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Report No: PAD688

INTERNATIONAL DEVELOPMENT ASSOCIATION

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED IDA CREDIT IN THE AMOUNT OF SDR 16.3 MILLION  
(US\$25 MILLION EQUIVALENT)

AND A

PROPOSED SCF-SREP GRANT IN THE AMOUNT OF US\$14.9 MILLION

AND A

PROPOSED GPOBA GRANT IN THE AMOUNT OF US\$5.0 MILLION

TO THE

REPUBLIC OF MALI

FOR A

RURAL ELECTRIFICATION HYBRID SYSTEM PROJECT

NOVEMBER 15, 2013

Energy Group  
Sustainable Development Department  
Africa Region  
County Department AFCW3

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## CURRENCY EQUIVALENTS

(Exchange Rate Effective September 30, 2013)

Currency Unit = XOF (FCFA)  
XOF 475 = US\$1  
US\$1 = SDR 0.652

### FISCAL YEAR

January 1 – December 31

## ABBREVIATIONS AND ACRONYMS

AEDD	Agence de l'Environnement et du Développement Durable
AFREA TF	Africa Renewable Energy Access Trust Fund
AMADER	Agence Malienne pour le Développement de l'Energie Domestique et d'Electrification Rurale
ANADEB	Agence Nationale du Développement des Biocarburants
BoS	Balance of Systems
BP	Bank Procedures
CAS	Country Assistance Strategy
CIF	Climate Investment Funds
CNESOLER	Centre National de l'Energie Solaire et des Energies Renouvelables
CREE	Commission de Régulation d'Eau et d'Electricité
DNACPN	Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances
DNCN	Direction Nationale de la Conservation de la Nature
DNCPN	Direction Nationale de Contrôle des Pollutions et Nuisances
DNE	Direction Nationale de L'Energie
DNEF	Direction Nationale des Eaux et Forêts
EDM SA	Energie du Mali Société Anonyme
EIA	Environnemental Impact Assessment
EMP	Environnemental Management Plan
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
ESME TF	Trust Fund to support Energy SME in Sub-Saharan Africa
ESMF	Environment and Social Management Framework
FMR	Financial Management Report
FY	Fiscal Year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEO	Global Environment Objective
GHG	Greenhouse Gas
GoM	Government of Mali
GPOBA	Global Partnership on Output-Based Aid
HEURA	Household Energy and Universal Access
ICT	Information and Communication Technologies
IDA	International Development Association
IFR	Interim Financial Reports

IP	Investment Plan (national investment plan approved by SREP sub-)
ISN	Interim Strategy Note
IVA	Independent Verification Agents
KfW	Kreditanstalt für Wiederaufbau
kW	Kilowatt
kWh	Kilowatt hour
LPG	Liquefied Petroleum Gas
MDG	Millennium Development Goals
MoEW	Ministère de l'Énergie et de l'Hydraulique - Ministry of Energy and Water
MoF	Ministry of Finance
MW	Megawatt
NCB	National Competitive Bidding
NGO	Non-Governmental Organization
NPV	Net Present Value
OBA	Output Based Aid
OMVS	Organization for the Management of the Senegal River Basin
OP	Operational Policy
OPEX	Operational Expenditure
O&M	Operations and Maintenance
PIM	Project Implementation Manual
REF	Rural Electrification Fund
RETs	Renewable Energy Technologies
RPF	Resettlement Policy Framework
PRSP	Poverty Reduction Strategy Paper
PV	Photovoltaic
RFP	Request for Proposal
SE4ALL	Sustainable Energy for All
SHS	Solar Home System
SME	Small- and Medium-sized Enterprises
SOE	Statement of Expenditures
SREP	Program for Scaling Up Renewable Energy in Low Income Countries
TF	Trust Fund
ToR	Terms of References
ToT	Training of Trainers
WB	World Bank

Regional Vice President:	Makhtar Diop
Country Director:	Ousmane Diagana
Sector Director:	Jamal Saghir
Sector Manager:	Meike van Ginneken
Task Team Leader:	Fabrice Karl Bertholet

**MALI**  
**Rural Electrification Hybrid System Project**

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## PAD DATA SHEET

*Mali*

*Rural Electrification Hybrid System Project (P131084)*

### PROJECT APPRAISAL DOCUMENT

*AFRICA*

*AFTG2*

Report No.: PAD688

Basic Information			
Project ID	Lending Instrument	EA Category	Team Leader
P131084	Investment Project Financing	B - Partial Assessment	Fabrice Karl Bertholet
Project Implementation Start Date		Project Implementation End Date	
11-Dec-2013		15-Mar-2020	
Expected Effectiveness Date		Expected Closing Date	
12-Mar-2014		15-Sep-2020	
Joint IFC			
No			
Sector Manager	Sector Director	Country Director	Regional Vice President
Meike van Ginneken	Jamal Saghir	Ousmane Diagana	Makhtar Diop
Recipient: Republic of Mali			
Responsible Agency: AMADER			
Contact:	Ismail Toure	Title:	General Director of AMADER
Telephone	+2232238567	Email:	
No.:			
Project Financing Data(in USD Million)			
<input type="checkbox"/> Loan	<input checked="" type="checkbox"/> Grant	<input type="checkbox"/> Other	
<input checked="" type="checkbox"/> Credit	<input type="checkbox"/> Guarantee		
Total Project Cost:	44.90	Total Bank Financing:	25.00
Financing Gap:	0.00		

<b>Financing Source</b>	<b>Amount</b>
RECIPIENT	0.00
International Development Association (IDA)	25.00
New	0.00
Recommitted	25.00
Climate Investment Funds (SREP)	14.90
GPOBA	5.00
Total	44.90

#### **Expected Disbursements (in USD Million)**

Fiscal Year	FY14	FY15	FY16	FY17	FY18	FY19	FY20		
Annual	0.80	2.50	6.50	10.00	11.00	10.50	3.60		
Cumulative	0.80	3.30	9.80	19.80	30.80	41.30	44.90		

#### **Proposed Development Objective(s)**

The objective of the Project is to expand access to modern energy services in rural areas of the Recipient and to increase renewable energy generation in target areas.

#### **Components**

<b>Component 1: Service improvement and extension of existing mini-grids</b>	<b>Cost (USD Millions)</b>
This component will increase renewable energy generation capacity in existing rural power stations supplying rural mini-grids and expand those mini-grids, through (i) addition of approximately 4.8 MWp of capacity through hybrid systems, including photovoltaic panels, inverters, batteries and control electronics, and (ii) mini-grid extension and densification.	39.4 million of which: - IDA : 19.5 million - SREP 14.9 million - GPOBA 5.0 million
<b>Component 2: Development of Off-grid Lighting Markets and Energy Efficiency</b>	<b>Cost (USD Millions)</b>
This component aims to (i) catalyze the markets for off-grid lighting and solar lanterns in targeted rural areas, and (ii) improve energy efficiency and promote a rational and efficient use of electricity on targeted mini-grids.	2.7 million Financed by IDA
<b>Component 3: Project Management Support and Capacity Building</b>	<b>Cost (USD Millions)</b>
This component supports Project management and implementation, capacity building and technical assistance to	2.8 million Financed by IDA

rural energy sector stakeholders, monitoring and evaluation.	
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<b>Institutional Data</b>
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<b>Sector Board</b>
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Energy and Mining
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<b>Sectors / Climate Change</b>
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Sector (Maximum 5 and total % must equal 100)
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Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Other Renewable Energy	80		
	Transmission / Distribution of Electricity	20		

Total	100
-------	-----

<input checked="" type="checkbox"/> I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.
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<b>Themes</b>
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Theme (Maximum 5 and total % must equal 100)
--

Major theme	Theme	%
Rural development	Rural services and infrastructure	100
Total		100

<b>Compliance</b>
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<b>Policy</b>
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Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
---	---------	--------

Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
--	---------	--------

Have these been approved by Bank management?	Yes [ ]	No [ ]
--	---------	--------

Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
--	---------	--------

Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]
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Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment OP/BP 4.01	X	



Natural Habitats OP/BP 4.04		X
Forests OP/BP 4.36		X
Pest Management OP 4.09		X
Physical Cultural Resources OP/BP 4.11	X	
Indigenous Peoples OP/BP 4.10		X
Involuntary Resettlement OP/BP 4.12	X	
Safety of Dams OP/BP 4.37		X
Projects on International Waterways OP/BP 7.50		X
Projects in Disputed Areas OP/BP 7.60		X

**Legal Covenants:**

Name	Recurrent	Due Date	Frequency
Recruitment of Procurement Specialist	No	Within 2 months of effectiveness	Once

**Description of Covenant:** the Project Implementing Entity has appointed a procurement specialist for the Project, under terms of reference, and with qualifications and experience satisfactory to the Association.

Name	Recurrent	Due Date	Frequency
Accounting Software	No	Within 3 months of effectiveness	Once

**Description of Covenant:** the Project Implementing Entity has purchased and installed a new accounting software factoring in its ability to generate financial statements

Name	Recurrent	Due Date	Frequency
Appointment of External Auditor	No	Within 4 months of effectiveness	Once

**Description of Covenant:** the Project Implementing Entity has appointed an external financial auditor for the Project under terms of reference, and with qualifications, and experience satisfactory to the Association

**Conditions**

Name	Type
Subsidiary Agreement	Effectiveness

**Description of Condition.** The Subsidiary Agreement satisfactory to the Association has been executed on behalf of the Recipient and the Project Implementing Entity.

Name	Type
------	------

Project Implementation Manual			Effectiveness
<b>Description of Condition.</b> The Recipient, through the Project Implementing Entity, has adopted the Project Implementation Manual (the “PIM”) satisfactory to the Association.			
<b>Name</b>			<b>Type</b>
Cross-Effectiveness			Effectiveness
<b>Description of Condition.</b> The Co-financing Agreements have been executed and delivered and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals under it (other than the effectiveness of this Agreement) have been fulfilled.			
<b>Team Composition</b>			
<b>Bank Staff</b>			
<b>Name</b>	<b>Title</b>	<b>Specialization</b>	<b>Unit</b>
Fabrice Karl Bertholet	Sr Financial Analyst	Team Lead	AFTG2
Manuel Berlingiero	Senior Energy Specialist	Energy	AFTG2
Maria Alexandra Planas	Senior Energy Consultant	Energy specialist	AFTG2
Christopher Saunders	Operations Officer	Operations Officer	AFTG2
Raluca Georgiana Golumbeanu	Infrastructure Specialist	Infrastructure Specialist	GPOBA
Leopold Sedogo	Energy Specialist	Energy Specialist	AFTG2
Marie-Paule Ngaleu	Program Assistant	Program Assistant	AFTG2
Paivi Koskinen-Lewis	Social Development Specialist	Social Development Specialist / Gender	AFTCS
Maman-Sani Issa	Senior Environmental Specialist	Senior Environmental Specialist	AFTN3
Mahamadou Bambo Sissoko	Procurement Specialist	Procurement Specialist	AFTPW
Celestin Adjalou Niamien	Sr. Financial Management Specialist	Sr Financial Management Specialist	AFTMW
Stephanie Nsom	Jr. Professional Officer	Energy Specialist	AFTG1
Rahmoune Essalhi	Procurement Assistant	Procurement	AFTG1
Sebastian Rodriguez	Consultant	Rural Energy / Gender	AFTG2
Aoua Toure Sow	Program Assistant	Program Assistant	AFCW3
Ruxandra Costache	Counsel	Counsel	LEGAM
Gevorg Sargsyan	Program Manager	Program Manager	SEGEN

Federico Querio	Energy Specialist	Energy Specialist	SEGEN
Vanessa Lopez Janik	Operations Analyst	Operations Analyst	SEGES
Gunjan Gautam	Consultant	Hybrid Systems	SADE

**Non Bank Staff**

<b>Name</b>	<b>Title</b>	<b>Office Phone</b>	<b>City</b>

**Locations**

<b>Country</b>	<b>First Administrative Division</b>	<b>Location</b>	<b>Planned</b>	<b>Actual</b>	<b>Comments</b>
Mali		Rural areas			

## **I. STRATEGIC CONTEXT**

### **A. Country Context**

1. Mali is a large (1,241,238 square km) landlocked country in the Sahelian belt in West Africa. It has a rapidly growing population of about 14.9 million (World Development Report, 2012) unevenly distributed due to the fact that about 60 percent of its surface area is desert. Population density is low and highly dispersed. The majority of the population (about 73 percent) live in rural areas.

2. From 1991 to March 2012, Mali was considered an example of democratic governance and political stability. The events of March and April 2012 took place in a country with a democratic record in which two non-violent democratic transfers of power had taken place during the past 20 years, and which was on track to organize a third presidential election. Mali's progress in building a democratic political system did not, however, translate into an effective and accountable governance system.

3. In 2012 and the beginning of 2013, Mali faced a complex crisis on three fronts (conflict and insecurity in the North, institutional and political turmoil in the South, and humanitarian and food insecurity across the country due to the 2011 drought) that had eroded the base of Mali's economy and society, including the government's ability to provide basic services for men and women. However, prospects for 2014 are encouraging: the liberation of the Northern part of the country with the assistance of African and international forces, led by France, and the swift adoption by the Malian authorities of a transition roadmap to restore democracy and peace have opened the door for the international community to resume development assistance. The Presidential election took place in July/August 2013, and resulted in the democratic designation of Mr. Ibrahim Boubacar Keita for a period of five years. Parliamentary elections will follow and are expected to take place before the end of 2013.

4. Mali's per capita Gross National Income (GNI) was about US\$610 in 2011. The country was ranked 182 out of 186 countries by the 2012 United Nations Development Program (UNDP) Human Development Index. Over the decade preceding 2012, Mali was able to achieve relatively high economic growth but more modest increases in revenue per capita given the increase in population. Over the period, annual growth of the Gross Domestic Product (GDP) averaged 5 percent, equivalent to 1.5 percent annual increase per capita. Over the period, the poverty rate declined (from 55.6 to 43.6 percent); however, the absolute number of poor people increased slightly given population growth. Most poor derive the majority of their income from subsistence farming and are therefore exposed to natural risks. According to the Mali Interim Strategy, around 75 percent of economically active Malians work in the agriculture sector, including 74 percent of economically active women. Overall, Mali remains one of the poorest countries in the world with about half of the population living below the poverty line of US\$ 1.25 per day.

5. Poverty has increased as a result of the drought of 2011 and the political crisis of 2012, from an estimated 43.6 percent in 2010, to 46.0 percent of the population at the end of 2012 – which is likely to worsen the gender situation, in particular the gender differences in key social and economic areas in Mali. Although the economic outlook depends, in the short term, on the

progress in the political and security situation on the ground, the growth rate is expected to return to its trend level of around 5 percent in 2013. Prospects for sustained growth and job creation will depend on increasing agricultural productivity, strengthening micro and macro-economic resilience, fostering regional integration, organizing the informal sector, and addressing population growth, malnutrition and gender disparities. This requires action in a number of areas, including irrigation, education and skills development, basic service delivery, safety nets and infrastructure, as well as continued improvements in the business environment and regional policy coordination.

6. Following the events of March 2012, the Bank triggered Operational Policy (OP.) 7.30 on *Dealing with De Facto Governments* suspending disbursements and preparation of new lending operations. However, following an assessment mission in the summer, the Bank authorized resumption of ongoing operations in September 2012. A new Interim Strategy Note (ISN) was presented to the Board on June 18, 2013, together with a budget support operation.

## **B. Sector and Institutional Context**

7. In spite of significant progress over the last decade, access to modern energy services remains low in Mali, especially in rural areas. About 80 percent of household energy needs remain satisfied by biomass resources (wood and charcoal), which cause health problems among the rural population through indoor air pollution, and aggravate environmental problems such as deforestation and land degradation. According to the Mali Interim Strategy Note (ISN), women and children are often responsible for most of household chores including cooking and fuel collection – which often takes them further and further from home due to deforestation. This disproportionate domestic work burden puts them at greater health risks due to poor ventilation as well as increased drudgery, time loss and potential gender based violence during wood collection. As a consequence, women's health and time poverty is particularly affected by poor access to electricity.

8. Over the last ten years, the Malian authorities have implemented policies to increase access to modern energy services, in particular to electricity. Current rates of access to electricity in Mali are estimated at 30 percent nationally, corresponding to an access rate of 55 percent in urban areas and 18 percent in rural areas. Electricity service provision in urban areas is under the responsibility of the State-owned national utility, *Energie du Mali* (EDM-SA). Over the last decade, EDM-SA has been able to expand access to electricity at a sustained pace in major urban centers and some peri-urban areas. At the end of 2012, EDM-SA had a client base of 290,000 connections, against 120,000 ten years earlier.

9. However, a majority of the Malian population lives outside of the EDM-SA concession perimeter. In order to reach this population and achieve the rural electrification goals set in its National Energy Policy, the Government of Mali (GoM) launched an ambitious rural energy access program. This program was implemented under the responsibility of a newly created rural electrification agency, AMADER. Also, from 2004 to 2012, the IDA-financed Household Energy and Universal Access (HEURA) project implemented by AMADER played a critical role in the development of the Malian rural electrification sector. It is estimated that 1,200,000 people gained access to modern energy services through the project (based on a fairly extensive definition of access including some populations benefiting from public lighting). While the

progression in rural access has been impressive (a ten-fold increase from about 1 to 2 percent of the rural population, to 18 percent in less than a decade), it has not yet reached a large majority of the rural population. The large majority of rural households still satisfy their energy needs by using kerosene and dry-cell batteries, which are extremely expensive and unreliable.

10. Mali is faced with structural barriers impeding its efforts to increase access to electricity. This includes the high cost of new generation and the dependency on petroleum product imports. Thermal generation is entirely based on imported petroleum products (diesel, Heavy Fuel Oil) which are especially costly in Mali, a landlocked country located far from the importing ports in the region (Dakar, Abidjan, Lomé, etc.), and connected with them through poor transport infrastructure. For this reason, hydropower is a critical resource for Mali. Following the commissioning of the Manantali regional hydropower plant in 2002, Mali has managed to aggressively increase access to electricity over a 10-year period. However, with power consumption growing up to 10 percent per year, new generation needs to be brought online to meet demand. The Félou hydropower plant, which has been developed as a regional project under the Organization for the Management of the Senegal River Basin (OMVS) due to its location on the Senegal River, has been recently completed and will, from 2014 onwards, bring annually about 135GWh of additional generation for Mali (equivalent to about 15 months of demand growth). Other small and medium sized hydropower plants are planned or under consideration. While these sites appear to belong to a least-cost development strategy, they will not be sufficient to meet the growing demand for electricity, due to their small size and run-of-river nature (the high demand season for electricity in Mali from March to June does not correspond to the rainy season in August and September). In addition, climate variability can impact the reliability of hydropower generation. Climate variability also impacts agricultural production, which relies on water and energy, with the potential to create a domino effect across sectors, affecting rural and urban communities.

11. Given increased energy consumption over time due to a fast growing population and economic growth, and the constraints on alternative energy sources (wood fuel, in particular due to deforestation), Mali is likely to remain dependent on oil product imports for transportation, cooking and a significant share of power generation for decades to come. This is exposing the economy as a whole to the volatility of oil prices. Local energy service providers in rural areas that operate isolated fossil fuelled mini-grids are particularly exposed to volatile fuel prices. For this reason, the Malian authorities are increasingly looking at solar energy as a potential resource, which could be exploited gradually as the prices of equipment fall with technological progress. This objective of gaining operational experience and building local capacity in solar applications explains why two of the three components of the national investment program presented as part of Scaling Up Renewable Energy in Low-Income Countries (SREP) are dedicated to solar energy investments.

12. A second structural handicap is the high cost of network expansion. Expanding the national electricity grid to reach a larger proportion of the population would require huge investments in transmission and even more in distribution because the overall population density of Mali is low and the rural population is dispersed. Network expansion also tends to reach households which are on average poorer than existing customers with low individual consumption. For this reason, the national network expansion will necessarily remain limited in

the foreseeable future and focus on: (i) expanding the distribution network in peri-urban recently urbanized areas (especially around Bamako), and (ii) connecting to the national grid isolated localities with a relatively high level of demand. This would still leave out a majority of the Malian population. For this reason, it is necessary to develop alternative solutions for providing access to modern energy services to this segment of the population. A possible approach is the development of rural mini-grids, which has been the primary strategy promoted by AMADER. For the rest of the rural population, non-grid solutions such as Solar Home Systems (SHS) or efficient solar powered lighting products will be required. The proposed project will support both approaches (hybridization of rural mini-grids, as well as SHS and lighting products).

13. In addition, the Malian electricity sector is facing serious short-term operational and financial challenges, related to high oil prices and the failure to implement cost-reflective pricing. Over the last decade, EDM-SA has been able to expand access to electricity at an aggressive pace. Initially, the expansion of grid-electricity was made possible by the availability of low-cost hydropower from the commissioning of Manantali hydropower plant. However, around 2006, growth in electricity demand resulted in Mali absorbing the entirety of its share (50 percent) of generation from Manantali. In order to meet additional demand, the Government adopted a strategy combining expensive short-term domestic thermal generation with longer term regional solutions expected to result in lower generation costs. The regional solutions included building infrastructure to interconnect with Cote d'Ivoire, and further development of Mali's hydropower potential, in particular through the Félou regional hydropower project. This shift in the generation mix should logically have been reflected in adjustments to the regulated national electricity tariffs. However, from 2004 to 2012, the Malian authorities failed to implement any tariff adjustments, with the exception of a limited increase in 2009 (about 3 percent on average). The national utility company was therefore faced with automatic increases in operating costs which it could not pass-on to consumers, resulting in an increasingly distressed financial situation. This contributed to a deterioration of the utility's technical and operational performance, characterized by illiquidity and the accumulation of short term debts (with local Banks and suppliers). Faced with structural, negative cash-flows, EDM-SA reduced capital and maintenance expenditure to a bare minimum, contributing to a situation of imbalance between supply and demand, and reduced reliability. Since 2010, significant GoM subsidies to EDM-SA have been required to cover operating costs (fuel purchase) and maintain electricity supply.

14. The level of subsidy to EDM-SA for 2013 has been temporarily increased to FCFA 57 billion for 2013 (equivalent to US\$80 million) in order to put the company in a position to reduce its stock of arrears. In addition, the GoM took a first step towards cost-reflective electricity tariffs by allowing an average increase of 6 percent in February 2013. In order to reduce the level of subsidy to EDM-SA, additional measures will be needed, including further tariff adjustments and an acceleration of generation investments. In addition, EDM-SA has been required by the GoM to prepare a short-term recovery plan identifying measures to improve operational performance and reduce costs.

15. *The Malian Rural Electrification Model:* The Malian rural electrification model is widely regarded as successful in the sub-region. It is largely a bottom-up model, driven by decisions from local private entrepreneurs / cooperatives to construct and operate small-scale mini-grids in

rural areas based on their perception of the local market. Investment subsidies from the Rural Electrification Fund (REF-AMADER) are designed to arrive at affordable tariff levels for rural customers and provide an acceptable financial rate of return for the private operators. Investment subsidies in new rural mini-grids were limited to 75 percent (average) of capital investment costs, with local private operators providing an average matching co-financing of 25 percent. Subsidy allocation was based on objective criteria (including the number of customers to be connected during the first two years, the average tariff and the cost of investment by connected off-grid customers). No subsidies for energy consumption or operating expenses were provided. Existing mini-grids are mainly diesel-run.

16. The increase in oil prices has impacted rural mini-grid operators to an even larger extent than the national utility. Most rural mini-grids are entirely reliant on generation with small gensets running on diesel oil. In order to cover their operating costs, rural operators have been forced to increase prices, and in some cases, reduce service hours. The application of price increases in rural localities is creating significant social tensions. Electricity prices in rural mini-grids are typically around 250 FCFA/kWh (50 USc/kWh). In comparison, the average regulated tariff for EDM-SA clients remains on average below 100 FCFA/kWh (20 USc/kWh), even following the adjustment applied in February 2013. In parallel with increased cost-reflectivity of regulated utility tariffs, reducing the fuel costs of rural operators would contribute to bridge part of the gap in energy costs between urban and rural households.

17. AMADER plays a central role as the agency responsible for developing household energy and rural electrification. In that regard the agency: (i) promotes electrification in rural and suburban areas, (ii) works with all types of operators, national and international private operators, NGOs, decentralized groups, cooperatives, etc., (iii) provides technical assistance and financial support (investment subsidies), and (iv) acts as *de facto* regulator in rural and suburban areas. As part of its mission to monitor the implementation of concession-type contracts, AMADER authorizes electricity price adjustments for rural operators. The general principle established by the sector legislation is that electricity prices in rural areas are not regulated. The role of *de facto* regulator exercised by AMADER results from contractual stipulations with rural mini-grid operators and is reciprocation for the initial investment subsidies. AMADER is responsible for analyzing and selecting the initial business plans of operators, providing initial investment subsidies out of the Rural Electrification Fund (REF) and monitoring the operators. Minimum technical specifications and quality of service standards that a rural electrification operator must comply with, are set in the contractual documents. Typically, private operators obtain authorizations to operate mini-grids for a period of 15 years. After analysis of their business plans, operators receive financing for investments under a financing agreement (“*convention de financement*”) with AMADER reflecting their commitments under the business plan. The two contractual agreements between AMADER and the rural operators (authorization contract and financing agreement) create concession-type arrangements. Ownership of the fixed assets remains with the State, with the operator being allowed compensation at the term of the contract for the non-depreciated portion of its contribution to the assets. Overall, these concession-type arrangements have proved fairly resilient, allowing mini-grids operators to continue to operate even faced with political instability, internal armed conflict, and rising fuel prices in 2012. Still, the exposure of rural operators to volatile and rising diesel prices remains a threat to their long-term viability and an obstacle to further expansion.



18. *Emergence of Local Private Rural Electrification Operators:* A significant number of local private or community-based (communities, women associations) energy actors have emerged with the support from AMADER and the Rural Electrification Fund. More than 60 operators are currently active for about 190 mini-grids. The operators have tested, through their projects, both market appetite and different technical and institutional arrangements for rural electrification schemes. A tendency towards concentration of the sector can be observed. While a large number of single site operators remain, four multi-site companies have emerged with 15 to 20 sites each. This consolidation appears to facilitate professionalization of the operators, through diffusion of experience and best practices and increased specialization. Given the political and security situation of Mali, local actors are likely to conserve comparative advantages for the management of rural energy concessions, possibly in partnership with foreign firms. While there is a trend towards multi-site operators compared to local management, establishing good relationships with the local communities is critical for operators. For all mini-grids supported by AMADER, a local committee representing the community (*comité villageois*) has been established in order to create a channel for communications and discussions with the operator and with AMADER.

