AFRICAN DEVELOPMENT BANK GROUP

SCALING UP RENEWABLE ENERGY PROGRAM IN LOW INCOME COUNTRIES

Mini Hydropower Plants and Related Distribution Networks Development Project

COUNTRY: REPUBLIC OF MALI

March 2018

LIST OF ACRONYMS

AfDB	African Development Bank
ADF	African Development Fund
AfIF	Africa Investment Facility
AMADER	*L'Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale*
ARP	Abbreviated Resettlement Plan
CIF	Climate Investment Fund
CREDD	Economic Recovery and Sustainable Development Strategic Framework
DEPS	Directorate of Studies and Strategic Planning
DNE	National Energy Director
EDM-SA	*Energie du Mali – Societé Anonyme*
ESIA	Environmental and Social Impact Assessments
ESMP	Environmental and Social Management Plan
GHG	Greenhouse Gases
GoM	Government of Mali
IPP	Independent Power Producer
PDM-Hydro	Mini Hydropower Plants and Related Distribution Networks Development Project
PMU	Project Management Unit
SREP	Scaling-up Renewable Energy Programme
TSF	Transitioning States Facility

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1. INTRODUCTION

Background Information

1.1 Mali, a landlocked country in the Sahel with a large portion of its territory in desert, has a burgeoning population that is expected to grow from 18.1 million in 2016 to around 23.5 million by 2025. Only 37% of the population lives in urban areas, the majority of which are clustered around the capital of Bamako. The forecasted proportion of urban dwelling is not expected to exceed 40%, even as the population rises into 2025

1.2 Almost 80% of the primary energy supply in Mali is from biomass, primarily from wood and charcoal for domestic use. Particularly in rural areas, Malians rely heavily on biomass as the sole form of energy. Some rural agglomerations have implemented diesel generation as an alternative, but this is expensive and subject to fluctuations arising from price and availability of fuel. This heavy reliance on biomass leads to a deforestation rate of about 4,000 square kilometres per year at current levels; increasing population will put heavier burdens on biomass resources.

1.3 The electricity sub-sector in Mali is relatively undeveloped; the national energy access rate is 41%. In rural areas, only 17% of the population has formal access to energy, while urban areas see access rates closer to 70%. Even with overall production capacity of 556.2 MW, *Energie du Mali* (EDM-SA) is unable to meet the needs of its existing customers and continues load-shedding despite imports from Côte d'Ivoire and purchasing power from Independent Power Producers (IPPs) for an additional 50 and 98 MW in 2016, respectively. For those households with access to electricity, the average cost nationally in 2016 was USD 0.23 per kWh, almost double the continent-wide average of USD 0.14 per kWh.

1.4 Providing access to energy, particularly in rural areas, is supported by government policy and is driven by the *L'Agence Malienne pour le Développement de l'Energie Domestique et l'Electrification Rurale* (AMADER). The United Nations Development Programme and the United Nations Industrial Development Organization have supported, through AMADER, a long-term program seeking to provide decentralized energy through 10 horsepower diesel engines to drive power generation, water pumping and other devices in a multifunctional approach. At the village level, these platforms are managed primarily by women's associations. However, absent a local feedstock, these village platforms rely on expensive and sometimes difficult to procure diesel fuel.

1.5 Armed conflicts starting in 2012 in Northern Mali, as part of a secession for an area referred to by rebels as *Azawad,* led to nearly three years of armed conflict that drew in French and African Union troops to re-stabilize the region. Though a ceasefire was signed in 2015, sporadic violence still occurs throughout the country, including a mid-2017 attack by Islamists on a luxury resort in Bamako. Food insecurity, economic instability and low delivery of basic services outside urban areas are all cited as key drivers for continued instability throughout the country.

Project Rationale

1.6 The Mini Hydropower Plants and Related Distribution Networks Development Project (PDM-Hydro) is part of the Scaling-up Renewable Energy Programme (SREP) Investment Plan (IP) endorsed by the SREP Sub-Committee (SC) November 2011. Backed by several donors, SREP comprises three investment projects: (i) an on-grid Solar project not yet approved and dropped for the SREP sealed pipeline, (ii) the PAPERM project approved in September 2014 and currently under implementation; and (iii) this mini hydropower plants project. In addition, Mali is benefiting from an allocation of USD 25 million under the SREP set-aside for a Solar PV project.

1.7 The original feasibility study for this project covered six sites including the two mini hydropower plants that shall be supported by this project, as well as four micro hydropower plants that will be supported in a subsequent project.

