval Date	Practice Area (Lead)
Investment Project Financing (IPF)	21-Nov-2023	15-Dec-2023	Energy & Extractives
Borrower(s)	Implementing Agency		
	Kenya Electricity Generating Company PLC, Kenya Electricity Transmission Company Limited (KETRACO), Ministry of Energy & Petroleum		

Proposed Development Objective(s)

To increase the capacity for energy trade and renewable energy integration of the Kenya power system.

Components

Component A: Installation of System Stabilization Equipment

Component B: Construction of a 400kV substation at Kimuka

Component C: Battery Energy Storage Systems

Component D: Technical Assistance, Capacity Building and Solar Auctions Preparatory Activities

PROJECT FINANCING DATA (US\$, Millions)**Maximizing Finance for Development**

Is this an MFD-Enabling Project (MFD-EP)? Yes

Is this project Private Capital Enabling (PCE)? Yes

SUMMARY

Total Operation Cost	202.00
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Total Financing	202.00
of which IBRD/IDA	153.50
Financing Gap	0.00

DETAILS

World Bank Group Financing

International Development Association (IDA)	153.50
of which IDA Recommitted	96.30
IDA Credit	153.50

Non-World Bank Group Financing

Trust Funds	48.50
Green Climate Fund	48.50

Environmental And Social Risk Classification

Moderate

Decision

Other

Other Decision (as needed)

B. Introduction and Context

1. This Project Information Document (PID) covers Phase Two of the Kenya Green and Resilient Expansion of Energy (GREEN) Multiphase Programmatic Approach (MPA) program approved by the World Bank’s Executive Directors on June 15, 2023 (P176698, Report No. PAD5130).

Country, Sectoral and Institutional Context

2. **The Government of Kenya’s (GoK) goal of universal access to clean, adequate, affordable, and reliable electricity is critically dependent on a robust transmission system to connect the main renewable power generation sources (geothermal, hydro and wind) in the central rift valley and eastern part of the country to the major load centers and to allow for greater connectivity to the regional hydropower resources.** Particularly, the load centers in the western and coastal regions are far from the supply sources (over 400kms) and in the absence of adequate transmission connectivity, local generation based on high-cost fossil fuel is used to supplement grid supply in these areas. Replacement of the fossil fuel-based generation is a critical element to reducing the cost of supply in Kenya,



which is high in terms of regional standard impeding the competitiveness of Kenyan industries.

3. **With the commissioning of the Kenya-Ethiopia Interconnector, supported under the Bank-financed Eastern Electricity Highway Project (EEHP, P126579), Kenya is now connected to Ethiopia's vast hydropower resources, giving impetus to regional energy trade through the Eastern Africa Power Pool (EAPP).** As a first of its kind in Sub-Saharan Africa, this interconnection is a flagship of power trade in the EAPP region and provides a key part of the infrastructure needed to connect the EAPP to the South African Power Pool (SAPP). The EEHP is co-financed by the World Bank, the African Development Bank (AfDB) and French Development Agency (AFD). While the interconnection has a transfer capacity of up to 2,000MW, transmission system constraints in Kenya currently limit offtake to only 200MW. Urgent investments are needed to address reactive power deficiencies and increase transfer capacity in the Kenya system to reap the full benefits from the interconnection.
4. **Recognizing the potential benefits, governments in Eastern Africa¹ have committed significant investments in developing physical transmission infrastructure that will lay the foundations for power trade in the region.** The Uganda-Rwanda and Ethiopia-Kenya interconnectors are completed while five other key transmission corridors are under construction (Kenya-Uganda, Rwanda- Burundi, Rwanda-DRC, Kenya-Tanzania and Tanzania-Zambia). Together with other planned interconnectors, this will result in all thirteen EAPP member countries being interconnected, allowing power flow from Egypt in the north to Tanzania in the south. In the medium to long term, there are opportunities for trade with the SAPP through the Tanzania-Zambia interconnector in the south. Greater regional integration will allow the region to better harness and integrate significant amount of renewable energy resources (hydro, geothermal, wind, and solar) by offering greater system inertia and balancing support to absorb the unexpected variations in the output of VRE plants. The operation of the regional interconnectors however needs a robust, secure and reliable transmission grid in Kenya.
5. **Some priority investments in the transmission network are needed urgently to increase integration of regional hydropower resources, strengthen capacity for transfer of renewable energy from generation sources to consumption load centers, and improve voltage stability towards meeting Kenya's goal of 100 percent clean energy, reduction in the cost of supply, and improvement in supply quality and reliability.** Import of hydropower from Ethiopia is projected to increase from the current 200MW to 400MW in the next three years as per the Power Purchase Agreement (PPA) signed in July 2022 between Ethiopia and Kenya (through their respective utilities-Ethiopia Electric Power (EEP) and KPLC). However, large injection of power beyond the current 200MW through the interconnector poses a significant risk of instability and outages to the Kenya network in case of disturbances along the interconnector or on the Ethiopia network. KETRACO commissioned a comprehensive study on the system needs for reactive power compensation devices and voltage support prior to commissioning of the interconnector that established the need for system reinforcements comprising of fast acting reactive power and voltage control devices (STATCOMs) at key substations in Kenya (Suswa and Rabai initially and two more in Western Kenya at a later stage) to enable operation of the interconnector at more than 200MW. This equipment will stabilize system voltages and protect the system in case of outages in the interconnector.
6. **Several other constraints in the electricity system need to be addressed for greater dispatch of renewables.** The system has high and inflexible must-run capacity compared to the considerably low off-peak demand (about 56% of the peak demand). This leads to frequent energy curtailment during the low load period, including venting of