19. *Local Economic Impact of Rural Electrification:* Rural electrification appears to be a significant driver for income generating activities, which can have considerable impacts on improved livelihoods of men and women within rural communities and women's organizations who may be using manual labor or time intensive activities that can benefit from mechanization. An impact evaluation survey carried out in 2009/2010 to assess the impact of rural electricity provision from a representative sample of 2,000 rural consumers highlighted the importance of rural electrification for the creation and growth of income-generating activities.

20. *Integrating Gender Considerations into the Design and Implementation of Energy Activities.* AMADER's track record in mainstreaming gender in its programs is exemplary in the African sub region and is recognized and appreciated by partners and stakeholders. The gender work in Mali was initiated in 2011, when a field level and institutional gender assessment was conducted to review AMADER's operations in 3 out of Mali's 8 regions. This intervention reviewed the gender impacts of AMADER programs, working procedures, and assisted AMADER in the development of a gender strategy and action plan. The action plan resulted in two notable outcomes: (1) the institutionalization of a full time gender focal point; and, (2) the design of an investment plan to operationalize the main recommendations of the assessment. This plan attracted various stakeholders including UNWomen and local NGOs who agreed with AMADER to execute the joint program in February 2012, "Energy for the reduction of gender inequality in Mali" focusing initially in 19 rural localities. In spite of political instability, the gender and energy program continued its work and was able to initiate activities in 2 pilot localities (Simidji and N'Tobouougou) in 2013. The pilots have focused on strengthening off-grid power solutions to community centres, and training on construction/distribution of improved cookstoves and productive uses of energy services. AMADER's commitment to implementing activities specifically benefiting rural women, even during these difficult times, constitutes a tangible demonstration of ownership. The program will continue and be scaled-up under this Project.

21. Given the geography of Mali, over the next decades, neither projected expansion of the national electricity grid nor regional integration of power systems is likely to allow connecting a large proportion of rural households. Isolated off-grid or mini-grid rural electrification schemes will therefore remain the only option to bring modern energy services to a large proportion of the population for a long time. Recently, with support from bilateral donors (Russian, Dutch, and German), a few solar PV and biofuel mini-grid pilot projects have been tendered to test the introduction of renewable energy in existing thermal mini-grids on a project by project basis. A significant pipeline of business plans is under development, with technical assistance provided by AMADER, awaiting financing from the Rural Electrification Fund. This demonstrates the interest of rural populations and private operators in the energy services delivery business in Mali.

22. The proposed project aims at strengthening and further scaling-up rural electrification through the introduction of hybrid PV solar/diesel generation in rural mini-grids and installation of Solar Home Systems (SHS) when the cost of mini-grid expansion is not economically justifiable.

### **C. Higher Level Objectives to which the Project Contributes**

23. The proposed project is in line with the vision of the Malian authorities for the electricity sector. It will contribute to improving the viability of electricity provision by local operators in rural areas, and contribute to additional access expansion from existing mini-grids. The project also contributes to the long term agenda of limiting dependency on imported petroleum products and tapping the renewable energy potential of the country.

24. The project is consistent with the World Bank assistance strategy for Mali. The World Bank Group Interim Strategy Note (ISN) for FY14-15 proposes a selective program in support of short-term post-conflict recovery and long-term development objectives, underpinned by a Fragility Assessment. The program aims to both rapidly provide support to meet the needs of populations across the country and initiate new activities to better address long-term governance challenges. The WBG recognizes the centrality of the human development challenges that Mali faces in the aftermath of a period of conflict and insecurity and proposes a program focused on strengthening capacities and delivering basic services.

25. The ISN program is articulated around three priority areas: (i) laying the foundations for long-term accountability and stability; (ii) protecting human capital and building resilience; and (iii) preparing the conditions for economic recovery. The proposed Project will directly support the third area of engagement of the ISN (preparing the conditions for economic recovery) by consolidating and expanding rural access to modern energy services. In addition, it will contribute to social cohesion by reducing the divide between urban and rural areas with regard to access to basic infrastructure services.

26. The project is complementary with other World Bank operations in the sector. It constitutes a follow-up on a previous Bank operation, the Household Energy and Universal Access (HEURA) project, which supported rural electrification in Mali from 2004 to 2012, and played a critical role in the emergence and structuring of the rural electrification sector in Mali. The proposed project will complement the ongoing Mali Energy Support Project (P108440),

which supports the expansion of access in urban and peri-urban areas through the expansion and strengthening of the national utility's transmission and distribution network. As part of the post-crisis Mali portfolio realignment, and consistent with the ISN, the Mali Energy Support Project has been restructured in October 2013 resulting in a cancellation of funds in the amount of US\$25 million to be reallocated to the proposed Mali Rural Electrification Hybrid System Project

27. The project is also consistent with the World Bank Energy Strategy, which recognizes access expansion as an important means of improving equity and a key goal for concessional financing. Low rates of household electrification tend to undermine poverty eradication efforts, but also mean that government support to the energy sector benefits only connected and relatively wealthier urban households. In line with key objectives of the strategy, the project will contribute to scaling-up electricity access via a sector-wide engagement; support AMADER; and increase clean energy penetration.

28. Furthermore, the project is in line with the higher-level objectives of the Program for Scaling Up Renewable Energy in Low Income Countries (SREP). In particular, the proposed project aims *to develop renewable energies on a large scale, to effectively contribute to poverty reduction and sustainable development in Mali for the benefit of its population*. Achieving these objectives will help support low carbon emission development through the generation of new economic opportunities and increased access to energy services. The proposed project will help, among other things, to: i) reduce the exploitation of non- or less renewable energy sources (forestry resources); ii) reduce GHG emissions due partly to deforestation and partly to the use of fossil fuels; and iii) maximize economic development opportunities, through the creation of new economic activities and new jobs related to new technologies and involvement of the private sector among other things.

29. Finally, the project is also consistent with the GPOBA objectives of providing basic electricity services for the poor. A GPOBA grant (US\$5 million) will support the proposed project by making access to clean energy affordable to the poor in rural, isolated areas. Promoting OBA approaches in the rural electrification program is important for unlocking additional private sources for rural energy development, maximizing the benefits of renewable energy generation through increased access, and enhancing the performance of private operators while making off-grid connection and internal wiring affordable to the poor.

## **II. PROJECT DEVELOPMENT OBJECTIVES**

### **A. PDO**

30. The objective of the Project is to expand access to modern energy services in rural areas of the Recipient and to increase renewable energy generation in target areas.

### **B. Project Beneficiaries**

31. The direct project beneficiaries include: (i) currently connected rural households and businesses which will benefit from more reliable supply and expanded service hours; (ii) rural consumers (households, businesses, communities and facilities) that will gain access to

electricity under the project (through mini-grids or solar home systems); (iii) rural consumers who receive innovative lighting products; and (iv) persons trained.

32. Other indirect beneficiaries of the project include rural mini-grid operators, private photovoltaic dealers and contractors, lighting product retailers who will have an expanded market, and actors throughout the value chain for delivering lighting and renewable energy products in Mali.

### C. PDO Level Results Indicators

33. Key indicators include<sup>1</sup>:

- People provided with access to electricity by household connection– rural mini-grids and off-grid (number)
- Generation capacity of renewable energy (solar) (MW)
- Annual electricity output from renewable energy (solar, biofuel) (MWh/y)
- Greenhouse gas emission reductions (tons of CO<sub>2</sub> equivalent); and
- Direct project beneficiaries (number) of which female (percentage).

## III. PROJECT DESCRIPTION

34. The project is expected to increase the renewable energy installed capacity in approximately fifty of the existing rural mini-grids and facilitate subsequent gradual expansion of renewable energy fueled mini-grids to underserved areas. In addition to infrastructure investments, the project will promote the market for energy efficient products and will provide extensive capacity building in the rural energy services sub-sector and for the institutional strengthening of AMADER.

### A. Project Components

35. The project is structured around three main components: (1) Service improvement and expansion of existing mini-grids, (2) Development of off-grid lighting markets and energy efficiency, and (3) Project implementation and capacity building. The components are also aligned with the different funding sources (IDA, SREP and GPOBA) to simplify the disbursement arrangements.

36. **Component 1: Service Improvement and Extension of Existing Mini-grids (Total cost US\$39.4 million of which IDA US\$19.5 million, SREP US\$14.9 million and GPOBA US\$5.0 million).** Through its two sub-components, this component will increase renewable energy generation capacity in approximately fifty existing rural mini-grid power stations that currently rely exclusively on diesel generation. It will also expand access in rural mini-grids through distribution network extension and densification (including the cost of household connections supported by GPOBA). The focus of the component on renewable generation capacity with solar Photovoltaic (PV) and energy storage on batteries is justified by (i) the high cost of diesel-based generation in rural Mali, (ii) the fact that most mini-grids are located too far from the national transmission grid to be connected in the foreseeable future in an economically

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<sup>1</sup> The definition of the project takes into account SREP and GPOBA requirements.

viable manner, and (iii) the long term downward cost trend for renewable generation equipment.

37. ***Sub-Component 1 A – Hybrid Generation (Cost US\$31.9 million)***: This subcomponent, co-financed by SREP and IDA, will support the procurement and installation of an estimated additional 4.8MWp of generation capacity in hybrid systems (including photovoltaic panels, inverters, batteries, and control electronics) at an approximate estimated cost of US\$6,800 per kWp (excluding any additional gen-set capacity). In some cases, where specific site assessment determines it necessary to ensure efficient operation and automatic synchronization with the solar components and batteries, installation of hybrid systems could be combined with an increase in gen-set capacity. Acquisition of thermal generation equipment will primarily be financed by the operators concerned (and factored into the determination of their contribution to the investment) with possible complementary funds from IDA, if the operator's contribution is insufficient. SREP funds will not be used in any circumstances to support fossil fuel-based generation equipment. Procurement of the hybrid systems will be conducted by AMADER through turn-key contracts (typically for about 10 to 12 sites bundled together in a given area).

38. Hybrid solutions have been experimented with in about a dozen rural sites in Mali. The project will contribute to establishing a more systematic approach to hybridization. The technical design study will define *inter alia* the optimal technical design for hybridization of mini-grids, and assess the adequate sizing of the key components of hybrid systems. Selection of existing mini-grids for introduction of hybrid systems will be based on objective criteria related to the site characteristics and the operator's performance (including local demand, capacity and contribution of the operator, and regional balance). For the selected sites, a specific assessment will also determine whether part of fossil fuel-based generation could be replaced through local biodiesel production (principally *Jatropha* oil) based on local potential for biofuel cultivation.

39. ***Sub-Component 1 B – Mini-grid Extension and Densification (Cost US\$7.5 million)***: This sub-component, funded by GPOBA and IDA, will support increased access to electricity through the extension and densification of rural mini-grids. IDA will finance mini-grid network extension (medium and low voltage) and GPOBA will support the final connections to mini-grids. In addition, GPOBA will finance the installation of Solar Home Systems (SHS) for about 2,400 households that will not be reached by mini-grids because distribution line extensions are not economically justifiable. The primary objective of the GPOBA grant is to make access to basic electricity services affordable to the poor in rural areas. For this reason, the component partially supports the initial costs of household connection to basic electricity service, including internal wiring in the newly connected houses.

40. Household connection subsidies will be provided through GPOBA financing to poor households located in the service areas of existing mini-grids. The OBA subsidy will help overcome the obstacles which have prevented said households from being connected (high investment cost for the operator, unaffordable connection charges and costly internal wiring for households, etc.). With regard to SHS, the fee-for-service model will be used but it is only practical with a critical mass of customers in a given service area. For this reason, the proposed SHS activity is fairly small in scale and limited to the periphery of existing mini-grids. The fee-for-service model would be implemented by mini-grid operators in areas where they already have staff on the ground (synergies). Households which are relatively close to mini-grids but still

too far to be connected at acceptable costs will benefit from SHS. The proximity to existing mini-grids operators will make the fee-for-service model viable. The output-based (OBA) subsidy for mini-grids densification/extension or installed SHSs will be disbursed on verified outputs. This sub-component will also include the distribution of approximately 36,000 compact fluorescent lamps (three per household) for the users connected to the hybrid mini-grid systems and the SHS financed by OBA.

41. In addition to subsidy for household connections, where feasible, schools, clinics, local administration facilities, community and local product transformation units in areas served by the mini-grids would also be connected (though most such facilities are likely to be already connected and would benefit primarily from expanded service). Finally, this sub-component will support the Independent Verification Agents hired by AMADER and financed by GPOBA. The verification will ensure that: (a) new metered mini-grid connection/installed SHS and internal wiring are completed according to the minimum technical standards of AMADER; (b) connection is functional after three months, and (c) at least 80 percent of beneficiaries pay the mini-grid bills/fee-for-service.

42. **Component 2: Development of Off-grid Lighting Markets and Energy Efficiency (Total cost US\$2.7 million, funded by IDA).** This component aims to: (i) expand off-grid lighting and solar lanterns in targeted rural areas through catalyzing the markets, and (ii) improve energy efficiency and promote a rational and efficient use of electricity on targeted mini-grids. The component is aligned with the approach of the World Bank Group's Lighting Africa program. The two sub-components financed under this component are:

43. ***Sub-component 2 A – Off-grid Lighting and Solar Lanterns (Cost US\$1.5 million).*** Activities financed under this sub-component will include (a) output-based subsidies to private distributors for the sale of up to approximately one hundred thousand (100,000) Lighting Africa-certified solar portable lanterns and related pico-PV equipment such as plug-and-play Solar Home Systems SHS, and (b) the deployment and acquisition of approximately ten thousand (10,000) Lighting Africa-certified solar portable lanterns and related pico-PV equipment in selected public schools and other social facilities in project target areas. By focusing on demand- and supply-side investments, the proposed activities will leverage what is currently a viable but small and primarily urban-centric market to bring affordable, modern lighting to those who need it most, including the rural poor.

44. ***Sub-component 2 B – Energy Efficiency promotion (Cost US\$1.2 million).*** Building on previous work carried-out under the HEURA project, this sub-component will finance energy efficiency activities to reduce demands on the existing mini-grids. Activities will comprise communication campaigns in support of energy efficiency, including public awareness of energy efficient equipment and appliances. The campaigns will be coordinated with distributors and retailers to ensure availability of the appliances in retailers' inventories and negotiate promotional discounts. Prior to the campaigns, AMADER will ensure an effective application of fiscal exemptions on energy efficient equipment. Communication campaigns will also further facilitate understanding and encourage uptake of Lighting Africa products, supported by a comprehensive consumer awareness package. In addition to communication activities, the subcomponent will support acquisition of energy efficient equipment for women's groups and

rural production associations/collectives for productive uses and income generating activities. This support will continue and scale up the existing gender and energy program started by AMADER and UNWomen in 2012.

45. In Mali, women face a systematic ‘energy poverty’ in most of their daily activities, relying essentially on wood and charcoal to cover their basic energy needs. During the preparation of the 2011 gender assessment, it was possible to observe both men and women using electricity for productive uses, as well as visit women-owned small businesses that benefited from electricity, such as sewing shops, beauty parlors, restaurants and the selling of chilled drinks or ice through refrigeration. Integrating gender considerations in the design of electrification programs, by involving both men and women in design and consultations, and identifying ways to overcome barriers such as access to credit or technology, can further extend the benefits of electrification of rural communities. The activities under this subcomponent will therefore contribute to meet the investment needs on efficient appliances required in the program “Energy for the reduction of gender inequality in Mali “ started by AMADER and UNWomen. Also, the project will explore how women’s groups can play a role in the distribution and related awareness campaigns supported under Component 2.

46. **Component 3: Project Management Support and Capacity Building (Total cost US\$2.8 million financed by IDA).** This component supports project management, capacity building and technical assistance to AMADER and private operators.

47. **Sub-Component 3A – Project Management Support. (Cost US\$1.4 million).** This sub-component will include activities to support the management and successful implementation of the project. Activities could include, *inter alia*:

- *Technical and Procurement Capacity for AMADER.* This activity will provide support to strengthen AMADER’s capacity for project implementation including hiring two technical staff and one procurement specialist that will assist on the implementation of the solar PV hybrid mini-systems.
- *Project Management Support.* This activity will provide the financing for acquisition of equipment, materials, software and vehicles for carrying out project implementation.
- *Owner’s Engineer.* This activity will finance an owner’s engineer to supervise the installation of the mini-grid hybrid systems.
- *Studies and Audit:* This activity will finance key studies and consultancy required for the adequate implementation, monitoring and evaluation of the project, including the audits of the Project Annual Financial Statements. The technical studies will build on the technical work regarding technical design and site selection supported by the SREP preparation grant of US\$0.5 million.

48. **Sub-Component 3B - Capacity-building and Technical Assistance (Cost US\$0.9 million):** This sub-component will include two main program of activities associated with strengthening capacity for project implementation:

- *Capacity-building for Rural Electrification Actors and Stakeholders.* The project will support capacity strengthening (technical, financial, environmental and social, etc.) of the rural energy actors, in particular rural mini-grid

operators, AMADER and other relevant sector institutions (such as ANADEB, CNESOLER, AEDD, DNACPN, DNEF), and its partnerships with energy sector initiatives. The component will include technical assistance and specialized training for the supervisory and technical personnel of the private energy service providers (rural operators) and of the executing agency as well as the above-mentioned sector institutions. Particular attention will be given to ensuring that hybrid systems are installed, operated and maintained in a safe and adequate manner in order to ensure system performance and reliability. In addition, capacity building activities will build upon a formal and structured vocational training program implemented under the preceding HEURA project and an EU-EDF vocational training program for RE.

- *Capacity-building for the Ministry of Energy and Water.* This subcomponent will support activities and equipment to enhance the capacity of the Ministry of Energy and Water, including the DNE, to formulate, update, assess, monitor, evaluate and make recommendations with regard to energy sector access development strategy and planning.

49. ***Sub-Component 3C - Monitoring and Evaluation (Cost US\$0.3 million).*** This sub-component will support, inter alia, monitoring and evaluation activities throughout project implementation. It includes, in particular, the financing of a baseline study of targeted mini-grids before hybridization and a follow up study after investment completion in order to assess project impacts, which would be difficult to monitor throughout the project life. The baseline study methodology will be aligned with the SE4ALL methodology for measuring access, so as to measure the impact of the project more finely than with binary indicators. This evaluation will complement monitoring indicators and help provide a better assessment of the impact of rural electrification.

50. ***Sub-Component 3D - Information, Education and Communication (Cost US\$0.2 million).*** This sub-component will finance: (i) extensive information and promotional campaigns through existing media in rural areas (radio, institutional, grassroots) in order to raise interest and formal requests from operators and rural communities in support of the hybrid mini-systems and mini-grids, and (ii) communications between AMADER and local operators, relevant central government (energy, health, education, etc.) and local government institutions.

51. Activities under Component 3 will be implemented in close collaboration with the SREP Strategic Coordination Mechanism which focuses on capacity building, knowledge management and M&E at the programmatic level. Information generated under the Project M&E will feed into the program M&E system of the Strategic Coordination Mechanism. Knowledge management and communication activities will complement the planned activities under the Strategic Coordination Mechanism, while lessons learned from the Project will be consolidated and disseminated through the program knowledge management component of the Mechanism.

## **B. Project Financing**

### **Lending Instrument**

52. The proposed instrument is investment project financing in the amount of US\$44.9



million in the form of an IDA Credit of SDR16.3 million (US\$25 million equivalent), and SREP financing (US\$14.9 million not including a Project Preparation Grant of US\$0.5 million) and a GPOBA grant (US\$5 million) respectively. The Government’s estimated contribution (for the financing of staff costs of AMADER) is US\$8.9 million over the project life and contributions from private operators to the initial investments in mini-grid hybridization will be at least 5 percent of the investment per site. Maintenance of the hybrid systems is to be fully financed by the operators. The summary of project costs and sources of funding (not including the Government and operators’ contributions) is presented in the table below.

### Project Cost and Financing

Project Components <sup>2</sup>	Project cost	IDA Financing	% IDA Financing	SREP Financing	GPOBA Financing
1. Solar PV hybrid systems and mini-grids, of which:	39.40	19.50	49.5	14.90	5.00
- Hybrid Generation	31.90	17.00	53.3	14.90	0.00
- Extension and densification	7.50	2.50	33.3	0.00	5.00
	2.70	2.70	100	0.00	0.00
2. Off-grid lighting markets and energy efficiency	2.80	2.80	100	0.00	0.00
3. Project implementation and capacity Building	<b>44.90</b>	<b>25.00</b>		<b>14.90</b>	<b>5.00</b>
<b>Total Costs</b>					
<b>Total Financing Required</b>	<b>44.90</b>	<b>25.00</b>		<b>14.90</b>	<b>5.00</b>

### C. Lessons Learned and Reflected in the Project Design

53. Project preparation benefited from the experience gained in the previous projects in Mali supported by the Bank, especially the Household Energy and Universal Access (HEURA) project, as well as lessons learned from the implementation of hybrid mini-grids for rural electrification around the world<sup>3</sup>, as follows:

54. *There is high engagement of the local private sector in rural electrification concessions and low appetite from international private sector for larger concessions.* The HEURA project

<sup>2</sup> All contingencies are included in the component budget.

<sup>3</sup> Main lessons are summarized from the Alliance for Rural Electrification report on “Hybrid Mini-Grids for Rural Electrification: Lessons Learned”.

initially estimated that various “large” rural electricity concessions would be developed. These concessions were planned through a top down approach. Implementation revealed that the development of these top-down projects was difficult and did not reach the expected number as it required the participation of foreign private sector investors that are slow to engage in ventures in rural areas of Mali. On the other hand, the bottom-up approach to electrification, based on “spontaneous” proposals presented by private operators, and supported by AMADER after screening and analysis of the proposals (technical analysis, business plan), was successful, and attracted an impressive number of local private sector operators. The proposed project builds on the existing “bottom-up” model and will contribute to strengthening existing mini-grid operators.

55. *AMADER’s bottom up rural electrification approach needs to be complemented by projects of larger scale allowing a more systematic approach and lower unit investment costs, especially for renewable energy technologies.* The majority of mini-grid operators have implemented business models based on isolated conventional diesel-fueled mini-grids with low installed generation capacity per site (typically 20kW to 200kW). While considerable momentum has been created by these small-scale projects, unit investment costs are relatively high under this model, with procurement being carried out separately by each local operator. In addition, the operating performance and capacity of the operators is uneven. The introduction of a much more capital-intensive technology (hybrid generation) requires a more systematic approach to reduce initial investment costs and improve the operators’ capacity to operate and maintain the facilities. The project will accompany a movement towards sector consolidation, and facilitate the mobilization of new sources of financing for the sector.

56. *Results based financing (RBF) has been piloted in rural electrification in Mali.* Under the HEURA project, the private operators benefited from AMADER’s subsidy for generation, transmission, distribution and access, based on the RBF model. However, while significant progress was achieved with regard to generation, the access target sometimes remained unmet at the time of the last disbursement of the subsidy per full completion. The GPOBA component in the proposed project will enhance the scrutiny over the access performance of the operators, ensuring disbursement of subsidy after connections and internal wiring are completed.

57. *There is a need for simple and robust monitoring arrangements to be complemented by in-depth impact evaluation:* Rural energy projects should adopt simple, easy to monitor indicators for project implementation, and to complement this monitoring by a more comprehensive impact evaluation near the end of the project life. The results framework agreed with the GoM is simple and includes easy-to-monitor indicators that comply with the requirements of the different sources of funds. In addition, the project includes funds to conduct detailed surveys and evaluations of those potential benefits that cannot be easily monitored and measured (impact on income-generating activities, gender impact, etc.).

58. *Stand-alone photovoltaic systems (PVs) need to meet minimum performance expectations of rural households.* The appetite from the communities for photovoltaic technology, like solar home systems, was lower than expected during implementation of the HEURA project. The main reason identified was related to the mismatch between the high cost of the technology, electricity demand and expectations of the households targeted. At the time (between 2004 and 2008) the capacity of the solar home systems proposed was limited and did not meet the

expectations of households. Rural households in Mali are typically large and in order to satisfy their basic energy consumption (for lighting and radio), the size of the systems proposed at the time was usually not sufficient. Other issues included the lack of mechanisms and experience in ensuring a minimum quality and durability of the equipment. Technology and supply of SHS technology has significantly improved since and price for the systems has gone down. In addition, the project will use a fee-for-service model that has been piloted successfully by some operators in Mali in order to ensure appropriate incentives for operators to provide high quality equipment and continuous maintenance services.

59. *There is potential to stimulate income-generating activities following rural electrification.* Experiences from the HEURA project have shown that the availability of energy services stimulates new income-generating activities. Hybrid mini-grids have the potential to drive the creation of local businesses by extending the quality of service with longer availability of the service (diesel based mini-grids operate mostly only during peak demand times) and potentially reducing the cost of energy. However, previous experiences in Mali have shown that the lack of finance mechanisms to pay for connection costs and electric appliances required by prospective micro-entrepreneurs remain key barriers. The project will build up on the HEURA project's best practices by strengthening the relationship between rural electricity operators and clients through the promotion of local business models that take advantage of captive power available in the photovoltaic hybrid mini-grids (especially during the day), and through the gender and energy program started by AMADER in 2012. This approach will ensure a gender sensitive approach for the identification of energy services required in the communities and the finance of energy efficient appliances (e.g. refrigerators, agricultural transformation devices, etc.) that can create business opportunities and help the long-term sustainability of the mini-grid operation. Furthermore, AMADER will continue to lobby and coordinate with micro-finance institutions and other development partners for the promotion of income generation activities and planning.

60. Lessons learned in implementing sustainable hybrid mini-grids around the world have also been incorporated in project design and include how to tackle complex technical, financial and organizational issues, which must address end-users and their needs, capacity building and training, tariff and subsidy setting, and institutional strengthening. Key lessons include: i) utilizing local available resources as much as possible (i.e. solar, biofuel, etc.); ii) maximizing renewable resources to minimize high and volatile diesel prices; iii) making systems more attractive to private sector operators by providing output-based aid and long-term concessions; iv) providing adequate training and capacity building activities for operators; and v) developing a strong communication and information campaign at the onset of project development.