1.8 This project will contribute to an increase in the installed capacity of Mali's electricity system with a renewable energy source of 8.9 MW and promote the population's access to quality energy services. The annual energy produced is estimated at 23.68 GWh/year. Increasing renewable energy installed capacity is part of the first pillar of Mali's Economic Recovery and Sustainable Development Strategic Framework (CREDD 2016-2018). The project is in line with the National Strategy for the Development of Renewable Energies, dating back to 2006, which aims to enhance the share of renewable energies in the national electricity production.

1.9 From a policy perspective, GoM has embarked on a "sector turnaround" with donor support since the collapse of EDM-SA privatization in 2005. This includes substantial investment in decentralized energy as a way to reach the wider country, as EDM-SA's grid (and resources for expansion) are limited primarily to urban areas. Investment in mini-grids is therefore a high priority. Undertaken by AMADER, this typically has taken the form of concessionaires being awarded a license to operate diesel gensets. Subsidies required to operate such systems feasibly in the context of Malian rural communities' ability to pay have proven unsustainable. As such, EDM-SA is searching for alternatives including conversion to heavy fuel oil and exploring feasibility around solar with storage, solar hybrid and other generation schemes. Investment in hydropower, where available, is also a viable alternative to diesel and in line with EDM-SA's strategy and the national energy policy framework. The consultative process used to develop the SREP IP follows the bottom-up approach that makes use of local cooperatives to drive mini-grid investment decisions.

1.10 Lessons learned by AfDB in implementing power projects in Mali, including the preparation of the SREP IP alongside the Government of Mali (GoM), have been taken into account in this project design. Thus: (i) project implementation has been entrusted to EDM-SA, an independently-managed, partially private company with adequate expertise for the execution of project activities, (ii) the project includes provisions for additional support to the Project Management Unit (PMU) in terms of international expertise with regards to procurement, and (iii) the project includes provisions in the project design for training and capacity building for stakeholders, particularly women, in the communities that will benefit from the power generated.

1.11 The project's impact areas are the Ségou and Mopti regions in central Mali. They are not yet covered by the country's interconnected electricity grid and access to electricity is almost non-existent outside the major agglomerations, where limited access through diesel gensets is the only form of generation currently available. The project will help to reduce regional disparities and fragility by connecting 12,500 households and economic operators to the public electricity service. Furthermore, these regions have seen increasing incidents of violence and instability in recent years, so the economic and social effects of power availability to ten communities served by these mini hydropower plants will hopefully offset some of the political instability in the region.

1.12 The SREP IP was designed to promote the management and sharing of renewable energy knowledge and products in Mali. As such, the knowledge and products generated by this project will promote renewable energy development in Mali and offer opportunities for replication of good practices in other countries of the sub-region. The PMU's monitoring and evaluation expert will provide a periodic report on the trend of indicators. Furthermore, reports filed by supervision missions, the engineering consultant responsible for works monitoring and the project auditor are sources from which the Bank will draw lessons on the achievement of project objectives, with a view to improving the structuring of future operations.

Justification of SREP Intervention

1.13 This project is in line with SREP priorities and criteria, having already been included as part of the overall SREP Investment Plan for Mali. Specifically, the implementation of the two mini hydropower plants through this project will inform replication in subsequent micro hydropower projects, and it will contribute to the economic and social well-being in the communities where the two plants will be installed. It is also in-line with SREP's focus on making energy access affordable for end users without jeopardizing the long-term financial sustainability of the project.

1.14 In terms of the SREP results framework, the project supports the project-level outcomes of: (i) increased provision of community-level energy access in 10 rural communities, (ii) the implementation of a green mini-grid system to offset current use of diesel power generation, and (iii) modern energy access for 12,500 households, many of which currently rely exclusively on biomass for energy consumption. Overall, this increases installed RE capacity in Mali by 8.9 MW between the two plants. This results in overall country outputs of: (i) reduced or offset Greenhouse Gas (GHG) emissions of 15,800 tonnes (CO_2 equivalent) per year, (ii) increased health outcomes due to more stable and cheaper electricity to health centres in the ten served communities, (iii) 400 direct jobs during construction of which 15% are expected to be for women, (iv) 20 permanent direct jobs during the operation phase, 20 internships (50% reserved for women) and indirect employment opportunities generated by access to productive energy, (iv) linked capacity building ushering new economic opportunities and entrepreneurship, particularly for women. The SREP grant will also leverage resources provided by the African Development Fund (ADF) through the Transition States Facility (TSF) and the EU Africa Investment Facility (AfIF) by a factor over nearly five times.

2. PROJECT DESCRIPTION

Project Description and Objectives

2.1 The project aims at developing two mini hydro power plants by converting already constructed water retention dams through a retrofitting process. The total capacity of both plants is 8.9 MW with an expected energy generation of 23.68 GWh per year with an average capacity factor of 0.30 driven by the seasonal variation in water flow on the Bani river. Included in the project design is the construction and commissioning of two separate local distribution systems for 10 communities near the two plants. It is estimated that 12,500 household connections will be made along with the installation of 8,000 public lighting sets.