¹ Eastern Africa includes the thirteen Eastern Africa Power Pool (EAPP) member countries (Burundi, Djibouti, Democratic Republic of the Congo (DRC), Egypt, Ethiopia, Kenya, Libya, Rwanda, Somalia, Sudan, South Sudan, Uganda, Tanzania) and one EAPP prospective country (Eritrea).



substantial amount of geothermal steam. A technical study on battery energy storage systems (BESS) supported by the World Bank has identified that BESS could be effectively used to store geothermal based power during off-peak period for discharge during peak period, which will allow for full utilization of geothermal energy while reducing the use of costly fossil fuel-based generation for meeting peak load. The study has identified the immediate need for 400 MW of BESS capacity primarily for load shifting but also for grid stability by providing both fast and back up system reserves. While implementing the first BESS at scale, adequate legal and regulatory framework including their role in the system, ownership, contractual and remuneration arrangements for BESS services will need to be developed for leveraging private participation for meeting the future needs of BESS.

C. Proposed Development Objective(s)

7. To increase the capacity of Kenya power system for energy trade and renewable energy integration

Key Results

8. The outcome indicators proposed to measure achievement of the PDO are:

- a) Increased capacity of the Kenya system to import power through the Kenya-Ethiopia interconnector
- b) Reduced curtailment of renewable energy (GWh)

D. Project Description

9. The proposed Project will support the following components:

10. Component A: Installation of System Stabilization Equipment (IDA US\$84 million): This component will finance installation of two reactive power and voltage control equipment (STATCOMs) at the existing Suswa and Rabai substations. The STATCOMs will improve the fault levels, increase voltage stability, and enable safe operation of the Ethiopia-Kenya interconnector for greater import of cheaper and renewable energy from Ethiopia. The STATCOM at Rabai will also provide reactive power compensation, and reduce reliance on thermal power plants for energy and voltage support in the coast region. The component will also finance project management and supervision consultants.

11. Component B: Construction of a 400kV substation at Kimuka (IDA US\$ 29 million): The proposed 400kV substation at Kimuka will allow integration of the Kenya- Tanzania interconnection (currently under construction) and Ethiopia-Kenya interconnector enabling Tanzania to access hydropower resources of Ethiopia. The substation will also increase transmission capacity of more renewable energy (geothermal, wind and imports) from supply sources at Olkaria and Suswa to major load centers of Nairobi and the Coast regions of Kenya. The proposed substation site is on a land owned by KETRACO. The substation also includes construction of a short transmission line (about 1.5kilometres) in and out of the substation and an intertie (about 0.4kilometers) to the existing 400kV line to an existing 220/66kV substation. The component will also finance project management and supervision consultants.