## **IV. IMPLEMENTATION**

### **A. Institutional and Implementation Arrangements**

61. The Rural Energy Service Agency (AMADER) will be the sole implementing agency for the project in close collaboration with other relevant sector institutions (such as ANADEB, CNESOLER, AEDD, DNACPN, DNEF). AMADER has a solid experience in implementing national programs and delivering subsidies according to established GoM's policy. A reference framework for rural electrification development was adopted in 2003 in the country, leading to

the creation of AMADER, with a mandate to promote rural energy services and household energy. A Rural Electrification Fund to promote rural energy access was set up in 2000 and has been managed by AMADER since 2005. AMADER is an independent public body with a distinct legal personality (“Etablissement Public Autonome”). It was created by statute (Decree 03-226, May 30, 2003, pursuant to Legislative Act 03-006 May 21<sup>st</sup>, 2003), has its own Board of Directors, and enjoys a greater ability to retain needed expertise and act with autonomy compared to a line ministry.

62. AMADER also manages and coordinates the design, implementation, monitoring and evaluation of the rural electrification programs in Mali and has experience in managing World Bank and other donor-financed projects (e.g. for the closed WB project HEURA, KfW rural electrification projects, etc). It will thus be responsible for the proposed project.

63. AMADER’s Director General will manage the project. Implementation of Component 1 will be under the responsibility of the Rural Electrification Directorate and the implementation of Component 2 will be under the responsibility of the Domestic Energy Directorate. Component 3 will be implemented by various units within AMADER including the Administrative and Financial Unit, the Communications and Training Unit, the Technology and Monitoring and Evaluation Unit, among others. Component 3 will build on vocational training activities supported under the HEURA project and an ongoing EU-EDF vocational training program for RE in collaboration with AMADER and the Malian agencies for Education and Vocational Training. AMADER will have the support of an Owner’s engineer and additional technical capacity to supervise the implementation of the hybrid systems. AMADER staff includes approximately thirty-five management, technical and support staff. AMADER’s organizational chart is included in Annex 3.

64. In the proposed project, AMADER will play a more intensive role with regard to procurement than in previous Bank operations in rural electrifications for which the procurement was carried out primarily by local private operators. The centralized bulk procurement will allow for better prices and ensure that technical requirements are met. This operation will seek standardization of key equipment (inverter, batteries, etc.) and to benefit from lower unit cost through larger volume. For this reason, AMADER’s procurement capacity will be upgraded with a procurement specialist proficient with Bank procurement procedures. AMADER technical experts would also undergo capacity strengthening with regard to drafting technical specifications and contracts management. This capacity upgrade could take place rapidly. The project will also support under Component 3, additional consultants in technical, and other key aspects related to project implementation.

## **B. Results Monitoring and Evaluation**

65. Overall monitoring and evaluation (M&E) of project activities will be AMADER’s responsibility. The agency will carry out monitoring and evaluation of the different components/activities in accordance with the indicators included in the results framework (Annex 1). The indicators, targets, and mechanisms for monitoring have been discussed and agreed with AMADER, including SREP indicators at the program level. In addition, the project includes an M&E sub-component under Component 3 to strengthen AMADER’s capacity and to conduct key monitoring studies and activities. The AMADER M&E expert will work in close

collaboration with the SREP program M&E expert under the Strategic Coordination of the Program.

66. With regard to impact evaluation, some of the outcomes expected from the project (such as impacts on income-generating activities and gender for example) are challenging to monitor on a regular basis in the absence of workable reporting arrangements and would therefore be assessed during an impact evaluation study – to be carried out at the beginning of project implementation and before project closing. At a later stage of project implementation (e.g. during MTR), whether to include specific targets for those outcomes in the results framework will be determined. AMADER has a monitoring and evaluation specialist on staff who has previous experience monitoring the HEURA project.

### **C. Sustainability**

67. The GoM has demonstrated strong commitment and ownership of the proposed operation. The project concept was developed by the GoM through a participative process as part of the SREP national investment program preparation and approved by the SREP sub-committee in November 2011. The IDA financing for the project was formally requested by GoM on April 3<sup>rd</sup>, 2013. Key parameters for sustainability of the project include the Government's commitment to implementing its Rural Electrification Strategy as demonstrated by the launch of an ambitious rural energy access program in the last decade to achieve the rural electrification goals set in the National Energy Policy. In rural areas, private local energy companies and local initiatives (communities, womens' associations), with support from AMADER, are the drivers of Mali's successful rural energy access agenda. Mali's rural energy access rate increased correspondingly from 1 percent in 2000 to 15 percent in 2010. AMADER has also demonstrated strong ownership throughout project preparation and a very good track record in implementing the Bank-financed HEURA project, as well as other donor-financed projects.

68. *Financial Sustainability:* Financial sustainability of the project will be achieved through an integrated approach that includes investments in renewable energy, capacity building of stakeholders, integration with dynamic public-private partnerships, and provision of adequate technical assistance services. The additional assets financed by the project will become part of the concessions and be operated by the concessionaires until the contractual term of the concession expires. The operator's contribution to the financing of the concession assets are accounted for separately (for the purpose of determining price, only this contribution is factored in). Hybrid investments will dramatically reduce the operating costs of rural mini-grid operators through a reduction in fuel and other costs associated with fossil fuel-based generation (maintenance, spare parts), which are extremely high in rural areas. The savings will be used to: (i) ensure adequate maintenance of hybrid systems, (ii) remunerate the operators for their additional contribution, (iii) improve access and/or customer service, and (iv) reduce electricity prices for rural customers. Given the level of operator contribution (minimum of 5 percent) envisaged and that additional connections will be subsidized by GPOBA, most of the savings associated with hybridization will be passed on to rural electricity users. The portion of savings passed on to rural electrification will be defined through existing institutional and legal mechanisms for rural concessions.

69. AMADER, after consultations with the concerned operator and the committee representative of the local population, has the responsibility for approving price adjustments. This approach appears to work fairly well as AMADER, which is overseeing close to 190 rural mini-grids, has the ability to perform cost-comparisons across sites. In addition, the agency, which has an interest in the long term financial sustainability of rural concessions but also needs to be responsive to the demands of the rural populations and of their representatives, is in a good position to balance competing interests and considerations. There is an emerging consensus among rural electrification practitioners in favor of entrusting the responsibility for rural price regulation to electrification agencies rather than national regulators. With regard to the sustainability of subsequent scale-up, the entire approach is based on the assumption that any transformational change will only occur through the improvement of energy market conditions and financing of the energy sector, as well as the creation of specific conditions for gaining investors' confidence (public and private, small-/medium-/large-scale enterprises, national or international investors). Continued reduction in the prices of hybrid systems, together with the above-mentioned conditions, are indispensable for scaling-up of public and private investments in renewable energies in Mali. While purely privately financed rural electrification is a very unlikely prospect, a scale-up of rural electrification combining public-financing (through long term loans with low interest rates, rather than grant) and private concessionaires would become viable when capital costs for hybrid generation reach a sufficiently low level.

70. With regard to new connections supported by GPOBA, AMADER will also approve cost reflective prices for private service providers. Service providers will charge consumers tariffs covering O&M costs. No ongoing subsidies will be required once capital investments are undertaken. Moreover, the replacement of the fossil fuel-based generation with renewable energy under IDA parent project is expected to enhance the quality and reliability of service, which will be monitored as part of the GPOBA verification process. For SHSs, the fee-for-service model will be applied to ensure maintenance and recovery of the investment cost by the operators.

71. *Technical Sustainability:* Sustainability of hybrid systems generally relies on the engagement of the various stakeholders, in addition to the operator, including the communities and local authorities. Long-term viability should build on a sound design during project preparation and implementation, and a suitable capacity building curriculum to ensure smoothness for operation and maintenance, e.g. through the continued availability of appropriately trained local technicians and operators for maintenance. The remoteness of the sites and the use of relatively new PV technology (inverters, battery bank, control units, and PV modules) are likely to raise maintenance challenges that need to be properly addressed by an after-sales service plan and well-trained local operators.

72. Furthermore, close consideration should be granted to the project development model itself, to adequately forecast demand to avoid early obsolescence, to ensure sufficient and steady cash flow that provides for operation costs and provision for maintenance, and to the use of efficient appliances. The project, by its design, mitigates most of these challenging factors to its sustainability by building on the existing and praised AMADER/operators model to empower all the stakeholders, bring the sites near to cost recovery, standardize rural electrification equipment and provide for essential maintenance spare parts, develop productive use of electricity and deploy an energy efficiency strategy.

73. Technical work, under the responsibility of AMADER, is underway to further define the detailed functionalities of the hybrid systems. The technical design study will evaluate different mini-grid configurations and technology components such as PV module inverters, diesel and biodiesel reciprocating engines, battery banks, etc. The study will further propose an optimal system design and sizing criteria for mini-grids, taking into account the economic optimization between capital investment and operational costs and the need for sustainable operation. Hybrid systems have been experimented with in Mali, and several local operators have gained experience in the installation and management of hybrid systems, and demonstrated a willingness to share this capacity among operators. The longest running site, in operation since 2008, is functioning satisfactorily (with no indication so far of battery performance deterioration).

## V. KEY RISKS AND MITIGATION MEASURES

### A. Risk Ratings Summary Table

<b>Risk Category</b>	<b>Rating</b>
<b>Project Stakeholder Risk</b>	Substantial
<b>Implementing Agency Risk</b>	
- Capacity	Substantial
- Governance	Moderate
<b>Project Risk</b>	
- Design	Substantial
- Social and Environmental	Moderate
- Program and Donor	Moderate
- Delivery Monitoring and Sustainability	Moderate
- Sustainability	Substantial
<b>Overall Implementation Risk</b>	Substantial

### B. Overall Risk Rating Explanation

74. The overall risk rating of the project is substantial, especially given: i) the current political situation, ii) the challenging overall governance environment for Mali; iii) stakeholder support and expectations, and iv) the implementation risks including the maintenance and operation costs of the hybrid systems and the technical capacity of the operators to manage the systems. The main risks identified are:

- **Political Risks:** While security and political instability risks have decreased in 2013, following the successful organization of presidential elections and the establishment of peace-keeping forces to stabilize the security situation in Northern Mali, political and

security risks remain significant. These include risks of localized terrorist attacks in the North and political destabilization at the regional level in the longer run. Slow progress in dealing with the displaced Malian and refugee populations could also negatively impact political instability. In response, the Bank is (i) conducting a regional study to better understand factors behind insecurity in the region and to identify the type of development solutions which could help address this challenge, and (ii) preparing a new operation to support national reconstruction and economic recovery.

- **Tariff Risks:** At the sector level, the gap between regulated and uniform utility tariffs and the much higher prices applied by rural operators is a source of both institutional and social tensions. This gap reflects the much higher cost of providing the service in rural areas and is amplified by on-grid tariffs that are below cost. The Malian authorities have put in place a rural electrification model, which is not dependent on budget transfers for sustainable current operations. This financial autonomy of rural operators for financing current operations leads to resilience insofar as they must rely exclusively on revenues collected from customers. The State-owned utility EDM-SA is currently in a difficult operational and financial situation, which will require moving towards cost reflective tariffs. In such a context, any attempt to harmonize price levels between utility tariffs and rural mini-grids would require large additional operating subsidies to the electricity sector in order to subsidize local operators for the loss of revenues. In addition to the cost, administering and controlling subsidies would present considerable challenges. Therefore, by reducing operating costs for rural operators, the Project will contribute to mitigating the risks associated with the pricing gap between utility tariffs and rural prices.
- **Governance Risk:** At the country level, governance and systemic corruption risks are substantial despite the existence of tools and institutions to prevent leakages. In this difficult country context, AMADER operates as an autonomous agency with its own Board of Directors and it enjoys a greater ability to retain needed expertise and act with autonomy than a line ministry. The fiduciary environment appears also less risky with regard to the project to be implemented by AMADER.
- **Stakeholder Support:** Support for rural electrification is high, since it is expected to increase reliability of supply and lower the cost of electricity for households that are currently not connected to mini-grids. For this reason, the selection process of the sites to hybridize has the potential to be contentious. The process for determining sites benefiting from project investments will be based on clear and objective criteria. Successful project implementation would serve as a basis for the mobilization of additional financing for further hybridization.
- **Implementation Risks:** Implementation risks are related to three main aspects, as follows:
  - *Program Design:* Since investment costs for mini-grid improvements and expansion will be largely subsidized, the criteria and procedures for site selection need to be objective and transparent. The selection criteria of operators that can access the OBA subsidy for access will also be transparent and build on the practice accumulated under the HEURA project, with particular emphasis on the pre-financing capacity of the operators. The fee-for-service model is expected to ensure adequate maintenance of the equipment by the rural operators.
  - *Technical Capacity:* Hybrid solar systems have been piloted in a few sites in Mali but will, for most sites, represent a new technology for operators. The project



design integrates technical expertise and capacity building to assist in the management of issues specific to hybrid systems (maintenance, recycling) to ensure that the systems are properly installed and maintained. Main and specific risks related to civil, mechanical and electrical works, as well as grid expansion and logistical challenges were considered and found manageable under the project's scope, given that the sites are not "green field" and are of relatively small size. Construction supervision could be challenging for AMADER because the hybridization of several sites will take place simultaneously. In order to mitigate the associated risks, supervision will be carried out by in-house resources (two technical experts hired under the project) with the assistance of an owner's engineer.

- *Financial Sustainability*: The project will have a clear positive impact on the cash flow of mini-grid operators. Operators will benefit from a significant reduction in fuel costs, while the additional capital costs are mostly subsidized. However, financial requirements related to correctly maintaining systems, and replacing some key components (mainly batteries), need to be part of any financial plan for long-term sustainability. The upgrade of systems will allow an extension of service hours, primarily during the day. A framework and methodologies are already in place for determining prices and service adjustments. This arrangement is placed under the responsibility of AMADER, and associates the operators and the community (represented by a committee). Capacity building and awareness-raising of local stakeholders could also contribute to the long-term viability of rural electrification in Mali. Appropriate communication toward local communities and management of expectations is needed to convey key messages regarding the fact that the cost of supply will remain relatively high.

## **VI. APPRAISAL SUMMARY**

### **A. Economic and Financial Analysis**

75. The project would finance the introduction of PV solar generation in about 50 rural mini-grids currently operating purely on diesel generation. This would allow a reduction in fuel costs, an extension of service hours and additional connections for about 12,000 rural households.

76. There is significant global evidence that rural electrification projects can generate important economic benefits in the short-term that only increase over the long-term. Rural access to modern energy services reduces the cost of and improves access to sustainable lighting and communication services. It also improves the quality of basic social services (health, education, and security, in particular with public lighting). In the case of Mali, a survey carried out in 2009, of a representative sample of about 2,000 rural mini-grid clients also demonstrated that a fairly significant proportion of connections (15 percent) were dedicated to a large array of productive uses of electricity (e.g. retail and services, workshops, ice-making).

77. *Rationale for Public Sector Provision/Financing*: Globally, multiple effective rural electrification models have been piloted. Some of them are based on public sector provision, others on private operators and/or cooperatives. All of them, however, have been based on sustained commitment of the authorities and on public sector financial support. The Malian rural

electrification model is based on provision of service by local private operators, charging prices sufficient to cover operating costs, with subsidization of a majority of investment costs. The proposed operation would strengthen this model by reducing its exposure to volatile fuel prices.

78. *Value added of Bank's Support:* The World Bank involvement in this project would be in the continuity of the HEURA project (2004-2012) which played a critical role in the creation of the rural electrification sector. It builds on the capacity built by rural operators and AMADER over the course of the HEURA implementation. Thanks to the SREP and GPOBA financing, the project will contribute to the mainstreaming of hybrid PV solar generation in rural mini-grids, a technology which seems to have a clear potential in a country such as Mali where ample solar resources exist while geography limits the scope for grid expansion.

79. *Methodology of Economic Analysis:* On the cost side, the analysis of the project considers the initial investments in hybrid systems and mini-grid extension, as well as the incremental operating and maintenance costs resulting from the installation of hybrid systems (including battery replacement).

80. On the benefit side, the major benefits derived from the project will be the reduction of diesel generation (substitution) and increased access. The substitution benefits are estimated based on the reduction in fossil fuel-based generation costs (mainly fuel, lubricants and spare parts consumption). The benefits from increased access through new connections is valued at the estimated willingness to pay (WTP) of rural households. The WTP estimates are derived from the observed energy budgets of rural households and are therefore high, on a per kWh basis since electricity will substitute for costly energy usages (kerosene and dry cell batteries).

81. *Results and Conclusions:* Based on the above methodology, the project EIRR is estimated at 11.1 percent overall, corresponding to a Net Present Value of US\$2.6 million for total initial investment of US\$37.6 million. The project Economic Net Present Value would be derived primarily for increased access by poor households. The estimated rate of return of stand-alone hybridization (in substitution to thermal generation), is estimated at 9.1 percent. This rate of return is based on a cautious estimate of investment costs for hybrid (US\$6,800 per kWp excluding thermal gen-set).

82. Given the decreasing cost of solar equipment, batteries and converters, and increased local contractor capacity, it is expected that costs could fall further during project implementation. By bundling several sites (e.g. contracts for 10 sites of 100 kWp each instead of on 50 kWp site), and maximizing international competition for procurement, the project will seek to accelerate cost reductions. In the future, it is therefore expected that the equipment of new green field sites, as well as the expansion of existing hybrid sites, would carry lower costs which would facilitate finance mobilization.

## **B. Technical**

83. Various alternative options such as hydropower, large centralized solar systems, wind and large thermal, were considered and rejected due to important limitations for the Mali context or the project objective. Hybridization makes technical and financial sense in comparison to other technologies in terms of costs, ease of implementation and AMADER's readiness. Finally,

to help reduce the burden of fuel cost on the operators' finances, engines capable of running on biofuels or biomass were considered.

84. Hybrid standalone mini-grids (photovoltaic solar production with battery storage and thermal engine for back-up and management of peak loads) were found to be the most suitable technological option for the project. The main reasons for the choice of this technology are:

- *Scattered and Low-density Population Centers served by AMADER.* Mali is a vast country with many of the population centers currently served by AMADER, over 190, situated at significant distances from the national grid and with a low population (under 10,000 people). Distributed, modular and stand-alone energy production systems can be cost-effective when compared to the cost and time required to extend the national grid to these centers.
- *High Solar Radiation:* Average solar radiation in Mali is high and well-distributed over the national territory with an estimated 5-7 kWh/m<sup>2</sup>/day with a daily sun lighting duration of 7-10 hours. The global typical average is only around 4-5 kWh/m<sup>2</sup>/day.
- *Biofuel Production.* Mali has a long experience in the development of local production of biofuel due to high costs of fossil fuels and difficult availability in rural areas. Government and commercial projects have developed over 30,000 hectares of jatropha plantations (source ANADEB) for sustainable biofuel production, principally based on intercropping and as live fencing. The production of ethanol from sugar cane plantations on irrigated land of the Niger River in central Mali has also been encouraged by the government through commercial projects. The sustainability of the biofuel value chain has been long supported by the Dutch and French governments. The Garalo mini-grid in southern Mali has been equipped with bi-fuel (diesel and jatropha oil) systems to reduce O&M costs.

85. Solar/thermal hybrid systems have been piloted in a dozen small sites but not yet widely applied in Mali. Kimparana, the longest running site, has a 72 kWp hybrid capacity and over 5 years of satisfactory operation. The technologies involved are proven and relatively simple to replicate, so that the project does not pose any major construction and operational challenges. The technical parameters and estimated project costs for the hybrid power plants and the distribution lines have been benchmarked against actual unit costs for similar recent undertakings in Mali and neighboring countries.

86. The project will be implemented according to internationally accepted technical criteria and standards. Turnkey contracts will be awarded for hybrid power plants. A recognized Owner's Engineer, to be competitively procured, will carry out supervision of the mini-hybrid systems.

87. Component 1B will adopt conventional and standard equipment and techniques for rural electrification. There is no major technical issue with the technologies to be disseminated and distributed. AMADER and the operators have already successfully implemented grid densification and expansion based on simplified and optimized standards for numerous localities.

The project plans to promote the use of low cost designs and techniques as appropriate and, per AMADER's strategy, to reduce rural electrification investment and operating costs.

88. Solar Home Systems (SHS) are a simple renewable energy solution for dispersed users with a proven track record in Asia. In Morocco, the public utility ONE has had good experience increasing access to remote users through a 'fee-for-service' approach (over 150,000 units distributed) where the operator is not only in charge of the installation, but also of the identification of customers, fee collection, maintenance and quality of service assurance. In Mali a private operator has successfully implemented a 'fee-for service' scheme since 2001 with an install base of 153kWp of SHS. A typical SHS of 20-100 Wp can power 2-6 lights, radio, TV, cell phone batteries and small fans.

89. The project will also finance consulting services, training courses and feasibility studies that will be procured under international competitive bidding. ToRs for the studies, consultancies and feasibility studies will be reviewed by Bank experts to ensure that they comply with Bank and international quality standards.

### **C. Financial Management**

90. A financial management assessment was conducted at the Rural Energy Service Agency (AMADER) to determine whether: (a) there are adequate Financial Management (FM) arrangements in place within the agency to ensure that the funds will be used for the purposes intended in an efficient and economical manner and the responsible entity is capable of correctly and completely recording all transactions and balances related to the project; (b) the project's financial reports will be prepared in an accurate, reliable and timely manner; (c) the entity's assets will be safely guarded; and (d) the project will be subjected to auditing arrangements acceptable to the International Development Association (IDA). The said assessment complied with the Financial Management Manual for World Bank-Financed Investment Operations that became effective on March 1, 2010 and AFTFM Financial Management Assessment and Risk Rating Principles.

91. The FM assessment concluded that the Rural Energy Service Agency (AMADER) which will have the overall financial management responsibility of the project implementation has adequate FM arrangements in place to carry out the project activities. Indeed, AMADER has successfully implemented the recently closed Household Energy and Universal Access project (HEURA). Based on the HEURA experience with AMADER's FM capacity, some improvements would be beneficial in terms of staff training, internal control, reporting and auditing. These are: (i) AMADER is adequately staffed but the recently appointed Financial Director is not fully familiar with Bank procedures, (ii) the procedures manual used for HEURA might not be aligned with the specificities of the new project, (iii) the current accounting software cannot generate IFRs resulting in increased risks of inaccuracies if the IFRs are prepared manually, and (iv) external auditor arrangements are not in place.

92. As a result of the above-mentioned financial management constraints, AMADER will take the following mitigation measures as dated covenants:

- Purchase and set up new accounting software factoring in its ability to generate financial statements - no later than 3 months after the Effective Date of the Project.

- No later than four months after the project becomes effective, appoint an external auditor.

93. In addition, the updated FM procedures will be included in the Project Implementation Manual whose approval by the Bank is a condition of effectiveness. Also, as part of the FM Action Plan, the Financial Director will be trained in Bank procedures as needed through training sessions to be organized by the Bank FM team during Project implementation.

94. The project will involve external private implementing entities called operators and will comprise an Output-Based Aid (OBA) component aimed at increasing access to modern energy for about 12,000 low income rural households in rural areas of Mali. Specific measures will be incorporated in the project design to ensure smooth implementation and mitigate fraud and corruption risks:

- For the OBA component, Independent Verification Agents will be recruited by AMADER to ensure the verification of the OBA outputs according to the technical standard specified by AMADER before subsidies are paid;
- The selection of the operators will be clearly described in the implementation manual to ensure their viability, financial status, experience, geographic representation.

95. The overall FM residual risk for the project is rated **Moderate** due mainly to the previous AMADER's Bank experience and minimum FM arrangements already in place. It is considered that the financial management arrangements in place at AMADER satisfy the Bank's minimum FM requirements under OP/BP 10.00.

#### **D. Procurement**

96. Procurement for the proposed project will be carried out in accordance with the World Bank's Guidelines: Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits and Grants by World Bank Borrowers, dated January 2011; and Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits and Grants by World Bank Borrowers, dated January 2011, and the provisions stipulated in the Legal Agreement. National Competitive Bidding (NCB) shall be in accordance with procedures acceptable to the Bank. In line with the ISN, procurement under the proposed Project would operate under OP/BP 10.00 on Projects in Situations of Urgent Need of Assistance or Capacity Constraints and would therefore benefit from the flexibility on procurement methods and applicable thresholds among others.

97. AMADER, the sole implementing agency, has a solid experience in implementing rural electrification programs in Mali (e.g. for the closed WB HEURA project) and delivering subsidies according to established GoM policy.

98. In the proposed project, AMADER will play a more intensive role with regard to procurement than in previous Bank operations in rural electrifications for which local private operators carried out the bulk of procurement. The previous arrangements, which were flexible, and operator-driven, were well suited for the creation of rural mini-grids and the emergence of a rural electrification sector based on local private participation and entrepreneurship. However, they resulted in relatively high unit investment costs and did not always allow for standardized

technical approaches. This operation targets already existing rural concessions and will therefore seek standardization of key equipment (e.g. inverters, batteries, etc.) to benefit from lower unit costs through larger volume, proven technology, and increased competition for larger contracts.

99. The overall procurement risk for the proposed project is considered **Substantial**. In order to mitigate the risks identified in the procurement assessment, an action plan was prepared, in consultation with the client and included in Annex 3. The overall procurement residual risk rating is **Moderate**.

#### **E. Social and Environment (including Safeguards)**

100. The project is intended to have positive impacts for the overall development and growth of the country. In that context, the following socially positive project impacts can be highlighted: (i) increasing quantity and quality of electricity services in rural areas not only for rural households but also for small businesses; (ii) improving the quality of social services, particularly health services supplied by small health facilities in the rural areas which cannot afford individual generators; and (iii) gradually substituting traditional fossil fuel-based solutions and the ineffective use of biomass through investments in solar energy and biofuel. In summary, the project aims at linking economic, social and environmental benefits in a single paradigm of sustainable development and poverty reduction. This will enhance, in an integrated way, energy security, business start-ups, reduction of local pollution and improvement of the livelihoods and living conditions of the local communities (with special attention to vulnerable groups, including women and young people).

101. The proposed project is a category B project (Partial Assessment). Although the potential environmental and social impacts of the investments under the proposed project are expected to be generally minimal, localized impacts may occur, thus requiring appropriate mitigation. The following safeguard policies are triggered: OP/BP 4.01 (Environmental Assessment), OP/BP 4.11 (Physical Cultural Resources) and OP/BP 4.12 (Involuntary Resettlement). As the sites for the installation of the mini-grids have not been selected, AMADER's previous Environment and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF) prepared for the HEURA project have been updated for the proposed project and sent for Bank review. The ESMF and RPF have been disclosed in-country and at the Infoshop on October 17<sup>th</sup>, 2013. A Chance Finding procedure will be developed as part of the site-specific safeguards instruments.