2.2 **Location.** The project impact area is shared between two regions, Segou and Mopti, and includes 4 "*cercles*" (second-level administrative units) (Djenné, Tominian, Bla and San) and 14 "*communes*" (third-level administrative units) (Fakala, Madiama, Djenné in Djenné *cercle*, Ouan in *cercle* Tominian, Bla, Fani, Kulandougou, Yangasso in Bla *cercle*, San, Dieli, Djeguena, N'goa, N'torosso and Niasso in San *cercle*). The population of these 14 *communes* is around 521,800 inhabitants of which 50.71% of whom are women. The project will benefit 14 municipalities and 55 localities and will improve the living conditions of the populace through access to improved electricity services.

2.3 **Description of the Site.** The project will convert two existing water retention dams near Djenné (13°48'37.1"N 4°31'01.0"W) and Talo (13°16'39.1"N 5°17'36.4"W) on the Bani river, which is the principal tributary of the Niger river in Mali. The installed capacity of the plants will be 7.5 and 1.4 MW, respectively. Medium and low voltage distribution networks will be suspended in the air, using transformer substation a-top poles. This solution meets international standards and is suitable for rural areas where population density is low. Alternative solutions were explored by GoM and partners in the development of the project and rejected, per the table below:

Table 1: Alternatives Explored and Reasons for Rejection

Alternative	Description	Reason(s) for Rejection
Diesel power stations	Installation of diesel gensets by AMADER licensees	• Unregulated operating field with kWh prices 2.5-3x higher than those charged by EDM-SA • High operating costs and lower input stability • Adverse environmental impacts
Solar photovoltaic power stations	Installation of solar panels for generation	• Water retention dams already constructed; installation of hydropower plants is more economical and energy is also renewable
Construction of rural networks using cabins	100% of medium/low voltage transfer stations in low cabins	• Low density of populations served • Cabins would increase investment cost
Construction of underground distribution network	Installation of underground medium voltage distribution cables	• More expensive investment and costly ongoing maintenance • Currently dispensable in the project area

2.4 **Components of the project.** In order to minimize environmental and social impacts, the GoM opted to convert existing water retention dams into hydropower plants. The two dams are already functioning as water retention facilities and as such the project will consist of installing power plants at each site.

2.5 **Access road.** Access infrastructure for construction and maintenance of the assets is already largely in place, though some expansion of the work area during the installation of the plants at each dam will require some additional works area.

2.6 **Transmission line and substations.** In addition, transmission and overhead distribution systems will be installed. The distribution lines will be deployed along the existing National Roads 34, 6 and other public road easements without significant expropriation of built-up residential property or economic displacement

Project Components

2.7 The project will be divided in three components as follows:

- **Component A – Construction of Infrastructure.** This component includes the installation of the two mini hydropower plants in the existing dam, civil works, and construction of the transmission and distribution network.

    - **Sub-Component A1. Construction of the Djenné and Talo power stations**. This component will finance the design, manufacturing, supply, installation and commissioning of the hydro-mechanical equipment, electro-mechanical equipment and related equipment.

    - **Sub-Component A2. Construction of MV/LV distribution network**. This component will finance the medium and low voltage distribution network, including substations and prepaid meters, among the 55 target villages in the project area. The total length of the medium voltage transmission system build will be 231 km, leading to 55 substations distributed amongst 55 separate villages across 10 communities. The total length of low voltage distribution lines is around 275 km, while connecting cables will total in length to 400 km. This also includes installation of 8,000 public lighting sets.

    - **Sub Component A3. Environmental and social impact mitigation**. This component will finance the physical relocation of five buildings, along with compensation measures for 1,845 square metres of annual crops affected by installation of the distribution network.

- **Component B – Institution Building.** This component includes activities that build capacity relevant to project sustainability, community development, and support to developing future similar projects in Mali:

- **Sub-Component B1. Capacity building of key players**. This component will finance capacity building for key stakeholders in the electricity sub-sector in Mali, particularly EDM-SA in line with the SREP IP that found capacity shortfalls to design, prepare and assume project management functions.

- **Sub-Component B2. Feasibility studies for future projects**. This component will finance further feasibility studies, particularly related to the development of the four (4) micro hydropower plants that are under the PDM-Hydro project.

- **Sub-Component B3. Multi-functional platforms for women.** This component will finance multifunctional platforms that include equipment and training that will contribute to the rational use of energy and diversification of sources of income; this will be implemented in partnership with the Ministry for the Promotion of Women, Children and the Family (MPFEF).

- **Component C. Project Management**

  - **Sub-Component C1. Audit of project accounts.** This component will finance external audits of project accounts per the audit requirements outlined below.