12. Component C: Battery Energy Storage systems (IDA US\$ 33.5 million and GCF US\$45 million): The component will support the installation of the first battery energy storage system (BESS) with a capacity of upto 100MW/2 hour for load shifting renewable energy sources (primarily geothermal) but also grid stability by providing system reserves (both fast and backup reserves). The component will be co-financed by the Green Climate Funding (GCF). Kenya is one of seven countries benefiting from GCF funding under the Sustainable Renewable Risk Mitigation Initiative (SRMI) to shift to low-emission sustainable development pathways and increase access. The technical study on BESS has prioritized four sites that are owned by KenGen, KETRACO and KPLC for BESS installation [Embakasi (Nairobi), Kipevu



(Coast), Muhoroni (Western) and Olkaria geothermal complex (KenGen)]. Detailed site-specific feasibility studies will be undertaken by KenGen (the implementing agency of BESS) during project implementation building on the technical assessment and will confirm the best use case, sizing, design, and functionality of the BESS.

13. Component D: Technical Assistance, Capacity Building and project management (IDA US\$ 7 million and GCF US\$ 3.5 million), with the following sub components:

14. Subcomponent D1: Solar Auction Preparatory Studies (GCF US\$ 2 million), Capacity Building (GCF US\$ 1 million), and project management costs (GCF US\$0.5 million): Implemented by the Ministry of Energy and Petroleum (MoEP), the subcomponent will be financed from GCF grant of US\$ 3.5 million. The solar auctions preparatory studies (US\$2 million) will include: (i) sector diagnostic studies and assessments and preliminary projects identification, selection and prioritization; and (ii) project prefeasibility studies. The determination of the project structure and actual auctions are expected to be supported with IDA funding (co-financed with GCF) under the third phase of the MPA. Capacity building activities (US\$1 million) will support strengthening the institutional capacity across the sector in energy planning and system dispatch and operation. It will also include, among others: (i) legal, regulatory, and policy reviews to strengthen the framework including the remuneration mechanism for private sector participation in BESS; (ii) developing procedures for decommissioning and recycling of batteries in accordance with international best practice; (iii) training and capacity building in O&M of BESS technology; and (iv) socio-economic development opportunities especially in auctions and regulations. Project management and coordination costs (US\$0.5 million) will include the relevant costs for the project implementation and coordination team to be engaged by MoEP.

15. Component D2: Sector Technical Assistance and Capacity Building (US\$4 million IDA): The Sub-component will be implemented by MoEP and will support sector studies, enhancement in Least Cost Power Development Plan (LCPDP), energy policy review, capacity building, and training activities for sector development and to help sustain and enhance the policy, institutional, regulatory arrangements and reforms as well as gender and citizen engagement. The capacity strengthening will also include training and activities to strengthen governance, management, safeguards management, procurement, technical and operation capacity of MoEP, and the sector agencies including KETRACO, KenGen, the regulator (EPRA), KPLC, Geothermal Development Company (GDC), and Rural Electrification and Renewable Energy Corporation (RREC).

16. Component D3: Technical Assistance to KETRACO (US\$1.5 million IDA): This Sub-component will finance technical assistance to KETRACO including recruitment of an experienced firm to provide operation and maintenance (O&M) services for STATCOMs for a defined period after commissioning, given that the STATCOMs are new technology in the country. The O&M service provider will also support strengthening O&M practices and training of KETRACO staff. The component will also support enhancements in Transmission Master Plans.

17. Component D4: Technical Assistance to KenGen: (US\$1.5 million IDA): This subcomponent will support technical assistance and institution building support to KenGen including, among others: (i) technical assessment on pumped hydro storage; and (ii) geothermal reservoir resource modelling to assist in reservoir management for geothermal resource sustainability.