102. The ESMF identifies some minor potential negative impacts from the installation and operation of the mini-hybrid systems, the Solar Home Systems and the associated grid extension (i.e. minor resettlement for the mini-hybrid systems, impacts on the cultivated land during the construction of the transmission lines, impacts on socio-economic activities in case of land expropriation, inadequate handling of used batteries, etc.). These impacts could be mitigated with the implementation of adequate planning measures, the application of acceptable environmental and social measures for the installation phase, as well as adequate handling of residues and used batteries, and a compensation plan in case of resettlement. In addition, the selection of the sites for the installation of mini-hybrid systems should also include environmental and social criteria to minimize impacts. Finally, the ESMF recommends strengthening the environmental and social capacity of AMADER, conducting periodic

environmental and social audits and providing training and capacity building to the private operators.

103. A functional environmental and social management unit is in place within AMADER. This unit is familiar with the Bank's procedures as it was in charge of supervising the implementation of the ESMF and RPF for the HEURA project; however, as recommended by the ESMF, its capacity would need to be strengthened. Under its previous HEURA project, AMADER appointed a gender focal point within its agency to help integrate gender issues across its programs. This role will allow for timely guidance and technical assistance during project preparation and implementation.

**Annex 1: Results Framework and Monitoring**  
**MALI: Rural Electrification Hybrid System Project**

**Project Development Objective (PDO):** The objective of the Project is to expand access to modern energy services in rural areas of the Recipient and to increase renewable energy generation in target areas.

PDO Level Results Indicators	Core	Unit of Measure	Baseline	Cumulative Target Values							Frequency*	Data Source/ Methodology	Responsibility for Data Collection
				YR 1	YR 2	YR3	YR4	YR5	YR6	YR7			
<b>Indicator One:</b> People provided with access to electricity under the project by household connections – Other Renewable Energy - Off-grid (Number)	X & S R E P	Number	0	0	201,000	366,000	505,000	631,000	681,000	681,000	Quarterly Annual	AMADER ’s reports Quarterly Project reports	AMADER
<b>Indicator Two:</b> Generation capacity of renewable energy (other than hydropower) constructed under the project (MW)	X	MWp	0	0	0	1.4	2.9	3.8	4.8	4.8	Quarterly Annual	AMADER ’s annual reports and audits. Quarterly Project reports	AMADER
<b>Indicator Three:</b> Annual electricity output from renewable energy (solar, biodiesel) under the project	S R E P	MWh/yr	0	0	0	1,298	3,894	6,057	7,788	8,653	Quarterly Annual	AMADER ’s reports and audits Quarterly Project reports	AMADER
<b>Indicator Four:</b> Greenhouse gas emission reductions		CO2/tonnes	0	0	0	1,000	4,100	8,900	15,100	21,900	Annual	AMADER ’s reports	AMADER
<b>Indicator Five:</b> Number of direct project beneficiaries, of which female	X	Number	0	60	200,000 (50.4% women)	480,000 (50.4% women)	730,000 (50.4% women)	930,000 (50.4% women)	1,060,000 (50.4% women)	1,060,000 (50.4% women)	Quarterly Annual	AMADER ’s reports Quarterly Project reports	AMADER



<b>INTERMEDIATE RESULTS</b>													
<b>Intermediate Result (Component One): Service improvement and expansion of existing mini-grids</b>													
<i>Intermediate Result indicator One: Hybrid mini-grid systems installed</i>		Number		Procurement in place	Bidding documents finalized	10	30	40	50	50	Quarterly	AMADER reports Quarterly Project reports IVA Audit	AMADER IVA
<i>Intermediate Result indicator Two: Number of Solar Home Systems installed</i>		Number	0	0	440	1,200	1,800	2,440	2,440	2,440	Quarterly	AMADER reports Quarterly Project reports IVA Audit	AMADER IVA
<i>Intermediate Result indicator Three: Additional connections to mini-grids</i>		Number	0	0	2,000	5,000	8,000	9,770	9,770	9,770	Quarterly	AMADER reports Quarterly Project reports IVA Audit	AMADER IVA
<i>Intermediate Result indicator Four: Distribution lines constructed under the project</i>	X	Km	0	0	0	75	150	200	250	250	Quarterly	AMADER reports Quarterly Project reports	AMADER
<i>Intermediate Result indicator Five: Number of CFLs distributed</i>		Number	0	0	7,300	18,600	29,400	36,600	36,600	36,600	Quarterly	AMADER reports Quarterly Project reports IVA Reports	AMADER IVA
<b>Intermediate Result (Component Two): Development of off-grid lighting markets and energy efficiency</b>													
<i>Intermediate Result indicator One: Number of Solar lanterns disseminated</i>		Number		Subsidy parameters	35,000	60,000	80,000	100,000	110,000	110,000	Quarterly	AMADER reports Quarterly Project	AMADER

				defined								reports	
<i>Intermediate Result indicator Two: Number of Energy efficient equipment for social infrastructure distributed</i>		Number	0	0	10	20	30	40	50	50	Quarterly	AMADER reports Quarterly Project reports	AMADER
<i>Intermediate Result indicator Three: Localities reached by information and communication campaigns</i>		Number	0	0	0	15	30	40	50	50	Annually	AMADER reports Quarterly Project reports	AMADER
<b>Intermediate Result (Component Three): Project management support and capacity building</b>													
<i>Intermediate Result indicator One: Number of persons trained under the project</i>		Number	0	60	150	270	380	400	420	420	Quarterly	AMADER reports Quarterly Project reports	AMADER
<i>Intermediate Result indicator Two: Studies related to rural electrification completed</i>		Number	0	0	1	2	3	4	4	4	Annually	AMADER reports Quarterly Project reports	AMADER

\* The quarterly reports include the full range of data as they become available.

## Annex 2: Detailed Project Description

### MALI: Rural Electrification Hybrid System Project

1. The proposed operation will support the GoM's efforts to increase access to basic energy services by low income rural populations located in areas with no prospect of becoming connected to the national electricity grid in the next decade. The proposed operation will increase the viability of electricity service provision in rural areas and contribute to further scaling-up rural access.
2. The project is expected to dramatically increase the renewable energy installed capacity in the existing off-grid power stations and facilitate subsequent gradual expansion of renewable energy fueled mini-grids to underserved areas. In addition to infrastructure investments, the project promotes the market for energy efficient products and will provide extensive capacity-building in the rural energy services sub-sector and the institutional strengthening of AMADER.
3. The scaling up of the scope and effectiveness of hybrid mini-grid schemes in isolated areas in Mali is expected to open the way for future generalization on a country-wide scale which would have a transformative impact. Generalization of hybrid systems in Mali will require a continuation in the price reduction/performance improvement for key elements of the systems (especially batteries and inverters), but also in other project costs (preparation costs, installation, etc.), which would benefit from economies of scale and increased capacity from local contractors. AMADER is supporting electrification of rural areas located outside of EDM-SA perimeter in every region of Mali. There are currently approximately 190 rural electrification concessions in operation in Mali, operated as mini-grids. While many concessions remain operated by single-site producers, four larger multi-site players have emerged with up to 20 sites each under operation. Consolidation in the sector is expected to continue. Site selection during project preparation and implementation will take into account the need to coordinate project investments with other operations supporting reconstruction efforts in Northern Mali so as to ensure complementary and harmonized interventions.
4. The project is structured around three main components: (1) Service improvement and expansion of existing mini-grids, (2) Development of off-grid lighting markets and energy efficiency, and (3) Project implementation and capacity building. The components are also aligned with the different funding sources (IDA, SREP and GPOBA) to simplify the disbursement arrangements.
5. **Component 1: Service Improvement and Extension of Existing Mini-grids (Total cost US\$39.4 million of which IDA US\$19.5 million, SREP US\$14.9 million and GPOBA US\$5.0 million).** Through its two sub-components, this component will increase renewable energy generation capacity in approximately fifty existing rural mini-grid power stations that currently rely exclusively on diesel generation. It will also expand access in rural mini-grids through distribution network extension and densification (including the cost of household connections and internal wiring supported by GPOBA). The focus of the component on renewable generation capacity with solar Photovoltaic (PV) and energy storage on batteries is justified by (i) the high cost of diesel based generation in rural Mali, (ii) the fact that most mini-

grids are located too far from the national transmission grid to be connected in the foreseeable future in an economically viable manner, and (iii) the long-term downward cost trend for renewable generation equipment.

6. ***Sub-Component 1 A – Hybrid Generation (Cost US\$31.9 million)***: This subcomponent, co-financed by SREP and IDA, will support an estimated increase of 4.8MWp of the renewable generation capacity in rural mini-grids in the existing rural power stations through hybrid systems (including photovoltaic panels, inverters, batteries, and control electronics) at an approximate estimated cost of US\$6,800 per kWp (excluding any additional gen-set capacity). In some cases, where specific site assessment determine it necessary to ensure efficient operation and automatic synchronization with the solar components and batteries, installation of hybrid system could be combined with an increase in gen-set capacity. Acquisition of thermal generation equipment will primarily be financed by the operators concerned (and factored into the determination of their contribution to the investment) with possible complementary funds from IDA, if the operator’s contribution is insufficient. SREP funds will not be used in any circumstances to support fossil fuel-based generation equipment. Procurement of the hybrid systems will be conducted by AMADER through turn-key contracts (typically for about 10 to 12 sites bundled together in a given area).

7. Hybrid solutions have been piloted in about a dozen rural sites in Mali. The project will contribute to establishing a more systematic approach to hybridization. The technical design study will define *inter alia* the optimal technical design for hybridization of mini-grids, and assess the adequate sizing of the key components of hybrid systems. Selection of existing mini-grids for introduction of hybrid systems will be based on objective criteria related to the site characteristics and the operator’s performance (including local demand, capacity and contribution of the operator, and regional balance). For the selected sites, a specific assessment will also determine whether part of fossil fuel based generation could be replaced through local biodiesel production (principally *Jatropha* oil) based on local potential for biofuel cultivation.

8. Average solar radiation in Mali is well distributed over the national territory with an estimated 5-7 kWh/m<sup>2</sup>/day<sup>34</sup> with a daily sun lighting duration of 7-10 hours. The global typical average is only around 4-5 kWh/m<sup>2</sup>/day. Cost estimates for hybrid system investments have been derived from price references for similar projects in the sub-region and globally and conservative anticipations of downward cost trends. Recent IEA report “Rural Electrification with PV Hybrid System” finds capital cost of hybrid mini-grids in the range of US\$7,425/kWp to US\$12,150/kWp (IEA 2013). Typically, major contributors to this high capital cost are PV module and mounting structures; inverters and batteries, as well as Balance of Systems (BoS) costs. BoS costs include other electrical and structural components along with necessary engineering, design, and installation costs. BoS costs for deployment of small PV systems tend to be relatively high. Diesel gen-sets typically represent a smaller portion of total investments costs (about 10 percent). Price references for rural hybrid projects in Mali tend to be in the mid and sometimes upper range of the above price range. Observed high project costs can be explained in part by factors specific to Mali in particular extra costs and risk premium related to Mali’s landlocked geography and to its fragility and security risks (especially for foreign contractors deploying their personnel on the ground). On key objective of the project is to reduce investment costs, in particular the country specific additional costs. This would be achieved

through larger procurement packages (typically for about ten mini-grids instead of site by site) in order to achieve maximize interest from bidders and reduce preparation and installation costs (since the same approach can be replicated on multiple sites). In addition, by developing the capacity of local subcontractors, the project is expected to reduce additional costs created by the use of expatriate experts. Furthermore, there is a clear trend towards price reductions for key system components. This has been especially the case for PV panels recently and significant price reductions for inverters and batteries over the course of the project are likely. After analyzing recent project costs in Mali and in the sub-region (Senegal, Burkina Faso, Cape Verde) and anticipating some cost reductions, an estimate for the average unit investments cost for hybrid of US\$7,440/kWp has been retained. This estimate, inclusive of contingencies and thermal gen-sets) is close to the lower bound of the IEA range quoted above. Excluding gen-set costs, this translates into estimated unit costs of US\$6,800/kWp, an assumption also used for setting the project monitoring target and for the economic analysis. This relatively conservative cost estimate would not preclude the implementing agency from seeking further cost reductions, especially for contracts to be tendered later on during project implementation. Achieving further costs reductions would be critical to attracting additional funding for hybrid investments.

**9. *Sub-Component 1 B – Mini-grid Extension and Densification (Cost US\$7.5 million):***

This sub-component, funded by GPOBA and IDA, will support increased access to electricity through the extension and densification of rural mini-grids. IDA will finance mini-grid network extension (medium and low voltage) and GPOBA will support the final connections to mini-grids. In addition, GPOBA will finance the installation of Solar Home Systems (SHS) for about 2,400 households that will not be reached by mini-grids because distribution line extensions are not economically justifiable. The primary objective of the GPOBA grant is to make access to basic electricity services affordable to the poor in rural areas. For this reason, the output-based subsidy partially supports the initial costs of household connection to basic electricity service, including internal wiring in the newly connected houses. In addition, under GPOBA financing, the sub-component supports consultants' services for carrying out independent verifications of the output based subsidies.

10. Household connection subsidies will be provided through GPOBA financing to poor households located in the service areas of existing mini-grids. The OBA subsidy will help overcome the obstacles which have prevented said households from being connected (high investment cost for the operator, unaffordable connection charges and costly internal wiring for households, etc.). With regard to SHS, the fee-for-service model will be used but it is only practical with a critical mass of customers in a given service area. For this reason, the proposed SHS activity is fairly small in scale and limited to the periphery of existing mini-grids. The fee-for-service model would be implemented by mini-grids operators in area where they already have staff on the ground (synergies). Households which are relatively close to mini-grids but still too far to be connected at acceptable costs will benefit from SHS. The proximity to existing mini-grids operators will make the fee-for-service model viable. The output-based (OBA) subsidy for mini-grids densification/extension or installed SHSs will be disbursed on verified outputs. This sub-component will also include the distribution of approximately 36,000 compact fluorescent lamps (three per household) for the users connected to the hybrid mini-grid systems and the SHS financed by OBA.

11. Experience in Mali and elsewhere has shown limitations of the dealer model for SHS (quality, maintenance). In this context the fee-for-service model is attractive but only practical with a critical mass of customers in a given service area. For this reason, the proposed SHS activity is fairly small in scale and limited to the periphery of existing mini-grids. The fee-for-service model would be implemented by mini-grid operators in areas where they already have staff on the ground (synergies). Households which are relatively close to mini-grids but still too far to be connected at acceptable costs will be targeted for SHS. The proximity to existing mini-grids operators will make the fee-for-service model viable. The output-based (OBA) subsidy for mini-grids densification/extension or installed SHSs will be disbursed on verified outputs. This sub-component will also include the distribution of approximately 36,000 compact fluorescent lamps (three per household) for the users connected to the hybrid mini-grid systems and the SHS financed by OBA.

12. About twelve thousand (12,000) poor households in rural areas are expected to benefit of electricity through off-grid solutions under the GPOBA grant. The OBA grant design allows the operator to implement the least cost off-grid electrification option: (i) mini-grid densification/maximum one pole extension and internal wiring (US\$3.2 million) – a subsidy per connection and internal wiring of US\$227 (no pole) or US\$844 (one pole) is expected to finance access for 9,600 low income households in isolated rural areas; and (ii) SHSs (50 Wp) and internal wiring (US\$1.5 million) – a subsidy per connection and internal wiring of US\$586 will provide incentives to operators to connect 2,400 low income households in remote areas, where the extension of the mini-grid is not economically justifiable. The internal wiring includes 3 CFLs per household (taking into consideration the size of 10.8 persons per household) to promote the efficient use of electricity and make the payment of electricity consumption affordable to the poor. The OBA subsidy for mini-grids densification/extension or installed SHSs will be disbursed on verified outputs as follows: 80 percent based on verification of connection/installation of the SHS and internal wiring and 20 percent based on the verification of three billing cycles for mini-grid connection or adequate maintenance and fee-for-service for SHSs.

13. The proposed GPOBA component will support the objectives of the project by partially subsidizing the investment cost of mini-grids' densification/extension, SHSs and internal wiring to make access to clean energy affordable to low income households in rural, isolated areas. Promoting OBA approaches in the rural electrification program maximizes the benefits of renewable energy generation (hybridization of mini-grids with solar energy under the IDA project) through increased access, enhancing the performance of private operators while making off-grid connections affordable to the poor.

14. In addition to the GPOBA-funded subsidy for household connections, where feasible, schools, clinics, local administration facilities, community and local product transformation units in hybridized areas would also be connected (though most such facilities are likely to be already connected and would benefit primarily from expanded service).

15. Finally, this sub-component will support the Independent Verification Agents hired by AMADER and financed by GPOBA. For mini-grids, the verification will ensure that: (a) new metered connection and internal wiring is completed according to the minimum technical

standards of AMADER and (b) connection is functional after three months and at least 80 percent of beneficiaries pay the mini-grid bills/fee-for-service. For SHSs, verification will focus on (a) satisfactory installation of SHSs (50 Wp) and internal wiring and (b) maintenance and operation of SHSs after three months and payment of the bills by at least 80% of beneficiaries.

16. **Component 2: Development of Off-grid Lighting Markets and Energy Efficiency (Total cost US\$2.7 million, funded by IDA).** This component aims to: (i) expand off-grid lighting and solar lanterns in target rural areas through catalyzing the markets, and (ii) improve energy efficiency and promote a rational and efficient use of electricity on targeted mini-grids. The component is aligned with the approach of the World Bank Group's Lighting Africa program. The two sub-components financed under this component are:

17. **Sub-component 2 A – Off-grid Lighting and Solar Lanterns (Cost US\$1.5 million).** Activities financed under this sub-component will include: (a) output-based subsidies to private distributors for the sale of up to approximately one hundred thousand (100,000) Lighting Africa-certified solar portable lanterns and related pico-PV equipment such as plug-and-play Solar Home Systems SHS, and (b) the deployment and acquisition of approximately ten thousand (10,000) Lighting Africa-certified solar portable lanterns and related pico-PV equipment in selected public schools and other social facilities in project target areas. By focusing on demand- and supply-side investments, the proposed activities will leverage what is currently a viable but small and primarily urban-centric market to bring affordable, modern lighting to those who need it most, including the rural poor.

18. Given the limited availability and high cost of energy in targeted rural areas (double that of urban energy costs), energy savings and increased access by non-grid-based means remain highly justified. Lighting Africa-certified pico-PV products will also go beyond simple lighting, with many affordable solar lanterns now equipped with phone-charging capabilities.

19. The output-based subsidy to private distributors for the sale of these products will be an approximately US\$10 flat subsidy and will also be pro-poor through a higher subsidy percentage on smaller lanterns and a lower subsidy percentage on larger systems. Based on an average estimated retail price for likely Lighting Africa-certified products of US\$20, the subsidy levels are determined on the basis of the costs and consumers' ability to pay in such a way as to make the products affordable and preferable to the targeted consumers over other poor-quality products such as kerosene or low-efficiency battery-powered LED torches. The affordability levels are based on the actual expenditures on kerosene and batteries of the target households. Purchasers of subsidized products will supply data to facilitate verification and monitoring and evaluation of the overall activity. Subsidies will be paid out to pre-selected distributors upon confirmation of sales data by Independent Verification Agents.

20. The dissemination of solar lanterns to public schools will be based on Lighting Africa experiences elsewhere in the region. Specifically, the program will finance a schools targeting study to identify potential schools to benefit from solar lantern distributions and propose objective selection criteria. A final selection will be carried out by AMADER in close consultation with the Ministry of Education and the Inter-sectoral Committee. The project will

recruit a service provider to ensure the procurement of appropriate solar lanterns and setup of “lantern libraries” in selected schools. Students will have the opportunity to borrow lanterns after school to study at home in the evenings, allowing immediate and nearby households to observe their use, functionalities and benefits. As well as monitoring and evaluation of the products and their uses, the service provider will also be responsible for carrying out consumer awareness in communities ahead of distributions. This will be designed to ensure that school lanterns are distributed publicly and remain public goods throughout the life-cycle of the products.

21. ***Sub-component 2 B – Energy Efficiency Ppromotion (Cost US\$1.2 million).*** Building on previous work carried-out under the HEURA project, this sub-component will finance energy efficiency activities to reduce demands on the existing mini-grids. Activities will comprise communication campaigns in support of energy efficiency, including public awareness of energy efficient equipment and appliances. The campaigns will be coordinated with distributors and retailers to ensure availability of the appliances in retailers’ inventories and negotiate promotional discounts. Prior to the campaigns, AMADER will ensure an effective application of fiscal exemptions on energy efficient equipment. Communication campaigns will also further facilitate understanding and encourage uptake Lighting Africa products, supported by a comprehensive consumer awareness package. In addition to communication activities, the subcomponent will support acquisition of energy efficient equipment for women’s groups and rural production associations/collectives for productive uses and income generating activities. This support will continue and scale up the existing gender and energy program started by AMADER and UNWomen in 2012.

22. In Mali, women face a systematic ‘energy poverty’ in most of their daily activities, relying essentially on wood and charcoal to cover their basic energy needs. During the preparation of the 2011 gender assessment, it was possible to observe both, men and women, using electricity for productive uses as well as visit women-owned small businesses that benefited from electricity, such as sewing shops, beauty parlors, restaurants and the selling of chilled drinks or ice through refrigeration. Integrating gender considerations in the design of electrification programs, by involving both men and women in design and consultations, and identifying ways to overcome barriers such as access to credit or technology, can further extend the benefits of electrification of rural communities. The activities under this subcomponent will therefore contribute to meet the investment needs on efficient appliances required in the program “Energy for the reduction of gender inequality in Mali “ started by AMADER and UNWomen. Also, the project will explore how women’s group can play a role in the distribution and related awareness campaigns supported under Component 2. The project will build on the following existing activities under the program:

Community and domestic energy services	Lighting services for schools, alphabetization and community centers
	Strengthening community health clinics with solar kits for lighting and power for medical devices such as vaccine refrigerators or laboratory tests equipment
	Efficient renewable energy services through solar thermal (water heaters and evaporative coolers), biogas and biomass technologies
Productive services	Development of local transformation centres via electricity service connections, devices for food processing, cold chain, irrigation,



packaging, multimedia services and other services. These services will also offset consumption towards high photovoltaic energy production periods as to increase the financial viability of the mini-grids.
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23. Also with regard to the gender dimension during project implementation, after site-specific assessments, a scaled-up version of ongoing gender and energy activities could be initiated which will offer key benefits to hybrid mini-grids, including: (i) creating anchor customers that are endogenous and that produce economic activity in the locality, (ii) by promoting activities during the hours of highest solar production, the overall financial viability of the isolated mini-grid can be improved, (iii) by integrating the gender dimension to these activities, layers of the community that normally are more vulnerable could benefit from the new forms of energy, and (iv) since the solutions are modular, poverty and gender criteria can be used to target specific development objectives.

24. **Component 3: Project Management Support and Capacity Building (Total cost US\$2.8 million financed by IDA).** This component supports project management, capacity building and technical assistance to AMADER and private operators.

25. **Sub-Component 3A – Project Management Support. (Cost US\$1.4 million).** This sub-component will include activities to support the management and successful implementation of the project. Activities could include, *inter alia*:

- *Technical and Procurement Capacity for AMADER.* This activity will provide support to strengthen AMADER’s capacity for project management including hiring two technical consultants, and one procurement specialist who will assist with the implementation of the solar PV hybrid mini-systems.
- *Project Management Support.* This subcomponent will provide for the financing for acquisition of equipment, materials, software and vehicles for the carrying out of project implementation.
- *Owner’s Engineer.* This activity will finance an Owner’s Engineer to supervise the installation of the mini-grid hybrid systems.
- *Studies and Audit:* This activity will finance key studies and consultancy required for the adequate implementation, monitoring and evaluation of the project, such as:
  - i. *External Technical Expertise:* The sub-component will support as needed additional technical expertise during project implementation. External technical expertise during project preparation and early implementation is supported by a SREP Preparation Grant. In particular, the technical design study will evaluate different mini-grid configurations and technology components (such as PV modules inverters, diesel and biodiesel reciprocating engines, battery banks, etc.) and further propose an optimal system design for mini-grids, taking into account the economic optimization between capital investment and operational costs and the need of sustainable operation. In addition, it is expected that an external consultant will assist with final site selection based on pre-defined objective criteria.
  - ii. Environmental and social monitoring will finance required activities to

ensure application of safeguard measures throughout project implementation including study of recycling options for hybrid system components.

- iii. Financial Audits.
- iv. Assistance, as needed, will be provided to the government on how carbon finance operations work in general including an assessment of prospects, options and requisites for carbon finance, as well as the implications on project design. This would include: assessing the eligibility for carbon finance for hybridizing existing diesel systems and constructing new PV solar diesel systems; developing of a CDM Program of Activities (PoA); and studying the potential purchase of carbon credits generated from this PoA through the new carbon finance initiative for the Least Developed Countries, the Carbon Initiative for Development (Ci-Dev).
- v. Study on how to promote uses of electrical appliances for households and machinery for businesses (productive uses) in rural areas, including assessment of financing options such as *on-bill financing* (rural operators providing loans to customers and receiving loan repayments through monthly electricity bills), or microfinance. The study would build on the first preliminary work carried out under HEURA and would assess different financing models in order to increase electricity uses in rural areas and prepare activities to roll-out pilots in the project area. First pilot activities might be carried out.

26. ***Sub-Component 3B - Capacity-building and Technical Assistance (Cost US\$0.9 million)***: This sub-component will include two main programs of activity associated with strengthening capacity for project implementation:

- *Capacity building for Rural Electrification Actors and Stakeholder's*. The project will support capacity strengthening (technical, financial, environmental and social, etc.) of the rural energy actors, in particular rural mini-grid operators, AMADER and other relevant sector institutions (such as ANADEB, CNESOLER, AEDD, DNACPN, DNEF), and its partnerships with energy sector initiatives. The component will include technical assistance and specialized training for the supervisory and technical personnel of the private energy service providers (rural operators) and of the executing agency as well as the above-mentioned sector institutions. The operation of mini-grids requires a combination of skills at different levels of competence, training and certification. Particular attention will be given to ensuring that hybrid systems are installed, operated and maintained in safe and adequate manner in order to ensure system performance and reliability. In addition, capacity building activities will build upon a formal and structured vocational training program implemented under the preceding HEURA project and a EU-EDF vocational training program for RE. A systematic approach to capacity building will ensure the availability appropriately trained engineers, technicians and skilled labor for existing and new mini-grid operators and AMADER. These activities, which could include the identification of current curricula supporting RE, the development of new curricula, and training of trainers will also strengthen the

relationship between the Energy and Education sectors.