  - **Sub-Component C2. Recruitment of consulting engineer.** This component will finance the procurement of a consulting engineer through the duration of the construction and commissioning portion of the project.

  - **Sub-Component C3. Energy management campaign.** This component will finance a campaign, including communications materials, to educate the 10 localities on energy management practices.

  - **Sub-Component C4. Purchase of vehicles.** This component will finance the acquisition of project vehicles.

  - **Sub-Component C5. Operation of the PMU.** This component will finance the activities of the Project Management Unit, including the hiring of 20 interns throughout the project lifecycle (50% of which will be female).

Brief Description of Expected Outcomes

2.8 The project represents a vast reduction in cost for energy access to those customers that currently rely on diesel power. The average price will drop by nearly 200%, from around 300 CFA (USD 0.55 equivalent as of December 2017) per kWh for diesel-generated energy to around 97 CFA (USD 0.18 equivalent) per kWh. This represents a drastic drop in price and will low for significant cost savings for those benefiting from the project which can be allocated to other activities.

2.9 Given the expected power output of 23.68 GWh annually, the project will also mitigate potential greenhouse gases of up to 15,800 tonnes (CO_2 equivalent) per annum.

3. FINANCING PLAN

Description of Project Costs

3.1 The total estimated project cost, including 5% provisions for technical contingencies and price escalation, is USD 56.72 million. Project expenditures will primarily be priced in hard currency, except for around 12% of the overall budget which will be covered by local currency. 80% of the project comprises construction and installation of the power plants in the dams, including transmission/distribution infrastructure and associated civil works. Table 2 outlines the total project cost by project component, including contingencies.

Table 2: Project Cost by Component (USD million)

	Hard Currency	Local Currency (USD equivalent)	Total
Construction of Infrastructure	41.17	4.63	45.80
Institution Building	1.13	0.48	1.61
Project Management	2.90	1.25	4.15
Base Cost	**45.21**	**6.36**	**51.56**
Provisions for Contingencies	2.26	0.32	2.58
Provision for Price Escalation	2.26	0.32	2.58
Total Project Cost	**49.73**	**6.99**	**56.72**

3.2 The SREP contribution of USD 8.7 million will be co-invested alongside contributions from the AfDB's TSF and the AfIF, who are contributing USD 28.3 and 19.65 million each, respectively. Table 3 summarizes the project cost per source.

Table 3: Project Cost by Financing Source (USD million)

	Hard Currency	Local Currency (USD equivalent)	Total	% of total
AfDB (TSF)	24.20	4.10	28.31	50%
EU	16.82	2.83	19.65	35%
SREP	8.70	-	8.70	15%
Government of Mali	0.001	0.07	0.07	0.1%
Total	**49.73**	**7.01**	**56.73**	**100%**

4. IMPLEMENTATION ARRANGEMENTS

Institutional and Implementation Arrangements

4.1 The project was developed by the Ministry of Energy in consultation with the structures involved in its implementation (AMADER, DNE, EDM-SA, Ministries in charge of finance, planning, the environment, local communities and water resources). During preparation of the Mali SREP IP, several missions were undertaken during which public consultation workshops involving government authorities, the private sector, NGOs, Multilateral Development Banks, technical and financial partners were organized. Women beneficiaries, the Ministry for Women Affairs, women entrepreneurs and women's civil society organizations were also consulted and their proposals taken into account in the project design.

4.2 The Ministry of Energy will be the beneficiary of the financing extended to this project. Project management will be delegated to EDM-SA, which will ensure the development and maintenance of the works to be built. Project management activities will be assigned to a PMU to be created within EMD-SA. The company has already successfully implemented several projects financed by AfDB and other Development Partners. The PMU will comprise a coordinator (a senior executive, with service management experience), an electromechanical engineer specialized in hydropower generation, a power engineer specialized in distribution networks, a civil engineer, an environmentalist, a monitoring-evaluation expert, a socio-economist, an accountant, a procurement assistant, a management assistant and three drivers. The project coordinator will be seconded and exclusively dedicated to project tasks.

4.3 The PMU will benefit from the services of an electrical engineer specialized in transformer substations (a member of the PMU staff of the 225-kV Guinea-Mali Interconnection Project). The PMU will be supported by two individual consultants (specialists in procurement and administrative and financial management) who will be competitively recruited (as part of the PIE-GM project), and by an engineering consulting firm for works control and supervision.