Legal Operational Policies	Triggered?
Projects on International Waterways OP 7.50	No
Projects in Disputed Area OP 7.60	No

Summary of Screening of Environmental and Social Risks and Impacts

- 18.** The STATCOMs to be installed under Component A of the project will be at the existing Suswa substation owned by KETRACO and at the existing Rabai substatoion owned by KPLC. The location of the STATCOMs (both Suswa and Rabai) are in the implementing agency’s owned brownfiled sites meaning there are no involuntary resettlement risks or impacts. There are no known imediate sensitive environmental receptors proximal to these brown sites. Any environmental risks and impacts associated with the civil works or operation of the STATCOMs will be limited within the existing and fenced-off substations. The Suswa substation is located in rural Narok County which is home to the Maasai Vulnerable and Marginalized Groups (VMGs) who are the overwhelming majority in the county. The project site being a brownfield poses no adverse risks or impacts to the VMGs’ livelihoods, cultures or land. On the other hand, the Rabai STATCOM will be located in an urban setting, also in a brownfield with no adverse impacts to the surrounding communities.
- 19.** Component B will involve the construction of a 400kV substation on land that is owned by KETRACO and a short transmission line of about 1.9 Km line in line out (LILO) to the substation. Although a greenfield, the Kimuka substation land was purchased by KETRACO on a willing seller-willing buyer basis. The substation is in Kajiado County where the Maasai VMGs are the overwhelming majority. While the substation has no involuntary resettlement risks and impacts, KETRACO will acquire wayleave easement along the 1.9Km stretch for the LILO for the transmission corridor. Despite being in a VMG area, land in the area has been adjudicated and the 60 meter corridor will be acquired from a total of 38 project affected persons (PAPs) on a willing seller-willing buyer basis for the purpose of placing the easement. For this reason, there will be no adverse risks or impacts on the people’s livelihoods (which is predominantly pastoralism) except for restrictions regarding buildings and the types of trees/crops that can be planted along the wayleave corridor. There will also be no risks or impacts associated with involuntary resettlement. Potential environmental receptors in the area are Ngong Forest and Ngong river which are approximately 20km and 15km away respectively and unlikely to be impacted given that all the activities will be restricted to the fenced substation site and the acquired 1.5km transmission corridor wayleave.
- 20.** While the exact location of the BESS under Component C will only be known during implementation, it is clear that it will be on land owned by one of the three sector agencies based on the findings of the site-specific feasibility studies. There will, therefore, be no risks or impacts associated with involuntary resettlement or on people’s livelihoods. Should the feasibility study recommend the location of the BESS at the Olkaria geothermal complex, then it will be in a VMG area where the Maasai pastoralist VMGs are the overwhelming majority, but with no adverse impacts on their land or livelihood as this would be land owned by KenGen.



E. Implementation

Institutional and Implementation Arrangements

- 21.** The proposed Project will be implemented by three implementing agencies -MoEP, KETRACO and KenGen. KETRACO will implement Component A (installation of system stabilization equipment (STATCOMs), Component B (construction of 400kV Kimuka substation) and KETRACO specific technical assistance (Component D3). KenGen will implement Component C (battery energy storage systems) and technical assistance activities under Component D4. MoEP is the main implementing agency of the sector technical assistance and capacity building (Components D1 and D2).
- 22.** KETRACO, KenGen and MoEP have experience in implementing World Bank-funded and other donor-funded projects. Consultants supported KETRACO to prepare technical studies, designs and bidding documents for the STATCOM and Kimuka substations. These consultants will support KETRACO in procurement process and supervision of construction activities. Consultants will be procured for detailed feasibility study of the BESS to inform implementation and to support KenGen in the procurement process and implementation of BESS.
- 23.** Both KETRACO and KenGen will establish respective project implementation units (PIUs) dedicated for implementation of the Project. The PIUs will be led by senior staff with adequate experience with reporting arrangements that ensure that senior management has visibility over the project. Project oversight will be exercised by a steering committee in both agencies, comprising of the executive management. The PIUs will be resourced with adequate staff having skills in engineering, procurement, project management, survey, legal, environmental and social safeguards, and accounting. MEP is expected to appoint a PIU to implement the components under its responsibility.

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APPROVAL

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