- *Capacity building for the Ministry of Energy and Water.* This subcomponent will support activities and equipment to enhance the capacity of the Ministry of Energy and Water, including the DNE, to formulate, update, assess, monitor, evaluate and make recommendations with regard to energy sector access development strategy and planning.

27. ***Sub-Component 3C - Monitoring and Evaluation (Cost US\$0.3 million).*** This sub-component will support, inter alia, monitoring and evaluation activities throughout project implementation. It includes, in particular, the financing of a baseline study of targeted mini-grids before hybridization and a follow up study after investment completion in order to assess project impacts, which would be difficult to monitor throughout the project life. The baseline study methodology will be aligned with the SE4ALL methodology for measuring access, so as to measure the impact of the project more finely than with binary indicators. This evaluation will complement monitoring indicators and help provide a better assessment of the impact of rural electrification.

28. ***Sub-Component 3D - Information, Education and Communication (Cost US\$0.2 million).*** This sub-component will finance: (i) extensive information and promotional campaigns through existing media in rural areas (radio, institutional, grassroots) in order to raise interest and formal requests from operators and rural communities in support of the hybrid mini-systems and mini-grids, and (ii) communications between AMADER and local operators, relevant central government (energy, health, education, etc.) and local government institutions.

29. Activities under Component 3 will be implemented in close collaboration with the SREP Strategic Coordination Mechanism which focuses on capacity building, knowledge management and M&E at the programmatic level. Information generated under the Project M&E will feed into the program M&E system of the Strategic Coordination Mechanism. Knowledge management and communication activities will complement the planned activities under the Strategic Coordination Mechanism, while lessons learned from the Project will be consolidated and disseminated through the program knowledge management component of the Mechanism.

**Annex 3: Implementation Arrangements**  
**MALI: Rural Electrification Hybrid System Project**

**Project Institutional and Implementation Arrangements**

1. The Rural Electrification and Household Energy Service Agency (AMADER) will be the sole implementing agency for the Project. AMADER has a solid experience in implementing national programs and delivering subsidies according to established GoM policy. A reference framework for rural electrification development was adopted in 2003 in Mali, leading to the creation of AMADER, with a mandate to promote rural energy services and household energy. A Rural Electrification Fund to promote rural energy access was set up in 2000 and has been managed by AMADER since 2005.
2. AMADER also manages and coordinates the implementation, monitoring and evaluation of the rural electrification programs in Mali and has experience in managing World Bank and other donor-financed projects (e.g. for the closed WB HEURA project). It will thus be responsible for the proposed project.
3. AMADER's Director General will be the head of the project. Implementation of Component 1 will be under the responsibility of Rural Electrification Directorate and the implementation of Component 2 will be under the responsibility of the Domestic Energy Directorate. Component 3 will be implemented by various units within AMADER including the Administrative and Financial Unit, the Communications and Training Unit, the Technology and Monitoring and Evaluation Unit, etc. AMADER will have the support of an Owner's Engineer and additional technical capacity to supervise the implementation of the hybrid systems. AMADER staff includes approximately thirty-five management, technical and support staff (see below AMADER's Organizational chart).
4. The responsibilities of AMADER include, among other tasks: (i) supporting Project planning (e.g. implementation work-plans, budget estimates, M&E implementation plans, etc.) and assisting the rural operators on the implementation of the rural systems; (ii) actively overseeing project implementation to ensure quality and timely progress; (iii) implementing the M&E arrangements for the project, including its reporting requirements; (iv) ensuring compliance with agreed procurement, disbursements and financial management policies and procedures; (v) supervising the implementation and compliance with the ESMF and RPF; and (vi) ensuring regular reports on the progress of the project to the Inter-sectorial Committee and relevant ministries and to the World Bank, including prompt feedback on areas that need their attention or support. AMADER will prepare quarterly progress reports as well as more detailed annual reports to submit to the Bank.
5. In the proposed project, AMADER will play a stronger role with regard to procurement than in previous Bank operations in rural electrifications for which the bulk of procurement was carried out by local private operators. This operation will seek standardization of key equipment (inverter, batteries, etc.) and to benefit from lower unit cost through larger volume. For this reason, AMADER's procurement capacity will be upgraded with a procurement specialist

proficient with Bank procurement procedures. AMADER technical experts would also undergo capacity strengthening with regard to drafting technical specifications and contracts management. This capacity upgrade could take place rapidly. The project will also support under Component 3 additional consultants in technical, and other key aspects related to project implementation.

6. A functional environmental and social management unit is in place within AMADER. This unit is fairly familiar with Bank's procedures; however its capacity would need to be strengthened. The national environmental management framework remains relatively weak especially when it comes to the implementation and follow-up of the environmental and social management plans. Under its previous HEURA project, AMADER has appointed a gender focal point within its agency to help integrate gender issues across its programs. This role will allow for timely guidance and technical assistance during project preparation and implementation.

## **Financial Management, Disbursements and Procurement**

### *Financial Management*

7. A Financial management assessment was conducted at the Rural Energy Service Agency (AMADER) with the objectives to determine: (a) whether there are adequate Financial Management (FM) arrangements in place within the agency to ensure that the funds will be used for the purposes intended in an efficient and economical manner and the responsible entity is capable of correctly and completely recording all transactions and balances related to the Project; (b) the Project's financial reports will be prepared in an accurate, reliable and timely manner; (c) the entity's assets will be safely guarded; and (d) the project will be subjected to auditing arrangements acceptable to the International Development Association (IDA). The said assessment complied with the Financial Management Manual for World Bank-Financed Investment Operations that became effective on March 1, 2010 and AFTFM Financial Management Assessment and Risk Rating Principles.

8. The FM assessment concluded that the Rural Energy Service Agency (AMADER) which will have the overall financial management responsibility of the project implementation has adequate FM arrangements in place to carry out the project activities. Indeed, AMADER had successfully implemented the recently closed Household Energy and Universal Access project (HEURA). Based on the HEURA experience with AMADER's FM capacity, some improvements would be beneficial in terms of staff training, internal control, reporting and auditing. These are: (i) AMADER is adequately staffed but has appointed a new financial Director not fully familiar with Bank procedures, (ii) AMADER procedures manual used for HEURA might not be aligned with the specificities of the new Electrification hybrid project and its OBA component, (iii) the current accounting software cannot generate IFRs and therefore increase risk on accuracy of data due to manual elaboration of IFRs, (iv) the external auditor arrangements are no longer in place since HEURA closing.

9. As a result of the above mentioned financial management constraints, AMADER will take the following dated covenant mitigation measures:

- Purchase and set up new accounting software factoring in its ability to generate financial statements.
- No later than four month after the project becomes effective, appoint an external auditor.

10. In addition, the updated FM procedures should be included in the Project Implementation Manual whose approval by the Bank is a condition of effectiveness. Also as part of the FM Action Plan, the Financial Director will be trained to Bank procedures as needed through training sessions to be organized by the Bank FM team during project implementation.

11. The project will involve external private implementing entities called operators and will comprise an Output-Based Aid (OBA) component aimed at increasing access to modern energy for about 12,000 low income rural households in rural areas in Mali. Specific measures will be incorporated in the project design to ensure smooth implementation and mitigate fraud and corruption risks:

- For the OBA component of the project, Independent Verification Agents (IVA) will be recruited by AMADER to ensure the verification of the OBA outputs according to the technical standard specified by AMADER before subsidies are paid;
- The selection of the operators will be clearly described in the implementation manual to ensure their viability, seniority, financial status, experience, geographic representation.

12. The overall FM residual risk for the project is rated **Moderate** due mainly to the previous AMADER's Bank experience and minimum FM arrangements in place. It is considered that the financial management arrangements in place at AMADER satisfy the Bank's minimum FM requirements under OP/BP 10.00.

### **Financial Management Arrangements**

13. **Staffing:** The financial management will be ensured by AMADER's administrative and financial department that is well staffed with a newly recruited financial Director not fully familiar with Bank procedures, an experienced chief accountant familiar with Bank procedures and an administrative assistant.

14. **Budgeting Arrangements:** The budgeting process from elaboration to execution and control is clearly defined in AMADER's FM procedures implementation manual that will apply to the project. The budget will be reviewed and adopted by the Board of AMADER before the beginning of the year. Annual draft budgets will be submitted to the Bank's non-objection before adoption and implementation.

15. **Accounting Arrangements:** The current accounting standards SYSCOHADA, in use in Mali and applied with HEURA project will apply to the project. Project accounts will be maintained on a cash basis, supported with appropriate records and procedures to track commitments and to safeguard assets. Annual financial statements will be prepared by the AMADER accounting team in accordance with the accounting referential. The accounting and control procedures will be documented in the FM Manual to be revised.

## **Internal Control and Internal Auditing Arrangements:**

16. **Internal Control Systems:** FM and administrative procedures document the financial management arrangements including internal controls, budget process, assets safeguards, and clarify roles and responsibilities of all the stakeholders.

17. **Internal Auditing:** AMADER's management controller will be committed to carry out ex post reviews of the projects' activities and ensure compliance with the projects management procedures. He will play a significant role in reinforcing the operators on all FM issues as needed. If needed, depending on his workload after the first year of implementation, recruiting an internal auditor to take over the internal audit function may be considered.

## **Funds Flow and Disbursement Arrangements**

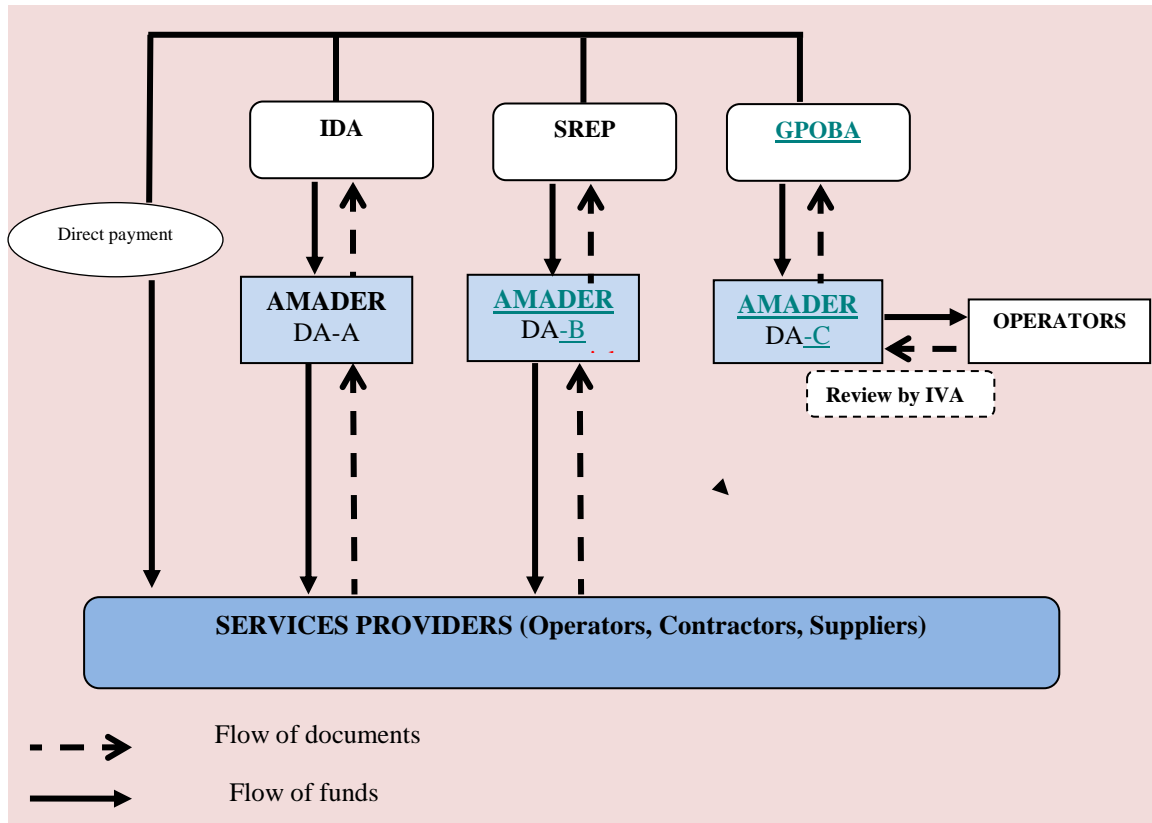
### *Designated Account*

18. Three Designated Accounts (DAs) for the three different financing sources (IDA, SREP and GPOBA) will be opened at commercial banks acceptable to IDA to facilitate payment for eligible expenditures. The DAs will be managed by AMADER according to the disbursement procedures described in the Administrative, Accounting and Financial Manual and Disbursement Letters which will be discussed in detail with the relevant government officials during negotiations. The first allocation of the Designated Accounts will cover approximately four months of expenditures. The minimum value of direct payment and special commitment is 20 percent (20 percent) of outstanding advance made to the DA.

### *Disbursement Methods*

19. Disbursement procedures arrangement will be detailed in the manual of accounting, administrative and financial procedures and the disbursement letter. Replenishment through SOEs (Statement of Expenditures), Direct Payment methods and special commitments will apply to the project. Funds will flow from the DAs to suppliers and operators. Activities co-financed by IDA and SREP will follow Bank procurement guidelines. The percentage of funding would be set in proportion to the share contributed by each donor. Reimbursements and direct payments will apply for the subsidies under OBA. The operators will pre-finance the activities and will be paid the subsidies after verification of the outputs by an IVA. For the activities related to the hiring of the IVA, replenishment of the DA will be SOE-based.

## Funds Flow Diagram



## Financial Reporting Arrangements

20. AMADER will produce quarterly unaudited Interim Financial Reports (IFRs) during project implementation encompassing activities for all components (including OBA component). The IFRs are to be produced on a quarterly basis and submitted to the Bank within 45 days after the end of the calendar quarterly period. The IFR format used for the previous HEURA project will apply. The IFR will present the consolidated financial statements (sources and used of funds and use of funds per component/categories/activities) as well as separate FS for each donor funds. AMADER will also produce the projects Annual Financial Statements and these statements will comply with SYSCOHADA and World Bank requirements. These Financial Statements will be comprised of:

- Statements of Sources and Uses of Funds which includes all cash receipts, cash payments and cash balances;
- Statement of Commitments;
- Accounting Policies Adopted and Explanatory Notes; and
- A Management Assertion that project funds have been expended for the intended purposes as specified in the relevant financing agreements.



## Auditing Arrangements

21. The Financing Agreement (FA) will require the submission of Audited Financial Statements for the project to IDA within six months after year-end. An external auditor with qualification and experience satisfactory to the World Bank will be appointed to conduct annual audits of the project's financial statements. A single opinion on the Audited Project Financial Statements in compliance with International Federation of Accountant (IFAC) will be required. In addition the auditor will provide a specific opinion on the OBA component activities. The external auditors will prepare a Management Letter giving observations and comments, and providing recommendations for improvements in accounting records, systems, controls and compliance with financial covenants stipulated in the FA.

22. The following actions need to be taken in order to enhance the financial management arrangements for the project:

### FM Action Plan

No	Action	Due Date	Responsible
1	Train the Financial Director to Bank procedures no later than one month of effectiveness and as needed during the project implementation	During Implementation	AMADER
2	Update AMADER FM procedures manual which is incorporated in the PIM to align it with the new project activities	By effectiveness	AMADER
3	Purchase and set up a new accounting software to generate financial statements and IFRs	Within three months of effectiveness	AMADER
4	Hiring the external financial auditor	Within four months after effectiveness	AMADER

### Financial Covenants

23. The Borrower shall establish and maintain a financial management system including records, accounts and preparation of related financial statements in accordance with accounting standards acceptable to the Bank. The Financial Statements will be audited in accordance with international auditing standards. The Audited Financial Statements for each period shall be furnished to the Association not later than six (6) months after the end of the project fiscal year. The Borrower shall prepare and furnish to the Association not later than 45 days after the end of each calendar quarter, interim un-audited financial reports for the project, in form and substance satisfactory to the Association. The Borrower will be compliant with all the rules and procedures required for withdrawals from the Designated Accounts of the project.

## Implementation Support Plan

24. Based on the outcome of the FM risk assessment, the following implementation support plan is proposed. The objective of the implementation support plan is to ensure the project maintains a satisfactory financial management system throughout the project's life.

FM Activity	Frequency
<b>Desk reviews</b>	
Interim financial reports review	Quarterly
Audit report review of the project	Annually
Review of other relevant information such as interim internal control systems reports.	Continuous as they become available
<b>On site visits</b>	
Review of overall operation of the FM system	Semi-annual
Monitoring of actions taken on issues highlighted in audit reports, auditors' management letters, internal audit and other reports	As needed
Transaction reviews (if needed)	As needed
<b>Capacity building support</b>	
FM training sessions	During implementation and as and when needed.

## Conclusion of the Assessment

25. The conclusion of the assessment is that the financial management arrangements meet the Bank's minimum requirements under OP/BP10.00. However some improvements would be considered in terms of training, internal control and reporting. The overall FM residual risk rating is **Moderate**.

## Procurement Arrangements

### *Procurement Environment*

26. Procurement arrangements for the Project have been designed with consideration for the country's post-election situation, the weakness of national procurement rules and procedures, past experience in procurement carried out under other Bank financed projects, and the classification of the Republic of Mali as a high risk country and also fragile state since July 1<sup>st</sup>, 2013.

### *Reference to National Procurement Regulatory Framework*

27. A Country Procurement Assessment Review (CPAR) for Mali was carried out in 2007. The assessment of the procurement regulation highlighted that the existing procurement

principles and most of the procedures needed to be strengthened. The current regulation on Public Procurement in Mali is the Decree No. 08-045/P-RM dated August 11, 2008. The focus has progressively shifted from reforming the legal and regulatory framework to focusing on strengthening the procurement capacity and the transparency of the national procurement system. In this regard, the Government has taken the following steps: (i) adopted an action plan based on the finding of the CPAR; (ii) setup a new legal and regulatory framework under the new Procurement Code; (iii) issued procurement regulations and standard bidding documents; and (iv) created a Regulatory body for public procurement and established procurement units have been established in regions and technical ministries, including the Ministry of Finance.

28. The National Competitive Bidding (NCB) will be acceptable to the Bank subject to the procedures below and as reflected in the Financing Agreement.

- a. **Use of Competitive Method:** Even though the National Procurement Code does not apply to small contracts, the procedures will require that for such contracts, a competitive method be used;
- b. **Advertisement:** In addition to the advertisement through a General Procurement Notice in the United Nations Development Business (UNDB) online and on the Bank's external website, bids would be advertised in national widely circulated newspapers;
- c. **Standard Bidding Documents:** All standard bidding documents to be used for the project shall be found acceptable to the Association before their use during the implementation of the project;
- d. **Eligibility:** No restriction based on nationality of bidder and/or origin of goods shall apply. Foreign bidders shall be allowed to participate in NCB without restriction and shall not be subject to any unjustified requirement which will affect their ability to participate in the bidding process. Recipient's government-owned enterprises or institutions shall be eligible to participate in the bidding process only if they can establish that they are legally and financially autonomous, operate under commercial law, and are not dependent agencies of the Recipient;
- e. **Advertisement:** Invitation to bids shall be advertised in a national newspaper of wide circulation or on the website of the Recipient's Procurement Regulator;
- f. **Bid Preparation:** Bidders shall be given at least thirty (30) days from the date of the invitation to bid or the date of availability of bidding documents, whichever is later, to prepare and submit bids; except in cases of emergency declared by the Beneficiary, and provided that such emergency is recognized by the Association and the Association has given its approval for less time for the bids submission;
- g. **Bid Evaluation and Contract Award:** the evaluation and contract award process of alternative bids would be revised according to Bank's Procurement guidelines. The criteria for bid evaluation and contract award conditions shall be clearly specified in the bidding documents;
- h. **Preferences:** No domestic preference shall be given to domestic/ West African

Economic and Monetary Union the West African Economic and Monetary Union (WAEMU) countries bidders; to domestically/regionally manufactured goods; and to bidders forming a joint venture with a national firm or proposing national sub-contractors or carrying out economic activities in the territory of the Recipient; and for domestically manufactured goods;

- i. **Fraud and Corruption:** In accordance with the Procurement Guidelines, each bidding document and contract shall include provisions stating the World Bank's policy to sanction firms or individuals found to have engaged in fraud and corruption as set forth in paragraph 1.16 (a) of the Procurement Guidelines; and
- j. **Right to Inspect and Audit:** In accordance with paragraph 1.16 (a) of the Procurement Guidelines, each bidding document and contract financed from the proceeds of the financing shall provide that: (i) the bidders, suppliers, and contractor and their subcontractors, agents personnel, consultants, service providers or suppliers, shall permit the Association, at its request, to inspect their accounts, records and other documents relating to the submission of bids and contract performance, and to have them audited by auditors appointed by the Association; and (ii) the deliberate and material violation by the bidder, supplier, contractor or subcontractor of such provision may amount to obstructive practice as defined in paragraph 1.16 (a) (v) of the Procurement Guidelines;
- k. **Suspension, Debarment and Exclusion:** The Association may recognize, at the request of the borrower, any exclusion from participation as a result of debarment under the national system, provided that the debarment is for offenses involving fraud, corruption or similar misconduct, and further provided that the Association confirms that the particular debarment procedure afforded due process and that the debarment decision is final.

#### *Use of Bank Guidelines*

29. Procurement for the proposed project will be carried out in accordance with the World Bank's "*Guidelines: Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers*", published by the Bank in January 2011; and "*Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers*", published by the Bank in January 2011, and the provisions stipulated in the Financing Agreement. The general descriptions of various items under different expenditure categories are described below. For each contract to be financed by the Credit, the procurement method or consultant selection method, the need for prequalification, the estimated cost, the prior review requirements, and the time frame are agreed between the Client and the Association project team in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

#### *Capacity Assessment and Remedial Actions*

30. An evaluation of the capacity of AMADER was carried out by the procurement specialist in Mali, on July 16, 2013, in line with the OP/BP 11 dated April 2013. Several shortcomings

were noted during the implementation of previous Bank funded projects, e.g. (a) significant delays in procurement processing, with a significant part of the time spent on preparation of tender specifications, and Terms of References (TORs); (b) uneven quality of procurement documents. Also, it has been pointed out that the procurement files were not always complete and also sometimes introduction of changes to the procurement methods were not accompanied by corresponding amendments to the plans. The assessment reviewed the organizational structure of the agency for implementing the project. The assessment covered areas in procurement such as legal and regulatory framework, roles and responsibilities, internal and external controls, approval systems and accountability, contracts register, responsibilities and roles of various players in contracted management based on both Government requirements and as required for prior review contracts for IDA. These issues are being factored into the design of procurement arrangements for the new Project (recruitment of a procurement specialist and of two technical experts).

31. Procurement issues and risks for implementation of the project which have been identified include: (i) lack of adequate procurement staff; (ii) lack of an updated manual of procedures including the current trends in line with World Bank procurement guidelines and Public Procurement Code; (iii) lack of the procurement plan; (iv) delays in the procurement processes, such as the selection of contractors, suppliers, consultants; and (v) poor record keeping system.

32. The overall unmitigated risk for procurement is “*Substantial*”. The overall procurement residual risk rating is **Moderate**. The proposed correctives measures which have been agreed to mitigate the risk are summarized in the following table:

#### Action Plan for Strengthening Procurement Capacity

No	Key risks	Mitigation Actions	By Whom	By When
1	-Lack of proficient procurement personnel to implement procurement actions	-Appointment of one proficient procurement specialist through a competitive process to support the project.	AMADER	-Within 2 months of effectiveness
2	-Lack of adequate key staff in the Procurement Unit	-Participation in procurement training workshops for mainstream procurement and technical staff at specialized procurement training institutions like ISADE, CESAG (Senegal) or any other acceptable institution to enhance their knowledge. -Provide hands-on training and mentoring to the procurement unit and other technical staff by involving them in the activities of the project -Continuous capacity building program to be developed for mainstream procurement and technical staff to respond to specific gaps identified.	AMADER  Procurement Specialist  AMADER/ Procurement Specialist	-Not later than 3 months within project implementation  (not a legal covenant)
3	-Lack of familiarity with	-Update of project implementation manual in line with World Bank procurement procedures and	AMADER	-Prior to

No	Key risks	Mitigation Actions	By Whom	By When
	current trends and updates of World Bank procurement guidelines and procedures	Public Procurement Code and agreed by Bank. -Organize a workshop to update procurement staff on current changes in Bank procurement procedures and work closely with Bank PS.		effectiveness  - At Project launch and throughout the life of the Project
4	- Delays in taking procurement actions like preparation of BD, RFPs, BER, TER, etc.	-Close monitoring of procurement plans on a monthly basis and closely monitor and exercise quality control on all aspects of the procurement process, including evaluation, selection and award.	AMADER /Procurement Specialist	- Throughout the life of the Project
5	-Inadequate space and lack of equipment for filing and archiving	-Provision of adequate space and equipment for filing and archiving -Develop good filing and data management systems -Carry out training	AMADER	- Within six months of effectiveness - (not a legal covenant)

33. **Operating Costs:** Operational costs would include project implementation-related expenditures such as in-country travel, office materials and supplies (stationary and other consumables, but not the purchase of equipment), office rentals and maintenance, utilities (including electricity and water), communication costs (including telephone and internet charges), equipment rental, operation maintenance and repair, travel and transport cost of the staff associated in the project implementation, including, per diem for project supervision activities in the field. These items will be procured using the procedures detailed in the Manual of procedures, which was reviewed and found acceptable to the Bank.

34. **Procurement Plans.** Simplified Procurement Plan: The Recipient developed a simplified procurement plan as per requirement of OP/BP 10.00 indicating procurements to be carried out over the first 18 months of the project implementation. The procurement plan consists of the procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, and prior review requirements. This plan was reviewed and approved by the Bank on October 18, 2013, and agreed at negotiations. It will be available in the project's database and in the Bank's external website after project approval. The procurement plan would be updated at least annually, or more frequently as required, to reflect the actual project implementation needs and improvements in institutional capacity.