4.4 A Steering Committee will be established by ministerial order to ensure proper project orientation, strengthen the participatory approach and achieve project objectives. The Committee will ensure coordination between all stakeholders for the smooth running of project activities, particularly with regard to crosscutting issues (environmental and social aspects, administrative authorizations, etc.). Its main mission will be to review project implementation progress, approve outcomes, reports, PMU annual activity plans and budgets, and make concrete proposals to the Government to address possible weaknesses identified in project execution. The Committee will comprise representatives of the ministries in charge of energy, finance, planning & environment, local authorities, public electricity structures (DNE, AMADER and EDM-SA) and regional directorates/decentralized agencies in the project area. It will be chaired by the National Director of Energy and will meet at least twice a year.

Project Timeline

4.5 The overall project, including grant approval and effectiveness, will span the period of January 2018 to December 2021. Table 4 below summarizes the project timeline.

Table 4: Implementation Timeline

Period	Stages	Monitoring/Feedback Loop
June - December 2018	Grant approval and effectiveness	• Approval and general information note • Signature of Agreement • Effectiveness and meeting of CPs • Launch mission
Sept 2017 – Jan 2018	Recruitment of consulting engineer	• Notice of EOI, bidding dossier • Approval of dossier and eval. Report • Recruitment of consulting engineer
June 2018 – Oct 2021	Consulting engineering services	• Verification of engineering designs • Preparation of works • Factory acceptance, works control and supervision, works reception
Nov 2018 – Mar 2021	Electrical infrastructure construction works	• Equipment supply and installation • Control and supervision • Project supervision by AfDB • Monitoring of ESMP implementation
Jan 2019 – Dec 2021	Implementation of protocol agreement	• Signature of the PMU protocol agreement • Services delivered by contractors
Dec 2021-June 2022	Project completion	• Grantee project completion report • AfDB project completion report

Procurement

4.6 Procurements financed under the project will be made in accordance with the Procurement Framework for African Development Bank Group-financed Operations, October 2015 edition, and provisions set out in the Financing Agreement to be signed following approval.

4.7 Procurement activities carried out by the PMU for goods, works and services will be conducted in accordance with AfDB Procurement Methods and Procedures. Relevant standard bidding documents will be used, in line with the recommendations of the Bank's assessment of the national procurement systems, which requires the use of the Bank's procurement policies when projects are implemented by public institutions/enterprises and delegated project management agencies. This will apply to all procurements undertaken by the PMU.

4.8 In view of the urgent need for the country to operationalize the project and to mitigate the risks of procurement delays, the GoM may request the Bank to accept the use of advance contracting This request, if received, will be analysed by AfDB’s Procurement Department and

any authorization shall be granted pursuant to the provisions of Article 11.2 of the Procurement Policy for AfDB Group Funded Operations.

Financial Management Arrangements and Audit

4.9 Responsibility for project administrative, financial and accounting management will be vested on the Directorate of Studies and Strategic Planning (DEPS) of EDM-SA, which will host the project PMU. DEPS is already implementing projects financed by the Islamic Development Bank, the West African Development Bank, as well as other bilateral partners. The PMU, drawing on support provided through the project, will have sufficient technical, human and material resources to put in place an effective internal control system and an acceptable financial management structure, notably through the correct and complete accounting of all transactions carried out during the project lifecycle, securing financial information and assets, updating and auditing data on available resources. Assessment of DEPS's capacity revealed that it lacked: (i) an administrative, financial and accounting procedures manual; and (ii) an integrated software adapted to the management of development projects.

4.10 Overall, the accounts will be kept based on a private-type accrual accounting using an integrated software adapted to development project management. The accounting plan will be drawn up based on the accounting standards of the Organization for the Harmonization of Business Law in Africa Uniform Act in force in Mali. Furthermore, the project will produce an annual work plan and budget, as well as quarterly financial management reports based on the execution of the work programme and the annual budget, annexed to the quarterly activity reports submitted to the AfDB, and which should provide a clear analysis between the budget forecasts and achievements of the quarter. Any discrepancies will be analysed and explained. The project will be included in the annual work programme of the Controller General of EDM-SA, through the risk audit department, which will ensure that the internal control mechanisms remain operational throughout the project implementation. Periodic reviews of transactions will also be undertaken, per the policies of the Controller General.

4.11 **Disbursement**. The Bank and SREP resources will be disbursed in accordance with Bank rules and procedures, particularly those contained in the Disbursement Handbook, using any of the following three methods: (i) the special account method; (ii) the direct payment method; and (iii) the reimbursement method. One of the acceptable methods will be used, as agreed among the relevant parties at project implementation.

4.12 **Audit Arrangements.** Accounts audit will be performed by an independent private audit firm on an annual basis for the duration of the project. Audits will be completed within one quarter of the close of the fiscal year.