#### Prior Review and Procurement Method Thresholds – Mali

	Procurement Method	Threshold for Procurement Method	Prior Review Threshold	Comments
1	ICB (Works)	>= 10,000,000	All ICB contracts	None
2	NCB (Works)	<10,000,000	First two contracts	None

3	Shopping (Works)	<= 100,000	None	Unless contracts specified in the PP by the Bank
4	ICB (Goods)	>= 1,000,000	All ICB contracts	All
5	NCB (Goods)	<1,000,000	First two contracts	None
6	ICB (Non-Consulting Services)	>= 1,000,000	All contracts	All
7	NCB (Non-Consulting Services)	>= 1,000,000	First two contracts	None
8	Shopping (Goods)	<= 100,000	None	None
9	Direct Contracting	All	All contracts	All

### Procurement Packages with Methods and Time Schedule - Goods, Works, and Non Consulting Services

(a) List of contract packages to be procured following ICB and direct contracting

(b) ICB contracts of goods estimated to cost US\$1,000,000 equivalent or above per contract and all direct contracting will be subject to prior review by the Bank

1	2	3	4	5	6	7	8	9
Ref. No.	Contract Description	Estimated Amount (US\$)	Procurement Method	P-Q	National Preference	Prior/Post	Date for Opening of Bids	Comments
1	Turnkey contract for the hybridization of 10 mini-grids	7,000,000	ICB	No	No	Prior	Jan 2015	
2	Mini-grid network extensions	400,000	NCB	No	No	Prior		1st two contracts are prior review
3	Procurement of 10,000 solar lanterns	500,000	ICB	No	No	Prior		

### Selection of Consultants

35. **Prior Review Threshold:** Selection decisions subject to Prior Review by Bank as stated in Appendix 1 to the Guidelines Selection and Employment of Consultants.

	Procurement method	Threshold for Procurement Method	Prior Review Threshold	Comments
1	Competitive Methods (Firms)	>= 200,000	All	QCBS/QBS/FBS/CQ
2	Single Source Selection	N/A	All	SSS

3	Consultant Qualification	<= 200,000	First two contracts	CQ
4	Least-Cost selection	<= 100,000	Contract of financial auditor	For relatively small standardized assignments such as auditing
5	Individual Consultant	N/A	>= 100,000	All

36. Consultancy services estimated to cost above US\$400,000 per contract for engineering and contract supervision and US\$200,000 equivalent or above per contract for other consultancy assignments and all single source selection of consultants (firms and individuals) irrespective of amount will be subject to prior review by the Bank. Short lists composed entirely of national consultants: Short lists of consultants for services estimated to cost US\$400,000 equivalent or less per contract for engineering and contract supervision and US\$200,000 equivalent or less per contract for other consultancy assignments may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. However, if foreign firms express interest, they will not be excluded from consideration. All terms of reference for consultants' services, regardless of contract value, shall also be subject to the World Bank's prior review.

37. Vocational training and workshops, within and outside the country, as well as study tours will be conducted in accordance with an annual program approved by the World Bank. The program will clearly define the nature of the training, the institutions in which it will take place, an estimate of its costs and the content of the courses and the names and duties of the beneficiaries. The procedures of such training will also be defined in the Project Implementation Manual.

#### **Procurement Packages with Methods and Time Schedule - Consulting Services**

1	2	3	4	5	6	7
Ref. No.	Contract Description	Estimated Amount (US\$)	Procurement Method	Prior/Post	Expected Proposals Submission	Comments
1	Hiring of GPOBA verification agents	300,000	QCBS	Prior		
2	Owners Engineer	500,000	QCBS	Prior	Jan 2015	
3	Project Auditor	50,000	LC	Prior		

38. Frequency of Procurement Supervision - Procurement Post Reviews (PPRs) and Independent Post Reviews (PRs) by the World Bank. Based on the assessed agency



implementation risk for procurement, which is Substantial, the World Bank will carry out PPRs or IPRs for all contracts that will be based on the procurement plan not having been subject of prior review by the World Bank using a sample of 15 percent. Based on continuing assessment of risk and the success of risk mitigation measures implemented, the sample size may be reduced as risk mitigation measures are successfully implemented. These changes will be communicated to the AMADER as outcomes of the PPR / IPR exercise, which also result in the revisions of the prior review and National Competitive Bidding ("NCB") thresholds.

39. **Fraud, Coercion and Corruption.** The implementing agency as well as bidders and service providers, i.e., suppliers, contractors, and consultants shall observe the highest standard of ethics during the procurement and execution of contracts financed under the project in accordance with paragraphs 1.16 and 1.17 of the Procurement Guidelines and paragraph 1.23 and 1.24 of the Consultants Guidelines, in addition to the relevant Articles of Mali Public Procurement Code which refer to corrupt practices. Project's procurement activities will be carried out in accordance with the 'Guidelines on Preventing and Combating Fraud and Corruption in Projects Financed by IBRD Loans and IDA Credits and Grants' dated 15 October 2006 and updated in January 2011.

40. **OBA Activities:** Procurement under GPOBA grant will be done by private sector entities, which will be reimbursed based on the agreed fixed subsidy per connection/SHS upon verifications and based on separate Sub-Grant Agreements. Procurement by the private sector selected by AMADER based on pre-identified criteria will follow commercial practices. The IVAs will be hired by AMADER on a competitive basis.

*Environmental and Social (including Safeguards)*

41. The project is intended to have positive impacts for the overall development and growth of the country. In that context, the following socially positive project impacts can be highlighted: (i) increasing quantity and quality of electricity services in rural areas not only for rural households but also for small businesses; (ii) improving the quality of social services, particularly health services supplied by small health facilities in the rural areas which cannot afford individual generators; and (iii) gradually substituting traditional fossil fuel based-solutions and the ineffective use of biomass through investments in solar energy and biofuel. In summary, the project aims at linking economic, social and environmental benefits in a single paradigm of sustainable development and poverty reduction. This will enhance, in an integrated way, energy security, business start-ups, reduction of local pollution and improvement of the livelihoods and living conditions of the local communities (with special attention to vulnerable groups, including women and young people).

42. The proposed project is a category B project (Partial Assessment). Although the potential environmental and social impacts of the investments under the proposed project are expected to be generally minimal, localized impacts may occur, thus requiring appropriate mitigation. The following safeguard policies are triggered: OP/BP 4.01 (Environmental Assessment), Physical Cultural Resources OP/BP 4.11 and OP/BP 4.12 (Involuntary Resettlement). As the sites for the installation of the mini-grids have not been selected, AMADER's previous Environment and Social Management Framework (ESMF) and a Resettlement Policy Framework (RPF) prepared for the HEURA project have been updated for the proposed project and disclosed in-country and

on the Infoshop on October 17, 2013. A chance finding procedure will be developed as part of the site-specific safeguards instruments.

43. The ESMF identifies some minor potential negative impacts from the installation and operation of the mini-hybrid systems, the Solar Home Systems and the associated grid extension (i.e. minor resettlement for the mini-hybrid systems, impacts on the cultivated land during the construction of the transmission lines, impacts on socio-economic activities in case of land expropriation, inadequate handling of used batteries, etc.). However, those impacts could be mitigated with the implementation of adequate planning measures, the application of acceptable environmental and social measures for the installation phase as well as adequate handling of residues and used batteries, and a compensation plan in case of resettlement. In addition, the selection of the sites for the installation of mini-hybrid systems should also include environmental and social criteria to minimize those impacts. Finally, the ESMF recommends strengthening the environmental and social capacity of AMADER, conduct periodic environmental and social audits and provide training and capacity building to the private operators.

44. A functional environmental and social management unit is in place within AMADER. This unit is familiar with Bank's procedures as it was in charge of supervising the implementation of the ESMF and RPF for the HEURA project; however its capacity would need to be strengthened, as recommended by the ESMF. Under its previous HEURA project, AMADER appointed a gender focal point within its agency to help integrate gender issues across its programs. This role will allow for timely guidance and technical assistance during project preparation and implementation.

#### *Monitoring & Evaluation*

45. Overall monitoring and evaluation (M&E) of project activities will be AMADER's responsibility. The agency will carry out monitoring and evaluation of the different components/activities in accordance with the indicators included in the results framework (Annex 1). The indicators, targets and mechanisms for monitoring have been discussed and agreed with AMADER. No later than 45 days after each quarter, AMADER will submit to the Bank the quarterly progress reports covering all project's activities, including procurement and financial summary report. Annual reports will be also submitted by AMADER to the Bank.

46. Bi-annual reviews by the World Bank, the first one to take place six months after effectiveness, should provide detailed analysis of implementation progress toward achieving the Project Development Objective and include evaluation of the financial management and a post-review of procurement aspects.

47. With regard to impact evaluation, some of the outcomes expected from the project (such as impacts on income-generating activities and gender for example) are challenging to monitor on a regular basis in the absence of workable reporting arrangements and would therefore be assessed during an impact evaluation study – to be carried out at the beginning of project implementation and before project closing. At a later stage of project implementation (for e.g. during MTR), whether to include specific targets for those outcomes in the results framework will be determined. AMADER has a monitoring and evaluation specialist on staff who has

previous experience monitoring the HEURA project.

### *Role of Partners*

48. In Mali, the development partners have actively embarked on the implementation of the Paris Declaration, in partnership with the GoM. A Joint Country Assistance Strategy (SCAP 2008-2011) binds 14 partners, including the African Development Bank and the WB Group for improvement in aid effectiveness and alignment with national priorities, such as the new *Growth and Poverty Reduction Strategy Paper* (2012-2017). Beyond these national frameworks, the development partners are also organized into sector Thematic Groups, including the “Energy and Infrastructure Group” chaired by the African Development Bank. The partners coordinate their sector dialogue with the Ministry of Energy and Water under the thematic group. The Energy Thematic Group, as well as the Environment/Climate Change Thematic Group, had been involved in the formulation of the SREP-Mali Investment Plan since its inception.

49. During the preparatory phase of the Investment Plan and its project components, several development partners had expressed interest in co-financing SREP projects; others to facilitate synergies with on-going projects to ensure better consistency with interventions funded by them. Since the Military Coup in March 2012, however, programs/projects were kept on hold. Representatives of development cooperation left the country. Since the second half of 2013, many development partners are in the process of re-engaging in Mali and re-assess their activities. Therefore, discussions have been on-going with development partners for the past few weeks on synergies to be created with the project. Partnerships could take several forms, depending on the specificity of the partners, their expertise and value added as well as the status of some their current or future programs/projects (at national and/or sub-regional level). It is envisaged to re-mobilize and strengthen the Coordination with the development partners.

50. At the same time, contacts with specialized financial institutions (e.g. micro finance) will help to define a framework on “clean investments” in the private sector. This is critical since a major constraint for the development of the sector is the expensive nature of loans provided by local commercial banks to the Malian private sector. Hence, this will allow to overcome one of the identified barriers in the RE sub-sector.

51. The following activities give an indication of on-going activities/projects in the rural electrification sector:

- AMADER submitted a financing proposal to IRENA for the hybridization of up to 30 existing isolated mini-grids.
- KfW is financing 14 new rural mini-grids supplied with hybrid systems.
- GIZ/ELCOM is supporting a 20 kWp hybrid power station and SHS.
- There is a growing trend among United Nations Agencies (notably UNDP) and the European Union towards greater involvement in the sector. Through its White Paper on Energy, France (AFD) has also expressed the desire to enter the country’s renewable energy sector in the medium term.

- UNWOMEN together with AMADER is developing the “Energy for the Reduction of Gender Inequality in Mali” program, focusing on improving the quality of community services and productive uses through modern sources of energy.

52. The project will also benefit from GPOBA support. GPOBA (and DFID in particular) approved the Project for eligibility for OBA subsidies as it meets its criteria of eligibility for support regarding the provision of access for the poor to basic electricity services and being a fragile state.

## Annex 4: Operational Risk Assessment Framework (ORAF)

### MALI: Rural Electrification Hybrid System Project

1. Project Stakeholder Risks						
1.1. Stakeholder Risk	Rating	Substantial				
<p><b>Description:</b> The imbalance in energy prices between national utility tariffs and rural prices is creating significant political and social tensions and calls for harmonization. Localities not selected for financing for the installation of hybrid mini-grid systems or SHS could be dissatisfied that expectations are not met and could generate tensions within the Country.</p>	<p><b>Risk Management:</b> The project will contribute to mitigation of the imbalance between national utility tariffs and rural electricity prices in targeted mini-grids by reducing fuel costs with PV generation. Moving towards cost reflective national utility tariffs, which the authorities have started to do this year, will also reduce this imbalance. Meanwhile, AMADER, through its information and dissemination campaigns, consultations with village committees, has also a critical role to play to help manage expectations of the rural population. Localities to benefit initially from funding from the project will be selected based on objective criteria. Furthermore the project aims to open the way for future hybridization funding in due course.</p>					
	<p><b>Resp:</b> Client</p>	<p><b>Stage:</b> Preparation, implementation</p>	<p><b>Recurrent:</b> <input checked="" type="checkbox"/></p>	<p><b>Due Date:</b> Ongoing</p>	<p><b>Frequency:</b> Ongoing</p>	<p><b>Status:</b> Not yet started</p>
2. Operating Environment Risks (Note for information: this section is not disclosed at Negotiation and Board presentation stages)						
2.1. Country	Rating	Substantial (H)				
<p><b>Description:</b> Security and political instability risks have decreased in 2013, with (i) the successful organization of presidential elections, and (ii) the establishment of peace-keeping forces and the stabilization of the security situation in Northern Mali.</p>	<p><b>Risk Management:</b> The Bank suspended its operation in the country following the March 2012 events and entered into OP7.30. Following the OP7.30 assessment mission and fiduciary assessment undertaken between June and August 2012, three operations have been approved between March and April 2013, and a new Interim Strategy Note has been endorsed by AFRVP and was presented to the Board on June 18, 2013. In response, the Bank is: (i) conducting a regional study to better understand factors behind insecurity in the region and to identify the type of development solutions which could help address this challenge, and (ii) preparing a new operation to support national reconstruction and economic recovery.</p>					

In the short run, risks of sporadic terrorist attacks nonetheless remain; in the longer run, risks of political destabilization at the regional level also remain. Lack of progress in dealing with the situation of Malian displaced and refugees' population could also be a factor of political instability.

Risks of macroeconomic instability and associated difficulties for the Government to properly execute its budget have also declined in 2013 with the resumption of foreign assistance and the large pledges from the international community. Macroeconomic risks today stem mostly from insufficient capacity to absorb aid efficiently, at both macroeconomic (inflation) and microeconomic (corruption, duplication) levels.

Fiduciary risks remain substantial, in the absence of significant progress during the political crisis on audit controls and follow ups through the judicial system (impunity), as well as insufficient public financial management capacity and transparency at the local level.

Macroeconomic risks are being mitigated by IMF/World Bank close monitoring of macroeconomic developments, through their respective financial programs (Extended Credit Facility and Development Policy Operations). Continued supervision from BCEAO on monetary and financial developments is also a strong instrument for mitigating risks of financial and Balance of Payments instability.

From January 2014, the World Bank will take the lead of the donor coordination structure, with a view to improving aid effectiveness through better disbursement monitoring and closer alignment to national systems and priorities. Efforts to mitigate fiduciary risks are undertaken through ongoing Development Policy Operations focused on governance, as well as through the World Bank Governance and Decentralization Technical Assistance Project, in coordination with other donors involved in these fields.

As part of its re-engagement strategy, the Bank is conducting policy and technical discussions with the Government, encouraging careful implementation of the 2012 budget, and prudent budgetary appropriations for 2013. Malian authorities have committed as well to protecting current expenditures for basic service delivery (education, health, agriculture) and social transfers. Also, authorities decided to continue to honor external debt service in spite of the suspension of aid programs, with a view to facilitate a quick re-engagement of donors when political conditions allow. The Bank's re-engagement strategy focuses on supporting basic services delivery through resumption of disbursements concerning the existing portfolio. A social safety net operation and an Education for All emergency project are planned to address the most vulnerable populations and poorest areas of the country.

The issue of improved oversight was being addressed in the new PRSC series when the crisis occurred. The Bank assisted the Government to design and implement the procurement reform, and intends to revisit the agenda immediately after the elections. In particular, the role of the Regulatory Authority needs to be strengthened. It is urgent to: (1) develop and implement a Capacity Building Strategy for staff involved in policy formulation, oversight and transactions; (2) build a

	solid oversight system; and (3) enforce the use of sanctions. A Policy Note on GAC was released to help the Bank refocus its engagement in this area. Actions planned under the PAGAM/GFP II for 2011-2015 aim to address key issues facing the PFM systems. Priorities include: (i) finalize the computerized accounting system, and fully implement the application AICE through its redeployment to revenues' services and its interconnection with the regions, (ii) strengthen the capacity of the section of accounts of the Supreme Court to develop a comprehensive action plan to audit the local communities and the state-owned enterprises, and (iii) align the legal and institutional framework with WAEMU Directives.					
	<b>Resp:</b> Bank, Client	<b>Stage:</b> Implementation	<b>Recurrent:</b> <input checked="" type="checkbox"/>	<b>Due Date:</b> Ongoing	<b>Frequency:</b> Ongoing	<b>Status:</b> Ongoing
<b>2.2. Sector and Multi-Sector</b>	<b>Rating</b>	<b>Moderate (M)</b>				
<b>Description:</b> At the sector level, there are significant political risks, related to the gap between regulated and uniform utility tariffs and the much higher prices applied by rural operators.	<p><b>Risk Management:</b></p> <p>The gap between regulated and rural tariffs reflects the much higher cost of providing the service in rural areas, but is amplified by regulated utility tariffs below costs. The State-owned utility EDM-SA is in a currently difficult operational and financial situation, which will require moving towards cost reflective tariffs. In such a context, any attempt to harmonize price levels between utility tariffs and rural mini-grids would require large additional operating subsidies to the electricity sector in order to subsidize local operators for the loss of revenues. In addition to the cost, administering and controlling subsidies would present considerable challenges. The Malian authorities have put in place a rural electrification model, which is not dependent on budget transfers for sustainable current operations. This financial autonomy of rural operators for financing current operations constitutes strength. The project, by reducing operating costs for rural operators, will contribute to mitigating the risks associated with the pricing gap between utility tariffs and rural prices.</p> <p>In addition, the critical situation of the utility has no direct impact on rural electrification by mini-grids which are managed and regulated separately. AMADER currently acts as de facto regulator for rural electricity tariffs. The advantage of this arrangement is that AMADER possesses the required expertise and information regarding rural electricity operators, and has a strong institutional investment in the sustainability of rural electrification. This type of regulatory arrangement is now recognized as good practice, and as superior to regulation of rural electricity prices by a national regulator.</p>					
	<b>Resp:</b> Client	<b>Stage:</b> Preparation and Implementation	<b>Recurrent:</b> <input checked="" type="checkbox"/>	<b>Due Date:</b> Ongoing	<b>Frequency:</b> Ongoing	<b>Status:</b> Ongoing
<b>3. Implementing Agency Risks (including fiduciary)</b>						
<b>3.1. Capacity</b>	<b>Rating</b>	<b>Substantial (S)</b>				

<p>Description:</p> <p>One challenge for AMADER's will be to sustain the achievements in terms of rural access and its implementation capacity, independently from projects by donors.</p>	<p><b>Risk Management:</b></p> <p>The rural electrification agency (AMADER), established in 2004 with the support of the Bank-financed HEURA project, has been critical in the expansion of rural access in Mali. The ICR of the HEURA project has rated AMADER's performance as implementing agency as Satisfactory. The GoM has initiated an institutional assessment of AMADER and its missions in order to identify mechanisms to ensure sustainability of AMADER. The project will further strengthen AMADER's capacity in some areas directly related to project implementation.</p>					
	<p><b>Resp:</b> Client</p>	<p><b>Stage:</b> Preparation and implementation</p>	<p><b>Recurrent:</b> <input checked="" type="checkbox"/></p>	<p><b>Due Date:</b> 2014 (Institution. assessment)</p>	<p><b>Frequency:</b> Once</p>	<p><b>Status:</b> Under preparation</p>
<p><b>3.2. Governance</b></p>	<p><b>Rating</b></p>	<p><b>Moderate (s)</b></p>				
<p>Description.</p> <p>Poor governance impacting on autonomy in project implementation.</p>	<p><b>Risk Management:</b></p> <p>The overall governance environment for Mali is challenging. However, AMADER is an independent public body with a distinct legal personality with its own board of directors and a greater ability to retain needed expertise and act autonomously compared to a line ministry. AMADER has a good track record with fiduciary functions for HEURA project implementation. As per the ICR, <i>“Financial management and procurement aspects of the project were continuously rated Satisfactory or Moderately Satisfactory and the related FM risk was rated moderate throughout project implementation. Overall, financial management covered adequately the project's accounting and reporting arrangements, internal control procedures, planning and budgeting, counterpart funding, funds flow arrangement, external audit reporting arrangements, and project accounting staff issues”</i>.</p> <p>Implementation arrangements for the project have been agreed with AMADER based on the evaluation its capacity and procedures. While the FM risk for AMADER appears moderate, the agency will be required to play a greater role in procurement than under the HEURA project which will necessitate some capacity strengthening. On the technical side, AMADER also needs strengthening of its expertise for supervising the installation and functioning of hybrid mini-grids. The project will finance the necessary technical expertise and training</p>					
	<p><b>Resp:</b> Client, Bank</p>	<p><b>Stage:</b> Implementation</p>	<p><b>Recurrent:</b> <input checked="" type="checkbox"/></p>	<p><b>Due Date:</b> Throughout project implementation</p>	<p><b>Frequency:</b> Ongoing</p>	<p><b>Status:</b> Not yet started</p>
<p><b>4. Project Risks</b></p>						
<p><b>4.1. Design</b></p>	<p><b>Rating</b></p>	<p><b>Substantial (S)</b></p>				
<p>Description:</p>	<p><b>Risk Management:</b></p>					



Hybrid systems are a relatively new area for AMADER requiring specialized technical expertise and raising new issues (e.g. battery replacement...).	International/local technical expertise has been mobilized during project preparation to assist AMADER. Also, an assessment of existing hybrid systems in Mali is ongoing in order to draw operational lessons. The project will also support focused technical assistance to operators and AMADER regarding hybrid system operations.					
	<b>Resp:</b> Client, Bank	<b>Stage:</b> Preparation and implementation	<b>Recurrent:</b> <input checked="" type="checkbox"/>	<b>Due Date:</b> Ongoing	<b>Frequency:</b> Throughout project preparation and implementation	<b>Status:</b> Ongoing
<b>4.2. Social and Environmental</b>	<b>Rating</b>	<b>Moderate (M)</b>				
<p>Description:</p> <p>Social and Environmental risks may occur due to: (i) participation of national institutions with limited experience in environmental management, (ii) significant but limited capacity for safeguard supervision by the Implementing Agency, and (iii) potential impacts associated with disposal of used components (batteries).</p>	<b>Risk Management:</b>					
	<p>The introduction of solar PV and SHS will have a positive environmental impact by reducing the use of diesel and expanding the system capacity with clean solar technology. The social impact will be positive due to increased access and improvements of service hours and as such in the quality of lives of beneficiaries. Construction of distribution lines may require compensation and/or resettlement of people in a few cases. AMADER's Environment Unit is familiar with World Bank safeguard policies and has built capacity during the HEURA project implementation. The ESMF and RPF recommendations to strengthen AMADER's environmental and social capacity will be enforced to ensure an adequate management of potential negative environmental and social issues that might be raised by the project. The project will include funding to study the issue of battery recycling/disposal after they reach the end of their technical life (4 to 5 years).</p>					
	<b>Resp:</b> Client, Bank	<b>Stage:</b> Preparation Implementation	<b>Recurrent:</b> <input checked="" type="checkbox"/>	<b>Due Date:</b> September 2013(ESMF update)	<b>Frequency:</b> Throughout project preparation and implementation	<b>Status:</b> Ongoing
<b>4.3. Program and Donor</b>	<b>Rating</b>	<b>Moderate (M)</b>				
<p>Description:</p> <p>Delays in processing or availability of SREP or GPOBA financing can delay overall project preparation.</p>	<b>Risk Management:</b>					
	<p>The three sources of funds are administered by the World Bank therefore it is expected that there will be no delays in processing the three sources together. SREP and GPOBA funding has been confirmed. The team will continue maintaining a regular coordination with the SREP TF Committee and GPOBA.</p>					
	<b>Resp:</b> Bank, SREP,	<b>Stage:</b> Preparation	<b>Recurrent:</b> <input type="checkbox"/>	<b>Due Date:</b> October 2013	<b>Frequency:</b> Once	<b>Status:</b> Not yet started

	GPOBA			(GPOBA) October 2014 (SREP)		
<b>4.4. Delivery Monitoring and Sustainability</b>	<b>Rating</b>	<b>Moderate (M)</b>				
<p>Description:</p> <p>Monitoring of the delivery of SHS or solar PV and of results on the ground will be critical and difficult given the large number of sites and operators.</p> <p>Many rural operators are financially weak.</p> <p>Limited capacity and experience of most private operators in operating and maintaining hybrid systems.</p>	<b>Risk Management:</b>					
	<p>The need to improve the monitoring of operators has been incorporated into the project design, drawing into the achievements and limitations of the HEURA project. An independent consultant will support AMADER on the supervision of the implementation and operation of the systems. GPOBA will also finance Independent Verification Agents (IVA) to ensure that the systems are properly installed. Additional technical capacity for AMADER will also be provided by the Project.</p> <p>The project will have a positive impact on the finances of operators by reducing their exposure to volatile oil prices. More than 60 rural electrification operators are currently active in Mali. A few operators are emerging with more than a dozen mini-grids under operation and easier access to credit. The deployment of hybrid systems is expected to help reduce rural electricity prices. However, rural tariff regulation by AMADER will need to integrate the requirement of sufficient cash-flow for maintenance and equipment renewal.</p> <p>The project will provide targeted technical assistance and training to operators with regard to hybrid systems. In addition, the adoption of a standardized technical approach for all projects will facilitate the strengthening and diffusion of local technical expertise.</p> <p>In addition, the project will use the mechanisms in place for community participation and complaints handling (“<i>comités villageois</i>”) to strengthen monitoring of the project.</p>					
	<b>Resp:</b> Client, Bank	<b>Stage:</b> Preparation Implementation	<b>Recurrent:</b> <input checked="" type="checkbox"/>	<b>Due Date:</b> Ongoing	<b>Frequency:</b> Ongoing	<b>Status:</b> Not yet started
<b>5. Overall Risk</b>						
<b>Preparation Risk Rating: Substantial (S)</b>			<b>Implementation Risk Rating: Substantial (S)</b>			
<p>Comments:</p> <p>The substantial rating combines a high country risk with some substantial project specific risks. The proposed project is largely a follow-up on a previous Bank operation, which has been mostly successful.</p>			<p>Comments:</p> <p>The substantial rating combines a high country risk with some substantial to moderate project specific risks. Project implementation will build on the existing Malian rural electrification model (institutions, local operators).</p>			

**Annex 5: Implementation Support Plan**  
**MALI: Rural Electrification Hybrid System Project**

**Strategy and Approach for Implementation Support**

1. The strategy for implementation support (IS) has been developed based on the nature of the project and its risk profile. It will aim at making implementation support to the client more flexible and efficient, and will focus on implementation of the risk mitigation measures defined in the ORAF.
2. The World Bank Task Team Leader will handle the day-to-day matters of the project as well as coordination with the client and among Bank team members. The implementation support envisaged under the proposed project includes technical and fiduciary (FM and procurement) support.
3. The team proposes bi-annual supervision missions. In line with the World Bank’s policy, the team would conduct twice-yearly supervision missions, including technical and fiduciary staff. In conjunction with the Government counterparts, the World Bank team would monitor and report on progress against the monitoring indicators agreed in the Results Framework, as well as verification of their achievement. They will also monitor risks, updating the risk assessment as needed and paying particular attention to the implementation risks.
4. A mid-term review would encompass a more in-depth stock-taking of performance under the project. It would be carried out approximately half-way through implementation of the proposed project. The mid-term review would assess progress towards achieving the individual Project Development Indicators and Project Development Objective. Based on the assessment of progress at the mid-point of the program, recommendations for improvements/changes and use of the contingency funds to the Project would be considered by both the Government counterparts and the World Bank management team. The mid-term review would also review overall Project Implementation arrangements, making adjustments as necessary.
5. Tables 1 and 2 below map out the proposed implementation plan, skills mix and other inputs required.

**Implementation Support Plan**

*Implementation Plan*

<b>Time</b>	<b>Focus</b>	<b>Skills Needed</b>	<b>Resource Estimate</b>	<b>Partner Role</b>
First twelve months	Team leadership, technical and procurement review of the ToRs and procurement documents and Institutional arrangement and Project supervision coordination	TTL, rural electrification specialist, energy specialist, GOPBA and Lighting Africa specialists, Procurement and FM specialists	US\$150,000	Ongoing exchanges of information as required by the preparation of the Project; preparation of TORs, procurement of goods and

				consultants; preparation of Project reports  Project implementation specialists appointed and available for training
2-48 months	Project overall supervision, technical and procurement review of the ToRs and procurement documents; technical support; Project supervision coordination  Fiduciary compliance	TTL, rural electrification specialist, energy specialist, GOPBA and Lighting Africa specialists, Procurement and FM specialists	US\$125,000 per annum	Supervision of installation and operation of mini- hybrid systems and mini-grids and

***Skills Mix Required***

<b>Skills Needed</b>	<b>Number of Staff Weeks</b>	<b>Number of Trips</b>	<b>Comments</b>
TTL/Power Sector Specialist	12 SWs annually first twelve months; 6 SWs annually afterwards	2 per annum	Washington DC based
Rural Electrification Specialist	4 SWs annually first twelve months; 3 SWs annually afterwards	2 per annum	Washington DC based
Energy Specialist	4 SWs annually first twelve months; 3 SWs annually afterwards	2 per annum	Washington DC based
Environmental / Social Specialists		1 per annum	Country Office staff
GPOBA Specialist		1 per annum	Washington DC based
Lighting Africa specialist		1 per annum	Washington DC based
Procurement	3 SWs annually first twelve months; 2 SWs annually afterwards	2 per annum	Country Office staff
FM	3 SWs annually first twelve months; 2 SWs afterwards	2 per annum	Country Office staff

***Partners***

<b>Name</b>	<b>Institution/Country</b>	<b>Role</b>
	<i>kFW / Germany</i>	<i>Hybridization finance</i>
	<i>UNWomen</i>	<i>Gender</i>

**Annex 6: Economic and Financial Analysis**  
**MALI: Rural Electrification Hybrid System Project**

**A. Summary**

1. The project would finance the introduction of PV solar generation in about 50 rural mini-grids currently operating purely on diesel generation resulting in the introduction of installation of 4.8 MWp of renewable capacity and associated equipment (including storage). In addition the project will finance connections for about 12,000 rural households (primarily to mini-grid, and with SHS for about 2,400 households).
2. Hybridization will allow for a reduction in fuel costs, more reliable supply and extended service hours and benefit existing electricity consumers and operators. Newly connected households would gain access to electricity.
3. There is significant global evidence that rural electrification projects can generate significant economic benefits in the short-term and even more so in a longer-term perspective. Rural access to modern energy services reduces the cost of and improves access to sustainable lighting and communication services. It also improves the quality of basic social services (health, education, and security in particular with public lighting). In the case of Mali, a survey carried out in 2009 of a representative sample of about 2,000 clients of rural mini-grids has also demonstrated a fairly significant proportion of connections (15 percent) dedicated to a large array of productive uses of electricity (for e.g. retail and services, workshops, ice-making, etc.).
4. *Rationale for Public Sector Provision/Financing:* Globally, multiple effective rural electrification models have been piloted. Some of them are based on public sector provision, others on private operators and/or cooperatives. All of them however have been based on sustained commitment of the authorities and on public sector financial support. The Malian rural electrification model is based on provision of service by local private operators, charging prices sufficient to cover operating costs, with subsidization of a majority of investment costs. The proposed operation would strengthen this model by reducing its exposure to volatile fuel prices.
5. *Value-added of Bank's Support:* The World Bank involvement in this project would be in the continuity of the HEURA project (2004-2012) which played a critical role in the creation of the rural electrification sector. It builds on the capacity built by rural operators and AMADER in the course of HEURA implementation. Thanks to the SREP and GPOBA financing, the project will contribute to the mainstreaming of hybrid PV solar generation in rural mini-grids, a technology which seems to have a clear potential in a country such as Mali with ample solar resources, but a geography limiting the scope for grid-roll out.
6. *Methodology of Economic Analysis:* On the cost side, the analysis of the project considers the initial investments in hybrid systems and mini-grids extension, as well as the incremental operating and maintenance costs resulting from the installation of hybrid systems (including battery replacement) to be financed by the operators (though some expenditures for training of operators would be supported through the project). Expenditure and benefits for Lighting Africa and energy efficiency activities (under component 2) are not considered in the analysis.
7. On the benefit side, the major benefits derived from the project will be the reduction of diesel generation (substitution) and increased access. The substitution benefits are estimated

based on the reduction in fossil fuel-based generation costs (mainly fuel, lubricants and spare parts consumption). The benefits from increased access through new connections is valued at the estimated willingness to pay (WTP) of rural households. The WTP estimates are derived from the observed energy budgets of rural households and are therefore high on a per kWh basis since electricity will substitute to costly energy usages (kerosene and dry cell batteries).

8. *Key Results and Conclusions:* Based on the above methodology, the project EIRR is estimated at **11.1 percent** overall, corresponding to a Net Present Value of US\$2.6 million for total initial investments of US\$37.6 million. The project Economic Net Present Value would be derived primarily from increased access by poor households. The estimated rate of return of stand-alone hybridization (in substitution to fossil fuel based generation), is estimated at 9.1 percent. This rate of return is based on an estimate of investment costs for hybrid (US\$6,800 per kWp excluding thermal gen-set) which considers only prudent cost reductions compared to recent projects in Mali.

9. Given the decreasing cost of solar equipment, batteries and converters, and increased local contractor capacity, it is however expected that costs could fall further during project implementation. By bundling several sites (e.g. contracts for 10 sites of 100 kWp each instead of one tender for a 50 kWp site), and maximizing international competition for procurement, the project will seek to accelerate cost reductions. In the future, it is therefore expected that the equipment of new greenfield sites, as well as the expansion of existing hybrid sites, would carry lower costs which would facilitate finance mobilization.

## B. Detailed Assumptions and Methodology

10. *Benefits and Costs of Hybrid Generation:* The benefits of hybrid generation are estimated based on the targeted load factor of PV (21 percent reflecting Mali's conditions). Generation from PV is adjusted to reflect storage losses in batteries (estimated at 5 percent). It is assumed that batteries would need replacing after 8 years. The table below presents the assumptions for the impact of the installation of 1 kWp.

Hybrid systems - impact for 1 kWp installed - in US\$											
	year	0	1	2	5	7	8	9	10	14	15
<b>Investments</b>											
PV panels and support structure		(2,240)									
Inverters		(1,450)									
Battery bank		(1,456)					(1,300)				
BOS (including civil works)*		(1,736)									
<b>Total investment costs</b>		<b>-6882</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>-1300</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Load factor	%		21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%	21.0%
Gross annual PV generation	MWh		1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84	1.84
porportion stored in batteries	%		40%	40%	40%	40%	40%	40%	40%	40%	40%
Losses on storage	%		5%	5%	5%	5%	5%	5%	5%	5%	5%
Net Incremental PV generation	MWh		1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Incremental O&M hybrid	USD		-154	-164	-179	-190	-196	-201	-207	-234	-241
Savings on thermal generation	USD		918	946	1034	1096	1129	1163	1198	1349	1389
<b>Net Opex reduction</b>	<b>USD</b>	<b>-</b>	<b>764</b>	<b>782</b>	<b>855</b>	<b>907</b>	<b>934</b>	<b>962</b>	<b>991</b>	<b>1,115</b>	<b>1,148</b>
<b>Net additional benefit/costs</b>	<b>USD</b>	<b>(6,546)</b>	<b>764</b>	<b>782</b>	<b>855</b>	<b>907</b>	<b>(366)</b>	<b>962</b>	<b>991</b>	<b>1,115</b>	<b>1,148</b>
<b>EIRR</b>	<b>9.1%</b>										

11. The savings on fossil fuel-based generation are based on a cost estimate of diesel-based

generation close to 50USc/kWh. This very high unit costs reflects factors specific to rural areas in Mali (high costs of diesel due to transportation and logistical costs, low engine efficiency related to small-size, sub-optimal load factor, the high cost of maintenance...).

diesel prices		650	FCFA/l
density		830	g/l
specific consumption		260	g/kWh
auxiliary losses		3%	
Fuel cost per net kWh		209.9	FCFA/kWh
Lubricants		7.3	FCFA/kWh
Other variable (spare parts, filters...)		5.0	FCFA/kWh
Genset tear and wear		25.0	FCFA/kWh
Cost of thermal generation		247.3	FCFA/kWh
Cost of thermal generation		49.5	Usc/kWh

12. On the OPEX cost side, the analysis accounts for significant additional maintenance requirement for hybrid systems. They are estimated annually at 3 percent of initial investment costs (total costs except BoS).

13. The benefits from hybridization will materialize as a very significant reduction in OPEX (which will vary depending on site characteristics and on the substitution rate achieved). The net benefits will be reallocated through the existing mechanisms for price adjustment for rural electricity concessions. The return on investment for operators will be based on their contribution to the investment (expected to be at least 5 percent). The bulk of the benefits will therefore be passed on to consumers (either existing consumers through price reduction or through additional connections). With a large share of renewable generation, operators will benefit from more stable operating expenditures which will strengthen their business model and financial viability (reduced exposure to fuel price volatility and less frequent need to negotiate price adjustments with AMADER and village committees).

14. *Benefits for Households Connected under the Project.* The first tranche of electricity consumption for rural households in Mali comes in substitution to other usages which are much more costly (primarily lighting with kerosene lamps and batteries, cell phone recharge and batteries). The impact of the project on the average poor rural household to be connected under the project has been assessed on the basis of their current monthly budget for energy consumption (excluding cooking).

<b>Estimated Current Household Energy Budget (month)</b>					
<b>Current Monthly Energy Budget - Unconnected poor rural households</b>					
	Unit price	Qty	Qty/hh	Frequency	Cost
Lighting					
Kerosene lamps		50	3	30	4500
Torches		150	3	4	1800
Recharge telephone		100	2	8	1600
Radio		150	1	3	450
				FCFA/month	7900
Total monthly budget				US\$/month	15.8

15. By switching to electricity for current energy usages, the typical household connected under the project would benefit from a significant reduction in energy costs for an identical level of service (typically from more than US\$15/month to about US\$7/month). Under this assumption, the electricity consumption of newly connected households would be low (less than 13 kWh/month).

**Estimated Future Household Energy Consumption (month)**

Future monthly consumption - newly connected households			
	hours/day	units/hh	kWh/month
LBC	10	3	9.9
Torches		2	
Recharge Telephone	4	2	1.2
Radio	5	1	1.5
TV	0	0	0.0
Refrigerator	0	0	0.0
Electricity Consumption		kWh/month	12.6
Monthly Service Fee		FCFA/month	3500
Monthly Service Fee		US\$/month	7

16. This is much less than the observed average consumption of rural households connected to mini-grids which are currently slightly above 40 kWh/month on average. Newly connected households targeted by the GPOBA grant will be significantly poorer and should therefore be expected to consume less than average. However, given the dramatic reduction in energy costs brought by electrification, one should expect also an increase in electricity consumption beyond pure substitution. This increase is not taken into consideration in the estimate of the project benefits which is conservative from a methodological standpoint because it does not assume any consumer surplus beyond the substitution effect.

17. *Overall Results:* The table below presents the EIRR and NPV estimates for the combination of hybrid investments and access financed under the project. (Solar Home Systems are not included which account for the slight difference in EIRR and NPV with the key results paragraph above which also includes SHS benefits and costs).

Summary Hybrid systems and network extension/densification												
Year		0	1	2	5	7	8	9	12	13	14	15
Hybrid systems	KUSD	(28,805)	-	-	-	-	(5,720)	-	-	-	-	-
Network and connections	KUSD	(6,529)										
Total investments	KUSD	(35,334)	-	-	-	-	(5,720)	-	-	-	-	-
Opex reduction substitution thermal	KUSD	-	3,361	3,441	3,760	3,989	4,109	4,232	4,624	4,763	4,906	5,053
Extra generation costs for new connections	KUSD	-	(665)	(685)	(749)	(795)	(818)	(843)	(921)	(949)	(977)	(1,006)
Extra other opex for additional connections	KUSD		(237)	(244)	(267)	(283)	(292)	(301)	(328)	(338)	(349)	(359)
Value of service for households (WTP)	KUSD		1,887	1,943	2,123	2,253	2,320	2,390	2,612	2,690	2,771	2,854
Net Annual Benefit / Cost	KUSD	(35,334)	4,345	4,454	4,867	5,164	(401)	5,478	5,986	6,166	6,351	6,541
EIRR		11.0%										
NPV		2,028										



## Annex 7: Scaling-Up Renewable Energy Program (SREP) in Low Income Countries

### MALI: Rural Electrification Hybrid System Project

Indicator	SREP/IDA Project	Transformational Scaled-up Phase <sup>4</sup>
Generation capacity of solar renewable energy (kW)	4,800	52,800
Annual electricity output from RE (solar, biofuel) (MWh)	8,653	95,183
People provided with access to electricity by household connection-off-grid (of which % female)	681,000 (50.4)	3,500,000
Avoided Greenhouse Gas Emissions over project life <ul style="list-style-type: none"> <li>• Tons per year [tCO<sub>2</sub>eq/yr]</li> <li>• Tons over 20 year lifetime [tCO<sub>2</sub>eq]</li> </ul>	6,868 tCO <sub>2</sub> /year 137,365 tCO <sub>2</sub> over 20 year lifetime (with net incremental PV generation 173,070 MWh)	75,548 tCO <sub>2</sub> /year
Direct Project beneficiaries including beneficiaries from Lighting component (of which % female)	1,060,000 (50.4)	NA
Financing leveraged through SREP funding of US \$15.4M (including preparation grant) [US\$ million, cumulative]	<ul style="list-style-type: none"> <li>▪ IDA: US\$25.0M</li> <li>▪ GPOBA: US\$5.0M</li> <li>▪ GoM: US\$8.9M<sup>5</sup></li> <li>▪ Private: US\$1.83M, which represents a minimum of 5% of investments per site</li> <li>▪ <b>Total:\$56.13M</b></li> </ul>	NA
SREP leverage ratio	1 : 2.64	NA
Other key transformational aspects of SREP intervention	<ul style="list-style-type: none"> <li>▪ Achieved standardization of hybrid mini-grids design</li> <li>▪ Coordinated implementation of off-grid electrification efforts aligned with updated National Energy Policy</li> <li>▪ Sustainable off-grid electricity access models developed to expand service to increasingly difficult to reach rural areas</li> </ul>	

<sup>4</sup> The Government's estimated contribution of US\$8.9 million targets the financing of staff cost of AMADER over the project life (6 and ½ years).

<sup>5</sup> Assumptions: The targeted population to be electrified according to the National Energy Policy is 51 percent by 2028, corresponding to multiplication of the number of households supplied with rural mini-grids of 3 times. In addition, the GDP per capita is expected to grow by 3 percent over the long term. The elasticity of electricity consumption to growth for poor developing country tends to be significantly above 1 therefore a 4 percent annual growth trend per capita would be realistic (resulting in total increase in per household consumption of 80 percent over 15 years). On basis, of the above assumptions (increase in rural households connected and in per household consumption) and assuming total hybridization of mini-grids, a potential for scale-up of 11 times in 15 years is deduced.

	<ul style="list-style-type: none"> <li>▪ 420 people trained, including AMADER, operators and their staff, to sustainably maintain and operate as well as provide sustained after sales services for solar home systems</li> </ul>
Co-benefits	<ul style="list-style-type: none"> <li>▪ Increased employment opportunities derived from additional service hours, solar supplies and service opportunities, with a special focus on women</li> <li>▪ Better integration of rural households by facilitating communications, and enhancing access to information.</li> <li>▪ Improved health by reducing kerosene use for lighting, which increases the incidence of general ailment, and respiratory disease.</li> <li>▪ Improved educational outcomes by enabling children to study for additional hours in the evening.</li> </ul>

## A. Introduction

### Country and Sector Context

1. Mali is a large landlocked country in the Sahelian belt in West Africa – with a low and highly dispersed population density, of which about 73 percent live in rural areas. Mali’s per capita Gross National Income (GNI) was about US\$610 in 2011. The country was ranked 182 out of 186 countries by the 2012 United Nations Development Program (UNDP) Human Development Index. From 1991 until March 22, 2012 when a military coup happened, Mali was considered an example of democratic governance and political stability. Since then, Mali faced a complex political and humanitarian crisis that has eroded the base of Mali’s economy and society. However, prospects for the remainder of 2013 and 2014 are positive – supported by the peaceful presidential election of Mr. Ibrahim Boubacar Keita for a period of five years which opened the door for the international community to resume development assistance. The World Bank presented a new Interim Strategy Note (ISN) to the Board on June 18, 2013.

2. Over the last ten years, the Malian authorities have implemented policies to increase access to modern energy service, in particular to electricity. As a majority of the Malian population lives outside the concession perimeter of the State-owned national utility, Energie du Mali (EDM-SA), the GoM launched an ambitious rural energy access program (2004-1012) – being implemented by the rural electrification agency, AMADER. Since then, the progression in rural access has been impressive (a ten-fold increase from about 1 to 2 percent of the rural population to 18 percent in less than a decade) – with currently more than 60 operators and 190 mini-grids. The Malian rural electrification model is widely regarded as a successful example in the sub-region. It is largely a bottom-up model, driven by decisions from local private entrepreneurs / cooperatives and includes investment subsidies from the Rural Electrification Fund (REF) of up to 70-80 percent of capital investment costs. Subsidy allocation was driven in particular by results-based criteria. No subsidies for energy consumption or operating expenses are provided. Local private operators have provided an average matching co-financing of 25

percent of the mainly fossil fuel based rural electrification projects. A tendency towards concentration of the rural mini-grid sector can be observed. While a large number of single site operators remain, four multisite companies have emerged with 15 to 20 sites each. For all mini-grids supported by AMADER, a local committee representing the community (comité villageois) has been established in order to create a channel for communications and discussions with the operator and with AMADER. However, a large majority of the rural population does not have access to electricity. Most of the rural households still satisfy their energy needs by using wood, charcoal, kerosene and dry-cell batteries, which are extremely expensive and unreliable. Especially in times of increased oil prices, mini-grid operators – who run their gen-sets on diesel oil – had to adjust tariffs and reduce service hours, which led to social tensions.

3. Mali is faced with structural barriers impeding its efforts to increase access to electricity. This includes poor transport infrastructure, high cost of new generation, dependency on petroleum product imports, high cost of network expansion, no cost-reflective pricing in the electricity sector, and increasing energy consumption due to a fast growing population (doubling every 25 years). Given the geography of Mali, over the next decades, projected expansion of the national electricity grid or regional integration of power systems are unlikely to allow connecting a large proportion of rural households. Isolated off-grid or mini-grids rural electrification schemes will therefore remain for a long time the only option to bring modern energy services to a large proportion of the population – in which case the cost of fuel remains a critical issue for access and sustainability.

4. Before the military coup and with support from bilateral donors (Russian, Dutch, German), a few solar PV and biofuel mini-grid pilot projects were tendered to test the introduction of renewable energy in existing fossil fuel run mini-grids on a project by project basis. Currently, a significant pipeline of business plans is under development (with technical assistance provided by AMADER), and awaiting financing from the Rural Electrification Fund – which demonstrates the interest of rural populations and private operators in the energy services delivery business in Mali.

### **Mali's SREP Investment Plan**

5. Mali has been selected as one of the first six countries to benefit from the Scaling-Up Renewable Energy Program in Low Income Countries (SREP). The SREP Expert Group who recommended Mali as one of the first six pilot countries recognized the efforts already made by the Government of Mali (GoM) to meet energy challenges, while highlighting the following aspects: (i) a low rural access to electricity; (ii) a sound institutional base for solar photovoltaic (PV) implementation; (iii) a positive track record in developments to date; (iv) a potential for productive use of energy in agriculture and small commercial entities; and (v) sustainable biomass and biodiesel programs in place.

6. In March 2012, the Government of Mali (GoM) secured approval of up to US\$40 million of SREP funding to implement a transformational renewable energy program with the support of the African Development Bank (AfDB) and World Bank Group. The SREP Mali Investment Plan (IP) was prepared under the leadership of the GoM, represented by the Ministry of Energy and Water, and by different specialized national agencies. The overall objective of the SREP IP is to demonstrate the economic, social and environmental viability of low-carbon development path with a view to increase energy access in the country, by using renewable energy and creating new economic opportunities. The SREP IP is in line with key strategies of the national energy sector, as well as with the main principles of the Growth and Poverty Reduction Strategy Paper and the National Climate Change Strategy. The three projects included in the SREP IP, which will add about 39.1 MW of renewable energy installed capacity, include the Solar PV IPP (AfDB/IFC, US\$12 million SREP funding), Hybrid Rural Electrification Project (World Bank, US\$15.4 million SREP funding), and the Mini/Micro Hydro Project (AfDB, US\$11 million SREP funding); another US\$1.5 million of SREP funding has been allocated to support the operation of the Strategic Coordination Mechanism. The three investment projects will be implemented in the spirit of a programmatic approach, with the Strategic Coordination Mechanism ensuring capacity building, knowledge management and M&E activities benefiting all three investment projects. Conversely, information and lessons learned from the three investment projects will feed into – and be consolidated – through the Strategic Coordination Mechanism for the benefit of the sub-sector. It is anticipated that the SREP Program in Mali will stimulate economic growth through the scaled-up development of renewable energy solutions. The Program will act as a catalyst for the transformation of the renewable energy market by obtaining support from the GoM for market creation, private sector implementation, and productive uses of energy – in order to remove barriers that are hindering scaled-up investments in renewable energy technologies.

## **B. Project Description**

7. The objective of the project is to expand rural access to modern energy services and to increase renewable generation in target areas. The project aims at strengthening and further scaling-up rural electrification through the introduction of hybrid PV solar/diesel generation in rural mini-grids and installation of Solar Home Systems (SHS) when the cost of mini-grids' expansion is not economically justifiable.

8. SREP and IDA funds will support the procurement and installation of an additional 4.8MWp of generation capacity in hybrid systems (including photovoltaic panels, inverters, batteries, and control electronics) at an approximate estimated cost of US\$6,800 per kWp (excluding any additional gen-set capacity). In some cases, where the site assessment determines it necessary in order to ensure efficient operation and automatic synchronization with the solar components and batteries, installation of hybrid system could be combined with an increase in

gen-set capacity. Acquisition of thermal generation equipment will primarily be financed by the operators concerned (and factored into the determination of their contribution to the investment) with possible complementary funds from IDA if the operator contribution is insufficient. SREP funds would not be used in any circumstances to support fossil fuel-based generation equipment, only for the RE components of the hybrid systems. Hybrid solutions have been experimented with in about a dozen rural sites in Mali (though the total installed capacity remains below 1 MWp). The project will contribute to establishing a more systematic approach to hybridization. The technical design study will define inter alia the optimal technical design for hybridization of mini-grids, based on local characteristics (demand level, load profile, etc.) and assess the adequate sizing of the key components of hybrid systems. In addition, based on objective criteria (including local demand, capacity and contribution of the operator, regional balance), the site selection study will propose a list of sites to be hybridized under the project. For the sites concerned, a site-specific assessment will also determine whether part of fossil fuel-based generation could be replaced through local biodiesel production (principally *Jatropha* oil) based on local potential for biofuel cultivation.

9. Average solar radiation in Mali is well distributed over the national territory with an estimated 5-7 kWh/m<sup>2</sup>/day<sup>34</sup> with a daily sun lighting duration of 7-10 hours, against a global typical average of only around 4-5 kWh/m<sup>2</sup>/day. Cost estimates for hybrid system investments have been derived from price references for similar projects in the sub-region and globally and conservative anticipations of downward cost trends. Recent IEA report “Rural Electrification with PV Hybrid System” finds capital cost of hybrid mini-grids in the range of US\$7425/kWp to US\$12150/kWp (IEA2013). Typically, major contributors to this high capital cost are PV module and mounting structures, inverters and batteries, as well as Balance of Systems (BoS) costs. BoS costs include other electrical and structural components along with necessary engineering, design, and installation costs. BoS costs for deployment of small PV systems tend to be relatively high. Diesel gensets typically represent a smaller portion of total investments costs (about 10 percent). Price references for rural hybrid projects in Mali tend to be in the mid and sometimes upper range of the above price range. Observed high project costs can be explained in part by factors specific to Mali, in particular, extra costs and risk premium related to Mali’s landlocked geography and to its fragility and security risks (especially for foreign contractors deploying their personnel on the ground). One key objective of the project is to reduce investment costs, in particular the country specific additional costs. This would be achieved through larger procurement packages (typically for about ten mini-grids instead of site by site) in order to achieve maximize interest from bidders and reduce preparation and installation costs. In addition, by developing the capacity of local subcontractors, the project is expected to reduce additional costs created by the use of expatriate experts. In addition, there is a clear trend towards price reductions for key system components. Recently, this has been especially the case for PV panels. Significant price reductions are likely for inverters and batteries over the course of the project. After analyzing recent project costs in Mali and in the sub-region (Senegal, Burkina Faso, Cape Verde) and anticipating some cost reductions, an

estimate for the average unit investments cost for hybrid of US\$7,440/kWp has been retained. This estimate, inclusive of contingencies and thermal gen-sets) is close to the lower bound of the IEA range quoted above. Excluding gen-set costs, this translates into estimated unit costs of US\$6,800/kWp, an assumption also used for setting the project monitoring target and for the economic analysis. This relatively conservative cost estimate would not preclude the implementing agency from seeking further cost reductions, especially for contracts to be tendered later during project implementation. Achieving further cost reductions would be critical to attracting additional funding for hybrid investments.