Environmental & Social

4.13 The Djenné and Talo mini-hydropower project is classified under environmental and social category 2. In its design, it incorporated two Environmental and Social Impact Assessments (ESIA) / Environmental and Social Management Plans (ESMP) and an Abbreviated Resettlement Plan (ARP) for project-affected persons. The power plants are added to the existing Djenné and Talo dams at sites already impacted from an environmental point of view by the Bani and Sélingué Basin Irrigation Development Program (PDI-BS). The ESIA/ESMPs and ARP reports have been validated at the national level and by the Bank. The ESMP and ARP summaries were disclosed on AfDB's website on October 2017.[1] AfDB supervision throughout project implementation will focus, among other things, on ensuring that the ESMP and ARP are being implemented properly and effectively.

4.14 The anticipated negative impacts of building the two plants and associated distribution lines are minor overall. There are low climate impact risks because the water retention dams are already constructed and have recently been refurbished; marginal impact of installing energy generation infrastructure is therefore low, aside from some specific risks arising from construction waste. Project implementation will mainly generate construction waste and will stand the risk of polluting the river. Concerning the deployment of distribution lines, the most significant impacts are related to the loss of vegetation and soils due to works reallocation. The impact on the social environment will concern: (i) the increased vulnerability of certain categories of locals; (ii) the non-preservation of places of worship or heritage sites; (iii) an interface management risk between the irrigation project and the PDM-Hydropower project; and (iv) obstruction of pedestrian traffic. Moreover, the influx of people from neighbouring districts in search of jobs may disrupt the socio-cultural balance among the local populations. Site staff could also adopt behaviours that may desecrate beliefs and customs or increase the risk of spreading STIs and HIV/AIDS. During the operations phase, the risks will be limited to electricity-related accidents involving the local population, which will be partially addressed by physical barriers restricting the planting of fruit trees under power lines.

4.15 Before the construction phase, the PMU will specify in the bidding documents obligations and clauses intended to protect the natural and human environments. The specifications of bidding documents for the execution of works will clearly indicate the environmental and social requirements to be complied with. In addition, the bid evaluation system will give priority to commitments regarding compliance with the environmental regulations of Mali and the inclusion of environmental considerations in all construction site operations. The guarantee period will cover environmental and technical aspects. Similarly, the selection of a consultant for the control and monitoring of works will necessitate the establishment of an environmental unit. The bid evaluation system will include relevant competence criteria.

[1] Available here: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Mali_-_Development_of_Mini_Hydroelectric_Power_Plants_and_Related_Distribution_Networks__PDM-HYDRO__-_Summary_ESMP.pdf

4.16 Before installing and setting up workers' camps and construction sites, the Contractor will, for each construction site, submit to the Consulting Engineering Firm and the PMU for prior approval: (i) working designs for optimizing the routes of power distribution lines; (ii) a Construction Site Traffic and Installation Plan; the installation of workers' camps and equipment depots near localities must be approved by the Consulting Engineering Firm to enable the EDM-SA to own the infrastructure at the end of construction works; (iii) a Site Environmental Protection Plan including a Site and Construction Site Environmental Management Plan and a Health, Safety and Environment Plan. To guarantee the safety of workers, local residents and users of road networks and the roads along the future power transmission lines, the Contractor will be required to take all precautions to prevent road accident risks, fire risks, etc. Furthermore, personal protective equipment– helmets, gloves, protective footwear and safety belts – will be made available to skilled workers.

4.17 Prior to the commencement of works, the project supervisor should, based on the working design, picket the road on the ground so as to: (i) optimize the identification of owners of property that may be damaged; (ii) define access to property that must be maintained during construction and/or returned to their owners after the works; (iii) implement the ARP, in collaboration with local authorities and in accordance with the legal provisions in force in Mali; and (iv) optimize the Deforestation/Reforestation Management Plan.

4.18 During the construction phase, the mitigation measures to be implemented by the Administration will include: (i) the organization, by the services of the Ministry for the Advancement of Women, Children and the Family and specialized NGOs, of information and sensitization campaigns for technical services, pupils, local residents, traditional rulers, authorities (local, regional and national), users, transport unions and local communities, using every possible means. The campaigns will also focus on: (i) safety- and risk-related issues in order to induce behavioural change among the population regarding the efficient use of energy and the fight against electrocution and global climate change (mainly for school children, clubs and youth centres); and (ii) incentives for hiring local manpower and subcontracting to local NGOs during the execution of works such as sensitization, the collection of climate, agricultural as well as forestry and wildlife data.

4.19 Mitigation measures during the operation phase will concern the safety of local residents, site workers and road users, the maintenance of power distribution lines, transformer stations and appurtenances (manholes, drainage ditches, earthing, etc.). Sensitization campaigns will be organized on safety requirements regarding newly installed electrical equipment (transmission lines and transformer stations), but also the technologies that will be powered by this energy and efficient energy use. Furthermore, to contribute to women empowerment, the project will establish multipurpose platforms (infrastructure and equipment) in 10 localities in the project impact area to contribute to ensuring efficient energy use and diversifying sources of income. Reports on the implementation of these project activities, indicating the number of participants for each locality, will be prepared. On the whole, the project will generate beneficial impacts during the operation phase.

Risks and Mitigation Measures

4.20 Given the maturity of hydropower technology, structure of the project and existence of water retention dams at the sites already, the overall project risk is considered low-moderate for project implementation. Table 5 below summarizes project risks and key mitigation measures.

Table 5: Summary of Project Risks

Risk Category	Rating	Mitigation Measures
1. Political and Governance	Moderate	Economic activity in the project area continues in spite of violence and unrest. An AfDB-financed project (Bani and Sélingué Basin Irrigation Development Program - PDI-BS) is underway in the same area and is being implemented without incident. The presence of other projects, including the SCATEC project and an IFC-led photovoltaic project in Ségou, indicate that security is a high priority for GoM in the project area.
2. Macroeconomic Stability	Low	In the medium term, the economic outlook remains positive; real GDP growth is projected to be 5% in 2018 and 4.9% in 2019. However, the economy still faces the risk of a downturn, particularly given the fragility of the security situation. The government's commitment to make fiscal decentralization a key priority entails carrying out regional development projects as part of government-region contracts, supported by a transfer of necessary skills and resources, as well as greater regional accountability.
3. Sector Strategies and Policies	Low	Project sustainability is underpinned by the strong commitment of the GoM to develop renewable energy sources with its full involvement in the implementation of the SREP.
4. Technical Design of Project	Low	The existing water retention dams have been recently studied and upgraded per the PDI-BS project; flow rate measurements are reliable and recent
5. Institutional Capacity for Implementation	Moderate	EDM-SA is experienced in operating and maintaining hydropower plants. Besides, the company's officials will participate in installing the power plant equipment, to better take over maintenance after the project
6. Fiduciary	Moderate	Oversight by the steering committee, which comprises energy sector stakeholders and other relevant ministries, will ensure robust governance over the project and adequate oversight of EDM-SA's PMU. Independent Audits to be undertaken on an annual basis and delivered to AfDB for oversight will contribute mitigate this risk.
7. Environment and Social	Low	Utilization of existing water retention dams, which already have established road access, adequately addresses environmental impacts; social impacts are partially addressed through multifunctional platforms and a public awareness campaign

5. SREP INVESTMENT CRITERIA

Outline of SREP Investment Criteria

5.1 A detailed outline of the SREP investment criteria relevant to the Liberia Renewable Energy Project are presented below:

- **Increased installed capacity from renewable energy sources**. The Talo and Djenné mini hydropower plants will, together, increase renewable energy installed capacity by 8.9 MW to generate a 23.68 GWh of energy per year, for total generation estimated at 592 GWh over the-25 year lifespan of the plants.

- **Increased access to energy through renewable energy sources**. 12,500 households and an estimated 71,250 people will be directly connected through the project, as energy in the project area is currently only available through expensive and limited diesel gensets. In addition, 8,000 community lighting sets will be installed.

- **Low emission development.** The project will offset 15,800 tonnes (CO_2 equivalent) of GHG emissions per year, for an estimated total GHG reduction of 395,000 tonnes (CO_2 equivalent) over the project lifetime. The project either directly displaces or mitigates future use of diesel generation, the only other available way to produce productive power.

- **Affordability and competitiveness of renewable sources:** Since the production cost of this project (CFAF 81 per kWh for the Djenné site and CFAF 115/kWh for the Talo site) is lower than the overall average cost of production of EDM-SA (CFAF 130/kWh in 2016), the company will be able to obtain revenues from new consumption to cover maintenance and operating costs, estimated on average at 2.5% of the investment cost per year, effective from the commissioning date.

- **Productive use of energy:** The 12,500 new connections across 55 villages in the project area will provide productive energy. This, coupled with the multifunctional platforms (capacity building and equipment provision) will enable productive use of energy for entrepreneurship. Salons, mechanical repair, welding, and refrigeration are examples of productive uses enabled, that were not previously feasible, in the project area.

- **Economic, social and environmental development impact:** The ten multifunctional platforms will help foster new economic activities in the project area localities, particularly in developing or expanding economic activities enabled from access to productive energy. Examples of platform-supported capacity building include salons, refrigeration, welding, simple manufacturing and vehicle mechanics.

- **Financial and Economic viability:** While the customers of isolated networks managed by AMADER's licensees pay electricity between CFAF 280 and 350 per kWh, the electricity consumption of project beneficiary households will be billed on average at CFAF 97 on the "domestic" portion of the current fee schedule for the area managed EDM-SA. In terms of production cost, both plants will produce below EDM-SA's average cost of production at CFA 130 per kWh.