10. The table below provides the breakdown of cost assumptions for hybrid investments. They are based on available cost data for recent projects in Mali and the sub-region. The assumptions anticipate likely reductions in component prices (as well as Balance of System costs - BoS). The final total estimate (US\$ 6,800 per kWp) excludes gen-set costs but includes additional contingencies to reflect potential risks. Procurement for turnkey contracts will seek to drive down investment costs further.

<b>Hybrid system - cost assumptions - in USD by kWp</b>	
<b>Investments</b>	<b>US\$/kWp</b>
PV panels and support structure	2,000
Inverters	1,295
Battery bank	1,300
Genset	500
BOS (including civil works)*	1,550
<b>Total</b>	<b>6,645</b>
excluding gensets	6,145
<b>Total ex gen-set with contingencies</b>	<b>6,800</b>

11. In addition to infrastructure investments, the project will promote the market for energy efficient products, provide extensive capacity building to rural electricity operators, and contribute to the institutional strengthening of AMADER.

12. The direct project beneficiaries are: (i) currently connected rural households and businesses which will benefit from more reliable supply and expanded service hours; (ii) rural consumers that will gain access to electricity under the project (through mini-grids or solar home systems); (iii) households that receive innovative lighting products; and (iv) persons trained.

13. **Transformation.** The proposed SREP project will contribute to the transformation of rural electrification efforts in Mali. The demonstrational impact of this project will be essential to achieving standardization and scaling-up of hybrid mini-grids in rural areas. Currently, the majority of rural electricity operators in Mali have implemented business models based on isolated conventional diesel fueled mini-grids with low installed generation capacity per site

(typically 20 kW to 200 kW) and requiring the use of high and volatile cost of fuel. While this model has contributed to electrification in rural areas, unit investment costs remain relatively high, with procurement being carried out separately by each local operator.

14. The proposed SREP project will offer an alternative to the current model based solely on diesel gen-set by demonstrating that electricity supply costs to customers in rural areas in Mali can be reduced by transforming diesel-based mini-grids into hybrid mini-grids using solar PV and, in some cases, biodiesel. The introduction of a more capital-intensive technology (hybrid generation) – with solar PV, energy storage, inverters and control units being financed by SREP – will allow for a more systematic approach for rural electrification, help reduce initial investment costs and improve the operators' capacity to operate and maintain the facilities. The SREP co-financed project will support this more systematic approach through the standardization of hybrid mini-grids in rural areas, transforming these hybrid mini-grids into the least cost off-grid electrification option in Mali. The proposed standardization will lead to higher access to energy and reduce fossil fuel consumption in rural areas, therefore lowering GHG emissions and indoor air pollution in homes using kerosene for lighting. Increased connectivity would further eliminate health risks to women and children arising from use of kerosene and wood fuels.

15. Furthermore, the project will accompany a transformative movement towards the consolidation of the energy sector, and facilitate the mobilization of new sources of financing for the sector. Through its systematic approach to rural electrification, by evaluating and standardizing the business models adopted in mini-grid extensions, the SREP project will be crucial for transforming the sub-sector. The SREP project will provide momentum to strengthen and attract private operators and diversify their portfolio of various energy and electricity services targeted to the needs of rural customers (including mini-grids, off grid lighting, energy efficiency appliances, SHS, operation and maintenance services for electrical appliances). Other sub-sectors and infrastructures including clean water, quality health care, job creation, information and communication technology will benefit from that transformation – which will positively impact the rural women and youth who can easily access relevant information.

16. The successful scaling up of the scope and effectiveness of hybrid mini-grid schemes in isolated off-grid areas in Mali will allow transformative impacts on a country wide scale and strengthen the effectiveness of the GoM rural energy access and clean energy agenda. A successful scale up of Mali's rural electrification program combined with the greening of Mali's rural energy mix will provide lessons to be learned and best practices for rural energy agencies in the sub-region. The potential for tapping additional funding from carbon-finance will be explored in early in project implementation. Given transaction costs, this option would likely be viable by bundling this project with other renewable energy projects in Mali, and using the specific methodology for access to measure emission reductions.

17. **SREP Rationale for Financing.** As many rural localities will not be targeted for an economically viable connection to the national electricity grid in the next decade(s), SREP funds will be crucial to continue to systematically expand and complement the GoM's rural electrification agenda, while increasing the share of renewable energy installed capacity in the mini-grid systems. Considering that, in the Malian context, traditional forms of power generation (mainly fossil fuel power plants and associated mini-grids) are becoming more expensive in terms of operating costs, renewable energies have become a more affordable option. However, investment costs for hybridization remain high with economic rates of return which are not quite yet at the levels considered adequate by MDBs for electricity projects, though further significant cost reductions are extremely likely. SREP funding is essential to making this project "bankable" and to accelerating the adoption of hybrid technology for rural electrification. SREP funding will also help to achieve a critical mass of hybrid projects and put in place a systematic approach for rural electrification with hybrid. Combining SREP grant funding with MDB's contribution will increase the attractiveness of this type of operation to other donors and/or investors who may be keen to finance similar projects. There is already a significant interest in Sahelian countries beyond Mali for hybrid systems with pilot projects in Senegal, Burkina Faso and Cape Verde. Increased availability of clean energy in rural areas would also provide multiple benefits, including the strengthening of Mali's decentralization policy by creating jobs and productive energy uses in rural areas; and by reducing the dependence on fossil fuels and biomass resources which provide most of the energy requirements in the rural areas.

### **C. Assessment of Proposed Project with SREP Investment Criteria<sup>6</sup>**

#### **a) Increased Installed Capacity from Renewable Energy Sources**

18. In 2011, the RE installed capacity in Mali was estimated at about 12 MW (including on-grid and off-grid systems), of which 1 to 1.5 MW – according to AMADER - can be attributed to solar PV in hybrid mini-grids in rural areas. The Rural Electrification Hybrid Project will add 4.8MW of solar energy installed capacity (including SHSs), therefore increasing the overall renewable energy capacity by half and tripling the current solar energy capacity, which translates into 8,653 MWh (see item 3c "Low Emission Development" for respective assumptions).

#### **b) Increased Access to Energy through Renewable Energy Sources**

19. The project will support implementation of Mali's Rural Electrification Strategy as demonstrated by the launch of an ambitious rural energy access program in the last decade to achieve the rural electrification goals set in the National Energy Policy. The government is currently revising the document of the National Energy Policy which will envisage electrification rates of 35 percent by 2020 and 55 percent by 2030 (from 15 percent). The share of renewable

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<sup>6</sup> For reference: SREP Programming Modalities and Operational Guidelines  
[https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP\\_Programming\\_Modalities\\_and\\_Operational\\_Guidelines\\_final.pdf](https://www.climateinvestmentfunds.org/cif/sites/climateinvestmentfunds.org/files/SREP_Programming_Modalities_and_Operational_Guidelines_final.pdf)



energy based electricity is targeted to reach 25 percent by 2033 (from 5 percent in 2012). The propose SREP financing will support hybridizing approximately 50 existing mini-grid systems benefiting approximately 40,000 households (430,000 people).

**c) Low Emission Development:**

20. The proposed SREP project will promote the scaled-up utilization of sustainable energy by providing electricity from renewable solar energy and biofuel. The hybridized mini-grids will produce low quantities of GHGs and replace the inefficient fossil fuel run gen-sets (diesel) that would have otherwise produced higher quantity of GHGs. The use of SHSs, off-grid lighting and solar lanterns also contributes to the global environment by reducing harmful emissions from carbon dioxide (CO<sub>2</sub>) that exacerbates climate change. Although modest, the proposed project will directly help avoid the equivalent of 6,868 tCO<sub>2</sub>eq per year (based on the proxy-based method) and 137,365 tCO<sub>2</sub>eq over a 20 year lifetime (see Table below for the estimates on Co<sub>2</sub> reductions). This number is very conservative as it underrates the actual fuel consumption of inefficient diesel gen-sets and does not consider the substitution of kerosene. Alternately, in many un-electrified rural households, kerosene is used for lighting, which, in addition to not being a very efficient source of lighting, also produces indoor smoke pollution (along with cooking from woodstoves) that contributes to general ailment and respiratory disease. Therefore, switching to solar home systems, off-grid lighting and solar lanterns will place the consumers that benefit from the intervention on a low emission development path and improve the local environment. Finally, carbon finance will be assess as a potential additional financing source in order to mainstream renewable energy technologies into the overall energy system, replacing fossil fuel technologies.

<b>Hybrid generation</b>		
PV Load factor	%	21.0%
Gross annual PV generation	kWh/y/kWp	1,840
proportion stored in batteries	%	40%
Losses on storage	%	5%
Net Incremental annual PV generation	kWh/y/kWp	1,803
<b>Annual impact for 4,700 kWp</b>		
Net Incremental annual PV generation	MWH	8,473
Emission reduction ( 793.7 tCO <sub>2</sub> eq per GWh)	tonnes	6,725
<b>Annual impact for 4,700 kWp and 100 kWp of SHS</b>		
Net Incremental annual PV generation	MWH	8,653
Emission reduction ( 793.7 tCO <sub>2</sub> eq per GWh)	tonnes	6,868
<b>Project impact over 20 years</b>		
Net Incremental annual PV generation	MWH	173,070
Emission reduction ( 793.7 tCO <sub>2</sub> eq per GWh)	tonnes	137,365

#### **d) Affordability and Competitiveness of Renewable Sources**

21. The current business model is based on isolated conventional diesel fueled mini-grids with low installed generation capacity per site (typically 20 kW to 200 kW). Operating costs with diesel gen-sets are very high in rural areas. In addition, the operating performance and capacity of the operators is uneven. The current cost of grid-based access is estimated at US\$1,000 per connection for urban or peri-urban areas. The costs rise tremendously for rural areas (including large villages) because of (i) increasing distance and falling density of households, and (ii) the prohibitive costs of substation and step-down transformation compared to the level of demand. International prices for solar PV modules have dropped dramatically over the last years (80 percent, 2008-12), the costs for battery banks and inverters less so. Therefore, the total system prices have declined less markedly. Although hybrid mini-grids and SHSs are a lower cost option, many are likely to be unaffordable by private operators and based on incomes of poor, rural households. Therefore, the SREP funds play a vital role by providing a cost buy-down subsidy that will make hybrid mini-grids and SHS more affordable, helping scale-up access by penetrating deeper into rural markets. It is expected that the risk/return profile for future projects will potentially be sufficient to stimulate private investment and concessional (ideally commercial) lending without future subsidies. It is important to note that, although the SREP project includes a significant grant subsidy to the private operators to reduce the cost to the end user, operators are expected to make a contribution to confirm their commitment. Finally, the SREP project will help to demonstrate that the average cost of connection and electricity supply per customer in rural areas of Mali can be reduced by scaling up RE and hence transforming hybrid mini-grids into the least cost off-grid electrification option in Mali.

22. Current levelized total costs of electricity supply with diesel gen-sets in Mali are around 50 USc/kWh. These costs could increase with oil prices in the future. Based on the investment costs estimates, the levelized costs of supply with hybrid in rural Mali would be close to parity with gensets (slightly above or below depending on the discount rate used – 8 or 10 percent). Based on long term trends for renewable generation equipment price and performance, the potential for hybrid technology to become clearly the least cost option for rural areas and to be financially viable with long term loans is evident.

#### **e) Productive Use of Energy**

23. Past experiences in the Mali rural electrification business model have shown that the availability of energy services stimulates new income-generating activities. Hybrid mini-grids have the potential to drive the creation of local businesses by extending the quality of service with longer availability of the service (diesel based mini-grids operate mostly only during peak demand times) and potentially reducing the cost of energy. However, the lack of finance mechanisms to pay for connection costs and electric appliances remain key barriers for micro-

entrepreneurs. Therefore, the project will build on best practices from World Bank's Household Energy and Universal Access project (HEURA) by strengthening the relationship between rural electricity operators and clients through the promotion of local business models that take advantage of captive power available in the photovoltaic hybrid mini-grids (especially during the day), and through the gender and energy program started by AMADER in 2012. This approach will ensure a gender sensitive approach for the identification of energy services required in the communities and the finance of energy efficient appliances (e.g. refrigerators, agricultural transformation devices, etc.) that can create business opportunities and help the long term sustainability of the mini-grid operation. Furthermore, AMADER will continue to lobby and coordinate with micro-finance institutions and other development partners for the promotion of income generation activities and planning.

#### **f) Economic, Social and Environmental Development Impact**

24. The proposed Project is in line with the vision of the GoM for the electricity sector. It will contribute to improving the viability of electricity provision by local operators in rural areas, and contribute to additional access expansion from existing grids. The project also contributes to the long term agenda of limiting dependency on imported petroleum products and tapping the renewable energy potential of the country (primarily solar energy, and to a lesser extent biofuels).

25. The proposed Project will help, among other things, to: i) increase quantity and quality of electricity services in rural areas not only for rural households but also for small businesses; ii) improve the quality of social services, particularly health services supplied by small health facilities in the rural areas which cannot afford individual generators; iii) reduce the exploitation of non- or less renewable energy sources (forestry resources) by gradually substituting traditional fossil fuel based-solutions and the ineffective use of biomass through investments in solar energy and biodiesel; iv) reduce GHG emissions due partly to deforestation and partly to the use of fossil fuels; and v) maximize economic development opportunities by creating new economic activities and new jobs related to new technologies and involvement of the private sector, among others; vi) contribute to the strengthening of the Malian private sector and the mobilization of foreign private funding through forward and backward linkages of renewable energy supply; vii) improve rural livelihoods (especially for women and young people); viii) improve the quality of services provided by different socio-economic facilities (including schools and medical centers); and ix) reduce the incidence of respiratory diseases (linked to indoor air pollution). In summary, the project aims at linking economic, social and environmental benefits in a single paradigm of sustainable development and poverty reduction. This will enhance, in an integrated way, energy security, business start-ups, reduction of local pollution and improvement of the livelihoods and living conditions of the local communities (with special attention to vulnerable groups, including women and young people).

26. The project includes funds to conduct detailed surveys and evaluations of those potential benefits that cannot be easily monitored and measured such as impact on income-generating activities, gender impact, etc. More detailed information on these non-quantifiable co-benefits will be available during project implementation.

#### **g) Economic and Financial Viability**

27. The economic analysis is presented in the main Project document and a dedicated annex. The expected economic rate of return for hybridization is estimated at 9.1 percent. This is based on relatively conservative assumptions for investment costs and the PV module load factor. The potential for improvement over time is therefore significant. The project will significantly reduce operating costs of targeted mini-grids and considerably improve rural operators' financial resilience by reducing their exposure to fuel price volatility (though the bulk of the project benefits will be passed on through to consumers through price adjustments under the contractual mechanisms of the concessions).

#### **h) Leveraging of Additional Resources**

28. The program will raise additional funds, by developing an innovative approach in the Malian context that is likely to attract the interest of other donors and private operators. The SREP funds will be catalytic and will leverage multiple sources of additional funding. SREP funding will act as key anchor for funding transformational technical assistance activities as well as vital subsidies to buy-down costs and make solar PV/diesel hybrid technology, SHS as well efficient off-grid lighting, more affordable to private operators and poor, rural households. The potential for scaling-up through the proposed project and beyond will most likely attract other development partners to consider partaking in the initiative by co-funding activities; especially as Mali is on its way back to peace and democracy. The support might come from bilateral development partners and eventually others. By developing an innovative standardized rural electrification approach, the SREP funds of US\$15.4 million will raise additional funds, , such as an IDA Credit (US\$25 million), a GPOBA grant (US\$5 million) and a Government's estimated contribution (for the financing of staff costs of AMADER) of US\$8.9 million over the project life of six and a half years. In total, against the investment of US\$15.4 million from SREP, about US\$36.33 million additional will be mobilized by IDA, GPOBA, the GoM as well as private operators which leads to a leverage ratio of at least 1:2.36. The contributions from private operators for mini-grids are estimated at a minimum of 5 percent of investments per site. The specifics will be finalized during project appraisal.

29. The SREP Investment Plan (IP) had foreseen a significant amount of contributions (tentative) from other sources such as bilateral development partners, trust funds and carbon finance. During IP preparation and before the military coup, discussions were held with several development partners who confirmed their interest in co-financing. As most of the activities were

put on hold during the last 1.5 years the international community is now resuming its development assistance. A new discussion round will have to be initiated in order to assess potential collaboration / co-financing interest. It can be noted that the contributions from the GoM and the World Bank / IDA will exceed the originally planned financing by US\$10.4 m (US\$1.4 m and US\$8.8 m respectively).

#### **i) Gender**

30. The proposed project is expected to expand energy services, provide electricity to those who currently do not have it and improve the quality of life directly for about 700,000 people, of which 50.8 percent are estimated to be female. In detail, the proposed SREP project will support acquisition of energy efficient equipment for women's groups and rural production associations/collectives and follow up on an activity program started by AMADER and UNWomen in 2012 in 19 rural localities called "Energy for the Reduction of Gender Inequality in Mali". The project will contribute to significantly improving the social and economic status of women since its initiatives will contribute to reducing the time and chores involved in collecting firewood (thereby freeing them for other tasks), improving their access to energy for income generating activities. Availability of modern energy services in rural communities will allow children to do their homework at night, women to be able to deliver babies in better conditions and to have a security of movement at night, etc. A whole range of income-generating activities is emerging from local communities once electricity is provided and service hours are expanded, including the creation of jobs through businesses for ice making, food processing, small retail shops, and restaurants. A 2011 gender assessment targeted to rural electrification initiatives identified a considerable potential for gender-specific activities to be scaled-up under the SREP program. In addition, it is important to note that health outcomes, including from the contribution to the reduction of indoor smoke pollution, is likely to be disproportionately beneficial in favor of women, as they tend to spend more time inside households caring for children and cooking. Under its previous HEURA project, AMADER appointed a gender focal point within its agency to help integrate gender issues across its programs. This role will allow for timely guidance and technical assistance during project preparation and implementation.

#### **j) Co-benefits of Renewable Energy Scale-up**

31. Rural electrification appears to be a significant driver for income-generating activities, which can have considerable impacts on improved livelihoods of men and women within rural communities and women's organizations who may be using manual labor or time intensive activities that can benefit from mechanization. The proposed project is expected to have a number of environmental, economic, health, and educational co-benefits, which will provide both global and local benefits, including:

- *Environmental Benefits:* Through the hybridization of diesel-run mini-grids, it was calculated that over a 20 year lifetime an amount of 137,365 t of carbon dioxide (CO<sub>2</sub>) emissions can be

avoided - as progress is made towards reaching electricity access. This number is very conservative as it underrates the actual fuel consumption of inefficient diesel gen-sets and does not consider the substitution of kerosene. The project would also have local pollution reduction benefits, as kerosene lamps also produce particulate emissions that would be offset.<sup>7</sup>

- *Economic Benefits:* Employment opportunities will also be generated by the project through developing off-grid lighting as well as energy efficiency markets – by, for instance, making lighting products more affordable to customers, undertaking awareness raising campaigns and training businesses and individuals so that they can provide after sales services. A new market for consumer electronics might potentially also be created as families with SHS demand more consumer electronics. The SHSs will also enable families to allot more time in the evening, particularly women, to income generating activities. Further, SHS will lead to better integration of rural households with markets (such as farmers) by facilitating communications using cell phones and access to information (on weather, prices, demand, etc.) derived from radio and television use.
- *Health Benefits:* The project will also improve health by avoiding the use of kerosene for lighting which produces indoor air pollution caused by particulate emissions that can increase the incidence of general ailment and respiratory disease.<sup>8</sup>
- *Educational Benefits:* More (reliable) hours of service as well as SHS use will also lead to improved educational outcomes by enabling children to study for additional hours in the evening aligned with Lighting Africa.<sup>9</sup>
- *Community and Safety Benefits:* With available public lighting, villagers will be able to carry out a whole range of activities that were previously limited. Shops and markets can be open in the evening for business, social ceremonies and events can be extended to the nighttime. In addition, public lighting could result in improved public safety.

In addition, SREP funding will help materialize the following opportunities:

- Standardized hybridization models lead to positive progress on cost curves through reduced costs of electricity generated in rural areas to scale up hybrid RE systems;
- Improved viability of existing mini-grid systems in rural areas such as reduced O&M costs due to fuel savings, reduced environmental impacts, centralized project/procurement management, etc.;
- Strengthened local capacity of rural electrification actors and stakeholders;
- Expanded energy service portfolio of local private sector businesses in rural areas according to rural customer's needs and preferences, including energy efficiency, off grid solar lighting, O&M services, etc.;
- Identify models to remobilize bilateral donors and assess carbon finance to scale-up rural energy access and the development of renewable energy in Mali; and

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<sup>7</sup> Schare, Stuart and Kirk R. Smith, "Particulate Emission Rates of Simple Kerosene Lamps". Energy for Sustainable Development I Volume II No. 2, July 1995. Honolulu, Hawaii <http://ehs.sph.berkeley.edu/krsmith/publications/keroseneemission.pdf>

<sup>8</sup> A recent impact assessment of SHS in Bangladesh reports the incidence of several types of preventable illness such as general ailment, respiratory diseases, and gastro-intestinal illness was lower among the members of the households that purchased a SHS (World Bank, 2013).

<sup>9</sup> Empirical evidence from the impact assessment of SHS in Bangladesh reports about 10-12 minutes extra study time for boys and girls and higher completed years of schooling in homes with SHS (World Bank, 2013).

- Strengthen the involvement of private sector operators in renewable energy production, through initiatives to build the technical and organizational capacity of private operators involved in the energy sector, as well as improvement of legal and regulatory arrangements and implementation of adequate financial incentives for the private sector.

#### **D. Monitoring and Evaluation**

32. Overall monitoring and evaluation of Project activities will be performed by AMADER, which will have an overall responsibility for monitoring and evaluating the different components/activities in accordance with the indicators included in the results framework (Annex 1). The indicators, targets and mechanisms for monitoring have been discussed and agreed with AMADER. Quarterly and Annual Reports will be submitted by AMADER; covering all Project's activities, including procurement and financial summary report. AMADER has a monitoring and evaluation specialist, who has previous experience monitoring the HEURA project; however, if needed, the project will strengthen AMADER's capacity for monitoring and evaluation. With regard to M&E, some of the outcomes expected from the project (e.g. impact on income-generating activities, gender impact, etc.) cannot be monitored on a regular basis. Therefore, a baseline study of targeted mini-grids before hybridization and a follow-up study before project closing in order to assess project impacts will be undertaken. The baseline study methodology will be inspired from the SE4ALL methodology for measuring access, so as to measure the impact of the project more finely than with binary indicators. This evaluation will complement monitoring indicators and help provide a better assessment of the impact of rural electrification.

#### **E. Implementation Readiness**

33. The Government is strongly committed to successfully implementing its Rural Electrification Strategy set in the National Energy Policy – as demonstrated by the launch of an ambitious rural energy access program in the last decade. The government is currently revising these goals and aims to reach 35 percent electrification by 2020 and 55 percent by 2030 (from currently 15 percent). The share of renewable energy-based electricity is targeted to reach 25 percent by 2033 (from currently 5 percent in 2012). At the regional level, the GoM is aligned with the ECOWAS, which recently adopted the Regional Policy on Renewable Energies, the Regional Policy on the Energy Efficiency and the Program on Small Hydropower. The main institutional driver of electrification in rural areas in Mali is the Rural Energy Service Agency, AMADER – supported by private local energy companies and local initiatives (communities, and women's associations). As for tariffs, electricity prices in rural mini-grids are typically around 250 FCFA/kWh (50 US\$/kWh). In comparison, the average regulated tariff for EDM-SA clients remains on average below 100 FCFA/kWh (20 US\$/kWh) even following the recent adjustment applied in February 2013. This tariff difference is creating social tensions, and the SREP funding can help to mitigate those tensions by bridging part of the gap in energy costs.

34. The Rural Energy Service Agency (AMADER) has the resources and capacity to implement the Project. AMADER has solid experience in implementing national programs and delivering subsidies according to established policy of the GoM and has experience in managing World Bank and other donor-financed projects (e.g. for the closed WB project HEURA, KfW rural electrification projects, etc.). In addition, the SREP Project Preparation Grant further strengthens the Implementation Readiness of AMADER and other partners. It includes a program of studies for technical design of hybrid mini-grids, site selection, project management and coordination activities including procurement, safeguards, monitoring and evaluation, training and capacity-building.

#### **F. SREP Additionality**

35. The proposed SREP intervention will directly contribute to increasing and strengthening rural electrification efforts as well as accelerating hybridization with renewable energy in Mali and the sub-region. In its absence, the current hybridization efforts are likely to remain uncoordinated and mainly unfunded, increases in rural access will stagnate and possibly taper off, and lack of adequate sustainability measures such as replacement of batteries may potentially reverse some of the gains; including a significant negative impact on AMADER's role for rural electrification.

36. The proposed SREP funded project enables a transformational scale-up by developing a new model that allows for the introduction of new technologies that address the specific challenges of the diesel mini-grids model. In its absence, the former model in its existing format will continue to stagnate or potentially falter as private operators will find it difficult to reach the un-served due to the lack of economies of scale and limited affordability. The proposed SREP funded project will help shift the focus of the off-grid electrification effort in Mali from one focused on diesel generation to a model focused on less expensive renewable energy. Moreover, the replacement of the fossil fuel based generation with renewable energy is expected to enhance the quality and reliability of service.