- **Leveraging of additional resources:** For each dollar mobilized through SREP, a total of USD 5.52 will be mobilized from other sources. This is in line with the targets outlined in the SREP IP for Mali.

- **Co-benefits of renewable energy scale-up:** The electrification of 55 localities will provide continuous lighting for students with beneficial effects, such as increased school attendance rates and improved school results. By offering the populace access to electricity, the project

will contribute to reducing social inequalities. It will also enable better service provision from community health service facilities.

6. SREP RESULTS FRAMEWORK

6.1 SREP Core Indicators and targets expected to be achieved as a result of the implementation of the proposed project are presented in Table 6 below.

Table 6: SREP Core Indicators

INDICATORS	TARGET
Annual Electricity Output in GWh	23.68
Increased Public and Private Investment (in USD million)	48.03
Number of people with improved access to electricity (men/women)	35,119/36,130
GHG emissions avoided in tons CO2 equivalent (annual/lifetime)	15,800 / 395,000

Monitoring & Evaluation

6.2 The monitoring and evaluation expert, as a member of the PMU, will report quarterly on the status of project indicators. The Bank's periodic supervision missions will focus, among other things, in monitoring performance against the SREP core indicators referred above, undertake assessments on the implementation of the procurement plan, the financial management side of the project and the implementation of the ESMP.

7. INDICATIVE TIMELINE

7.1 Table 7 presents an indicative timeline for the finalization of the project's appraisal, approval, effectiveness and first disbursement.

Table 7: Indicative Timeline

ACTIVITY	DATE
Appraisal	Completed
Approval by AfDB Board of Directors of AfDB's Co-financing	Completed
SREP Sub-Committee approval	March 2018
Approval by AfDB Board of Directors of SREP instrument	April 2018
Signature and Effectiveness	June 2018
First Disbursement	September 2018
Project Completion	June 2022

8. CONCLUSION AND RECOMMENDATION

8.1 Lack of access to reliable, affordable and productive energy is one of the key barriers in the social, economic and environmental development of Mali. The development of these two mini hydropower plants, using existing water retention dams, can significantly contribute to partially address these barriers and allow to increase the electricity access rate in the targeted region, contributing to economic growth and poverty reduction in central Mali.

8.2 It is recommended that SREP Sub-Committee approves a grant of USD 8.7 million to support the GoM in the implementation of the Mini Hydropower Plants and Related Distribution Networks Development Project.

Annex 1: Location of the Project Site

Annex 2: Economic Analysis

The avoided cost method was applied for economic analysis, using the the costs of hydroelectric developments compared with the variable costs of a similar capacity thermal power station (in this case diesel generators). The economic viability of the project therefore depends on the difference between the total supply costs of the project and the total supply costs by an alternative solution (use of generators).

The profit of the project is calculated as follows:

	Costs of energy supplied by alternative
(less)	Energy cost supplied by project
(less)	Investment cost of project construction
(less)	Annual operating and maintenance costs (sum)
(equals)	**Profit**

The following assumptions were used to estimate the costs and benefits of the project:

- The operating period for the project is 20 years;
- The economic cost of the construction investment is the total cost, excluding taxes, of the project, excluding provisions for price increases, adjusted for the appropriate conversion factors for works, services and labour
    - Maintenance costs and other operating expenses, representing 3% of the cost of the investment, were treated the same
  - The overall loss rate after project completion is 15%
- The average cost of electricity produced by the two hydropower plants is EUR 0.10 per kWh (65.6 CFA per kWh)
- The total production costs indicated by EDM-SA for the generators used in rural areas is EUR 0.25 per kWh

Specific variable cost assumptions of a diesel thermal power plant are as follows:

Variable	Unit	Value
Fuel costs	CFA/l	450
Fuel costs	EUR/l	0.69
Specific weight	kg/l	0.85
Specific consumption	g/kWh	240
Specific consumption	l/kWh	0.28
Fuel costs	EUR/kWh	0.19
Other variable costs	EUR/kWh	0.01
Total variable costs	**EUR/kWh**	**0.20**

Based on the above assumptions, the ERR calculated over a 20-year operating period is 18.4%. This corresponds with an ENPV of CFA 19.941 billion (USD 37 million equivalent). The ERR is above the discount rate of 10%. Therefore, the project is economically viable.

Sensitivity Analysis: The sensitivity analysis of the ERR and the ENPV used three different situations; (i) 10% increase in the investment costs; and (ii) 10% decrease in the quantity of energy produced. Situational analysis yielded the following results:

Situation Analysed	ERR	ENPV (CFA billion)
Base case	18.4%	19.941
10% increase in investment costs	16.8%	18.34
10% decrease in plant productivity	16.6%	16.399

Results from the sensitivity analysis demonstrate the economic viability of the project across scenarios compared to a “no project” case.